Natural Community Surveys of Isle Royale National Park, Lake Superior



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Cover Photo: Volcanic bedrock lakeshore along Scoville Point, Isle Royale. Photo by Jesse M. Lincoln.

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Land Acknowledgement: Minong and the waters immediately surrounding the archipelago are a significant part of the Anishinaabe's traditional cultural history and were part of the Grand Portage Band of Lake Superior Chippewa's (Ojibwe) ancestral land. For the Grand Portage Band, it is a traditional cultural property where they connect and practice their traditional heritage that has included hunting and trapping, maple sugaring, fishing, plant gathering, and spiritual practice. Minong had also been important to the band's economic viability through time. Many Grand Portage Band members use Minong's waters today to fish, which is an extremely significant part of Band member's lives and heritage. Other Band members use Minong's natural resources to gather plants, or visit it for its spiritual qualities. The Anishinaabe also believe that waters off Minong are thought to be the home of Mishepeshu, the underwater lynx. Mishepeshu is an important and potentially dangerous spirit being, or manitou, in traditional Anishinaabe belief system.

In addition, 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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Isle Royale National Park Service staff provided invaluable logistical support that facilitated efficient and safe surveys of Isle Royale. Photos by Jesse M. Lincoln (above and below right) and Joshua G. Cohen (below left).





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Introduction

Great Lakes islands provide critical habitat for native biodiversity and support rare and endemic natural communities. A diverse assemblage of over 32,000 islands occurs across the Great Lakes and in the connecting channels with over 400 islands in Lake Superior (Henson et al. 2010). Many of the islands within the Great Lakes 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 and 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.

To address this information gap, the Michigan Department of the Environment, Great Lakes, and Energy (EGLE) contracted Michigan Natural Features Inventory (MNFI) through U.S. Environmental Protection Agency (EPA) funding to conduct natural community surveys over the course of three years on Lake Superior islands. Surveys were conducted on Manitou Island, Rabbit Island, and Grand Island in 2023. In 2024 and 2025, surveys were conducted on Isle Royale National Park. This report focuses on the natural community surveys conducted on Isle Royale. For information on the natural community surveys conducted in 2023 on Manitou Island, Rabbit Island, and Grand Island, refer to Cohen et al. 2024a, Cohen et al. 2024b, Cohen et al. 2024c.

Natural Community Surveys

Extensive research has been conducted on the ecosystems of Isle Royale. These studies have focused on boreal forests, moose and wolf interactions, and coarse-scale vegetative mapping. At the turn of the century, Isle Royale was mapped through a collaborative effort involving the National Parks Service, The Nature Conservancy, and USGS using the US National Vegetation Classification (USNVC) (TNC 1999). Through this effort, Alliances and Associations within the USNVC were delineated using a plot-based sampling approach. This comprehensive mapping effort provided important information about the distribution and abundance of ecosystems across the island. However, the USNVC mapping occurred over a quarter of a century ago using a national community classification system and did not include an evaluation of ecosystem health. Prior to the current project, there has never been a concerted effort to systematically evaluate the integrity of Isle Royale's rarest ecosystems through the lens of



Conducting natural community surveys along the northeastern shoreline of Isle Royale with Lynette Potvin, Isle Royale National Park ecologist. Photo by Joshua G. Cohen.

Michigan's natural community classification (Cohen et al. 2015, Cohen et al. 2025). Through a grant from the Office of the Great Lakes, MNFI developed a prioritization of survey targets for rare natural communities on Great Lakes islands. This evaluation included South Fox Island, North Fox Island, and Isle Royale (Cohen and Lincoln 2019). This desktop analysis provided the impetus to engage with the EPA and EGLE to conduct targeted natural community surveys on remote islands in Lake Superior including Grand Island, Manitou Island, Rabbit Island, and Isle Royale.

The MNFI natural community classification defines a natural community 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 (Cohen et al. 2015, Cohen et al. 2025). 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. 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.

A critical goal of this project was to collect new data for natural communities to provide natural resource managers and planners with accurate, detailed, standardized baseline information on the current status of ecosystems on these islands that can help guide biodiversity stewardship and restoration and ongoing planning efforts. Qualitative surveys assessed the integrity, classification, and delineation of natural community occurrences and detailed the 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 Isle Royale.

Study Area

Isle Royale is located in Lake Superior about 15 mi south of Ontario and 56 mi north of the Keweenaw Peninsula (Figure 1). The archipelago includes one large island (Isle Royale) surrounded by over 400 small islands. Isle Royale is 45 mi long and 9 mi wide, with an area of 206 sq mi, making it the fourth-largest lake island in the world, the largest natural island in Lake Superior, and the second-largest island in the Great Lakes (after Manitoulin Island).

Landscape Context

The island is composed largely of volcanic ridges, running roughly southwest-to-northeast. The parallel ridges are over 700 ft above Lake Superior in many places. Isle Royale, like the Keweenaw Peninsula, was formed about a billion years ago during the Keweenawan Period of the Precambrian during a prolonged period of extensive surface volcanic activity known as the Midcontinental Rift. During this period, basaltic lava flows were deposited with interbedded conglomerate and sandstone layers. Following the cessation of volcanic activity, alluvial deposition on top of the basalt produced a thick matrix of sedimentary rock composed of conglomerate, sandstone, and siltstone facies (Huber 1975). The current land mass of Isle Royale is the result of a geologic syncline (a fold in rock layers) that formed the Lake Superior basin. One end of the fold forms Isle Royale, while the other forms the Keweenaw Peninsula; the two regions therefore share the same geologic formations (Huber 1975, Schaetzl et al. 2009).

There are two major bedrock formations on the island: the Portage Lake Lava series or Portage Lake Volcanics covering about 85% of the island, and the Copper Harbor Conglomerate covering the remaining 15%. The Copper Harbor Conglomerate were deposited over the basalt flows and are concentrated in the south/southwestern portion of the island, especially along Houghton Ridge (Huber 1975). Although referred to collectively as the Copper Harbor Conglomerate, the formation contains layers of sandstone, siltstone, and stromatolites of varying thicknesses and clast size. The age of both the Portage Lake Volcanics and Copper Harbor Conglomerate is generally accepted to be in the range of 1,120 to 1,000 million years old (Huber 1975, Schaetzl et al. 2009). The Feldtmann Ridge is the highest sheer cliff on Isle Royale and is composed of Copper Harbor Conglomerate (Huber 1975). The parent materials of these sedimentary rocks are predominantly eroded volcanic rocks similar to those exposed elsewhere on the island. Sandstones comprising the upper part of the Copper Harbor Conglomerate formation are exposed along Malone Bay, Siskiwit Bay, Houghton Point, and Houghton Ridge. These sandstones are characterized by dramatic red coloration due to the iron-rich content of the basalts from which they are derived. We refer to these here as Copper Harbor sandstones, following Daniels (1982).

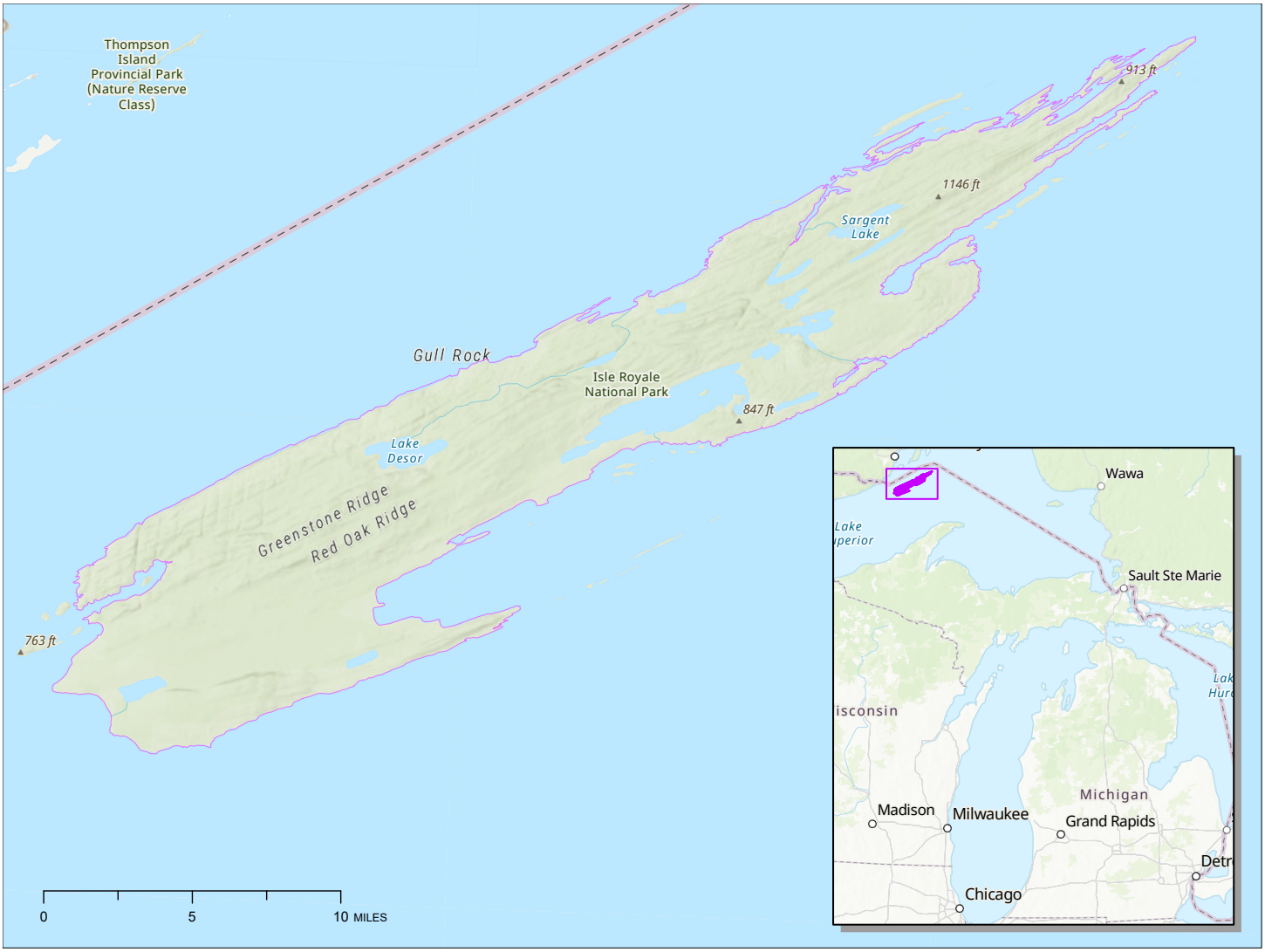


Figure 1. Map of Isle Royale. Isle Royale occurs in Lake Superior just south of Ontario and north of Michigan's Keweenaw Peninsula.



Along the rugged northern coast of Isle Royale volcanic bedrock occurs in large expanses of volcanic lakeshore cliff backed by boreal forest. These Portage Lake Volcanics cover approximately 85% of the island. The southwest-northeast orientation of Isle Royale and its position in unprotected waters of Lake Superior result in the island experiencing frequent high winds, high waves along the shorelines, and frequent summer fog. Photo by Jesse M. Lincoln.







Portage Lake Volcanics are exposed along Isle Royale's shoreline with Michigan's highest concentration of volcanic lakeshore cliff (top) and volcanic bedrock lakeshore (middle and bottom). Photos by Jesse M. Lincoln.



The Copper Harbor Conglomerate cover 15% of Isle Royale and are concentrated along the southwestern portion of the island. Sandstones comprising the upper part of the Copper Harbor Conglomerate formation are exposed along Houghton Point (pictured above), Houghton Ridge, Siskiwit Bay, and Malone Bay (pictured below). Photo by Jesse M. Lincoln.



North of Schooner Island, reddish Copper Harbor sandstones transition to greyish Portage Lake Volcanics. This stretch of sandstone bedrock lakeshore constitutes the northernmost extent of sandstone bedrock lakeshore in Michigan. The age of both the Portage Lake Volcanics and Copper Harbor Conglomerates is over a billion years old. Both volcanic bedrock lakeshore and sandstone bedrock lakeshore are rare in Michigan and were targeted for natural community surveys. Photo by Jesse M. Lincoln.



Boreal forest is the matrix forest across Isle Royale. The boreal forest is highly variable with canopy coverage, vegetative structure, and floristic composition correlated to the frequency of wind disturbance, wildfire, and moose herbivory. This view was captured looking northward from the Ojibway Tower along the Greenstone Ridge. Photo by Joshua G. Cohen

Early inventories of bedrock community types by MNFI separated assemblages occurring on conglomerate from those on basalts. However, subsequent investigations found the substrate types often co-occurred, particularly in shoreline communities, and there were resultant similarities in diversity, composition, and structure of the plant assemblages found on basalts and the conglomerate (Albert et al. 1997). The current MNFI classification treats basalts and conglomerates as "volcanics".

The geologic formations on Isle Royale were modified by various glacial periods, with most recent last ice-advance occurring some 12.9 to 11.6 thousand years ago (Portenga et al. 2023). This ice-advance altered the ridges and valleys, leaving a relatively thin mantle of glacial deposits. Beginning around 10 thousand years ago, there was a rapid glacial retreat which accounts for the lack of glacial deposits on the northeastern most two-thirds of Isle Royale where Precambrian bedrock is most extensively exposed (Huber 1973, Portenga et al. 2023). Meltwaters from the glaciers created distinct lakes and wetlands across Isle Royale. Isle Royale has also been impacted by lake level fluctuations of Lake Superior, which varied with shifting outlets, position of ice, and patterns of melting across the Lake Superior basin (Huber 1975, Breckenridge 2013, Portenga et al. 2023).

Cultural History

Indigenous occupancy of the upper Great Lakes immediately followed the retreat of the glaciers. Isle Royale has long been a cultural touchstone for the Indigenous Peoples of the region. The unique geologic conditions found on Isle Royale led to a high concentration of copper near the earth's surface and copper artifacts from the Lake Superior basin date back as far as around 7,800 years ago (Martin 1999). Copper was mined for millennia and the island has hundreds of pits and trenches from prehistoric Indigenous mining (Martin 1999). Isle Royale was also an important hunting and trapping ground for Ojibwe people from nearby Minnesota and Ontario, who referred to the island as Minong or "the good place", "the beautiful place", or "the place of abundance". Fish, woodland caribou, snowshoe hare, beaver, berries, and medicines were harvested (Cochrane 2009). Maple sugar was also an important resource and was collected by North Shore Ojibwe families "for significant interludes of time" from forests between the Greenstone and Red Oak Ridges (Cochrane 2009).

By the 1830s, a commercial fishery was established on the island. Copper mining began at a large scale in the 1840s (Albert 1995, Gale and Gale 1995). Small, ephemeral communities developed around these economic hubs and later seasonal residents built homes and resorts. During the copper boom in the 19th century, parts of Isle Royale were deforested by miners, commercial loggers, and wildfires, which were often intentionally started by the miners. Portions of Isle Royale were logged sporadically from the early 1800s to the early 1900s to support mining ventures and to create barrels for fish, but commercial ventures were brief and unprofitable (Gale and Gale 1995). In 1935, as negotiations for acquisition for the park were beginning,

Mead Timber Operations built a camp at Siskiwit Bay to harvest timber from the boreal forest and conifer swamp. Over 18,000 cords of pulpwood for paper production were exported (Gale and Gale 1995). Once the island became a national park in 1940, logging and other exploitive activities ended, and the forest began to regenerate.

Wildlife

The significant anthropogenic disturbances in the 19th and early 20th century led to the extirpation of several species on Isle Royale, including woodland caribou (*Rangifer tarandus caribou*), Canada lynx (*Lynx canadensis*), and, presumably, American marten (*Martes americana*) (Manlick et al. 2018). Flocks of passenger pigeons (*Ectopistes migratorius*) were infrequently observed feeding on the acorns in the forests of Red Oak Ridge (Cochrane 2009). There was no mention of moose (*Alces alce*s) on the island prior to 1910, at which point a population was established when moose are thought to have crossed from the mainland (Adams 1909, Janke et al. 1978) Following their arrival, the moose population grew to 1,000 to 5,000 animals by the early 1930s (Mech 1966), leading to over-browsing and starvation in the late 1930s (Rotter and Robertus 2015). The fluctuating moose population has had extreme impacts on the vegetation of Isle Royale. Preferential browsing by moose on balsam fir (*Abies balsamea*), a historically major component of the island's boreal forest, has caused its widespread loss and localized regeneration failure in previously occupied systems (Brandner et al. 1990). As a result, Isle Royale forests have seen significant shifts in composition and structure along with increased vulnerability to invasive species (Rotter and Robertus 2015). Yew (*Taxus canadensis*), once common across Isle Royale, has been nearly eliminated on Isle Royale's mainland (Rotter and Robertus 2015) and is restricted to the low shrub layer and rugged topography. Mountain-ash (*Sorbus decora*) has seen similar declines in abundance from browse pressure and now persists primarily in the understory and low shrub layer and as an "edge" species along lakeshores, cliffs, and other hard-to-reach locations (Slavick and Janke 1993). Many browsed species can persist as heavily pruned saplings for decades, especially balsam fir, and stunted individuals may be found throughout forests across the island.

Isle Royale supports the longest predator-prey study on record, resulting in an increased understanding of the complex wolf-moose interactions and ecological consequences (Manlick et al. 2018). Wolves (*Canis lupus*) were hunted on Isle Royale as early as 1930 (Vic Foerster,



An open moose savanna adjacent to the Ojibway volcanic bedrock glade off of the Greenstone Trail. The fluctuating moose population has had extreme impacts on the vegetation of Isle Royale. Moose browse has caused widespread regeneration failure of several species, including balsam fir (*Abies balsamea*), yew (*Taxus canadensis*), and mountain-ash (*Sorbus decora*). As a result, Isle Royale's natural communities have seen significant shifts in composition and structure along with increased vulnerability to invasive species. Photo by Jesse M. Lincoln.



Isle Royale supports the world's longest predator-prey study. The longitudinal research of moose (*Alces alces*, above) and wolves (*Canis lupus*, below) has informed the understanding of the population dynamics between predators and prey for over 67 years. Photos by Jesse M. Lincoln.



personal communication). Wolves are known to have reestablished on the island in 1945 as the moose population started to recover and have subsequently exerted varying degrees of influence on the moose as wolf populations fluctuated (Rotter and Robertus 2015). Although there is no documentation of wolf presence on Isle Royale prior to the 19th century, wolves likely accessed the island episodically via winter ice and the modern wolf population represents recolonization and not continuity of occupancy. Wolves also exert direct population control of beaver on Isle Royale, and the beaver population has rapidly decreased following the introduction of additional wolves in 2018 (Romanski, personal communication 2025). Changes in wolf abundance influence moose kills and indirectly impact the red fox (*Vulpes vulpes*) population, which declines with fewer moose carcasses available to scavenge (Rotter and Robertus 2015). The drop in red fox lowered predation on snowshoe hares, which spiked dramatically from 2012 to 2013, leading to shifts in hare browse across the island and intensified browse pressure on white spruce (*Picea glauca*) and black spruce (*P. mariana*). Intense hare browse on spruce can lead to impaired recruitment and reduced sapling abundance (Olnes and Kielland 2017, Olnes et al. 2019). Notably absent from the island are white-tailed deer (*Odocoileus virginianus*). This absence is a dramatic departure from the surrounding mainland where deer populations are much higher than historic abundances, causing dramatic shifts in floristic composition and vegetative structure of natural communities.

Natural Communities

Isle Royale supports a diverse array of natural community types. Two distinct upland forest types occur on Isle Royale. The majority of the island is dominated by uneven-aged boreal forest characterized by white spruce, northern white-cedar (*Thuja occidentalis*), paper birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*), and balsam fir, which increases in importance in forests along Lake Superior. Mesic northern forest is restricted to the western third of the island where there are deeper soils and is characterized by yellow birch (*Betula alleghaniensis*) and sugar maple (*Acer saccharum*) with infrequent red oak (*Quercus rubra*). The island's steep topography and position in Lake Superior subject the island's natural communities to extreme windthrow, periodic fire from lightning strike, and heavy snowfall. Moose and hare herbivory along with beaver dynamics along wetlands exert dramatic influence on the structure and composition of the boreal forests.

Wetlands occur in the depressions between the island's prominent ridge features, along lakes, and embayments. These include northern wet meadow, poor fen, patterned fen, rich conifer swamp, poor conifer swamp, muskeg, wooded dune and swale complex, and hardwood-conifer swamp, all of which are strongly influenced by moose herbivory and beaver-mediated water levels. In the absence of emerald ash borer (*Agrilus planipennis*), mature black ash (*Fraxinus nigra*) persists throughout the island



Isle Royale supports a diverse array of natural community types. Numerous bedrock ecosystems and wetlands occur within the matrix boreal forest. Meltwaters from the glaciers created distinct inland lakes and wetlands across Isle Royale. Photo by Jesse M. Lincoln.



Frequent fog and low summer temperatures create suitable growing conditions along Isle Royale's bedrock shoreline for numerous rare plant species that are disjunct from their core range in artic and alpine regions. Photo by Jesse M. Lincoln.

in wetland complexes and along forested streams and seepages.

Rapid glacial recession led to markedly thinner soils on the eastern two-thirds of the island with more prevalent exposed bedrock along the ridges and south-facing slopes of the island (Portenga et al. 2023). Volcanic bedrock glades occur in the eastern portion of the island and occur within a matrix of boreal forest and wetlands that fill the basins between lava series. The glade systems are strongly influenced by drought caused by shallow soils and the aspect of the severe slope of bedrock limiting water retention; interactions between windthrow and moose herbivory; and past fires caused by lightning or anthropogenic ignitions. The prevalent windthrow across the island generates many areas of open-canopied boreal forest that can be difficult to differentiate from the open glade systems when evaluating aerial imagery. Extreme browse is leading to the failure of many woody species to regenerate and replace mature trees, and there is a widespread, if gradual, conversion of boreal forest to open woodland or moose savannas, especially at the western end of the island (Rotter and Robertus 2015).

Bedrock shoreline communities are pronounced on the perimeter of the islands. Isle Royale's shoreline supports large expanses of volcanic bedrock lakeshore and volcanic lakeshore cliff, which intergrade locally. Volcanic cobble shore occurs locally within coves and bays. Several embayments also support sand and gravel beach. Along the southwestern portion of the island, sandstone bedrock lakeshores, sandstone lakeshore cliff, and sandstone cobble shore occur locally from exposed sandstone layers of the Copper Harbor Conglomerate.

Isle Royale, like many areas of shoreline along the Keweenaw Peninsula, experiences low summer temperatures and fogs that create suitable growing conditions for plant species with characteristic arctic distributions. These "relics of the late Wisconsin dispersal"

were established following the glacial retreat at the end of the last ice age and persist where Lake Superior moderates the local climate (Slavick and Janke 1993). Similarly, there are several plant species with a western distribution that have unusually isolated populations on Isle Royale (Marquis and Voss 1981); it is thought that a transcontinental distribution of their populations along the margins of the glacial front existed at one point in time and subsequently persisted in microhabitats with continuously exposed bedrock (Slavick and Janke 1993). Consequently, many of these plant species are particularly rare, found nowhere else in Michigan, and are quite disjunct from their core ranges, resulting in an unusual concentration of rare plant species associated with the bedrock communities of Isle Royale.

Fire

Throughout the upper Midwest region, fire is an integral process that influences patterning of ecosystems across the landscape and maintains species composition and vegetative structure. Fire regimes, or the occurrence and distribution of fire on the landscape, exhibit considerable spatio-temporal variation. Fire frequency, the number of times a fire occurs over a given time period, varies across space (e.g., depending on landform, vegetation type, landscape configuration, and distance and orientation to natural firebreaks) and through time (e.g., depending on climatic conditions, time since last fire, and duration of droughts) and is influenced by human population density and culture (Heinselman 1981, Whitney 1986, Dickmann and Cleland 2002, Cleland et al. 2004). In the past, human- and lightning-set fires frequently spread over large areas of the northern Great Lakes region. Indigenous peoples have been an integral part of the fire regime across this region. Pine-dominated landscapes across the region have been shaped by cultural burning (Loope and Anderton 1998, Anderton 1999, Larson et al. 2021). There is also increasing understanding that in addition to the prevalence of fire in these upland ecosystems, fire was a key component in peatlands (Meunier et al. 2019, Sutheimer et al. 2021) and coastal wetlands (Albert 2003). Fire or "Ishkode/ Shkode'' was used to promote culture, community, medicine, food, hunting, and pest control, facilitate travel, and attenuate wildfire risk (Kimmerer and Lake 2001, Huffman 2013, Hoffman et al. 2022, Parks et al. 2025). Prior to colonization, Indigenous fire stewardship shaped fire regimes across North American landscapes, providing safe living and foraging conditions and reduced wildfire (Hankins et al. 2025).



Burnt white pine stumps along the upper margin of volcanic bedrock glade south of the Greenstone ridge. Fire is a key ecological process influencing floristic composition, vegetative structure, and successional trajectories of natural communities on Isle Royale. Photo by Joshua G. Cohen.

Fire has been a persistent and influential ecological process shaping the patterning, composition, and successional trajectories of natural communities on Isle Royale (Cooper 1913, Slavick and Janke 1993). Based on the presence of fire-scarred red pine and white pines near Harvey Lake and Sumner Lake and the historic usage of Todd Harbor and McCargoe Cove as traditional portals, it is likely that Indigenous Peoples applied cultural fires on specific portions of Isle Royale to maintain open understories for foraging, hunting, foot trails, canoe portages, resin production, improving berry crops, and camping.

Fire is mentioned in the earliest surveys of Isle Royale: "It is nearly certain that fire has played a part in the vegetational history of almost all if not the entire forested area of the island" (Cooper 1913). During the nineteenth century, fire frequency and extent increased substantially as a result of Euro-American mining activity. Fires were intentionally set to clear vegetation, improve access to mining sites, and expose surface copper deposits (Slavick and Janke 1993). General Land Office survey records from the 1840s document burned areas near mining camps, and extensive fire impacts across upland forests and wetlands, particularly a "fire swept" swamp at the head of McCargo Cove (Ives 1848, Cooper 1913) (Figures 2 and 3). These anthropogenic fires altered forest structure, composition, and successional trajectories across large portions of the island.

Cooper (1913) documented highly variable post-fire successional pathways on Isle Royale, strongly influenced by fire severity and effects on organic soil layers. Low- to moderate-severity fires that left the humus layer largely intact typically resulted in rapid establishment of early-successional "burn forests," dominated by paper birch (*Betula papyrifera*) and other fire-adapted species. In

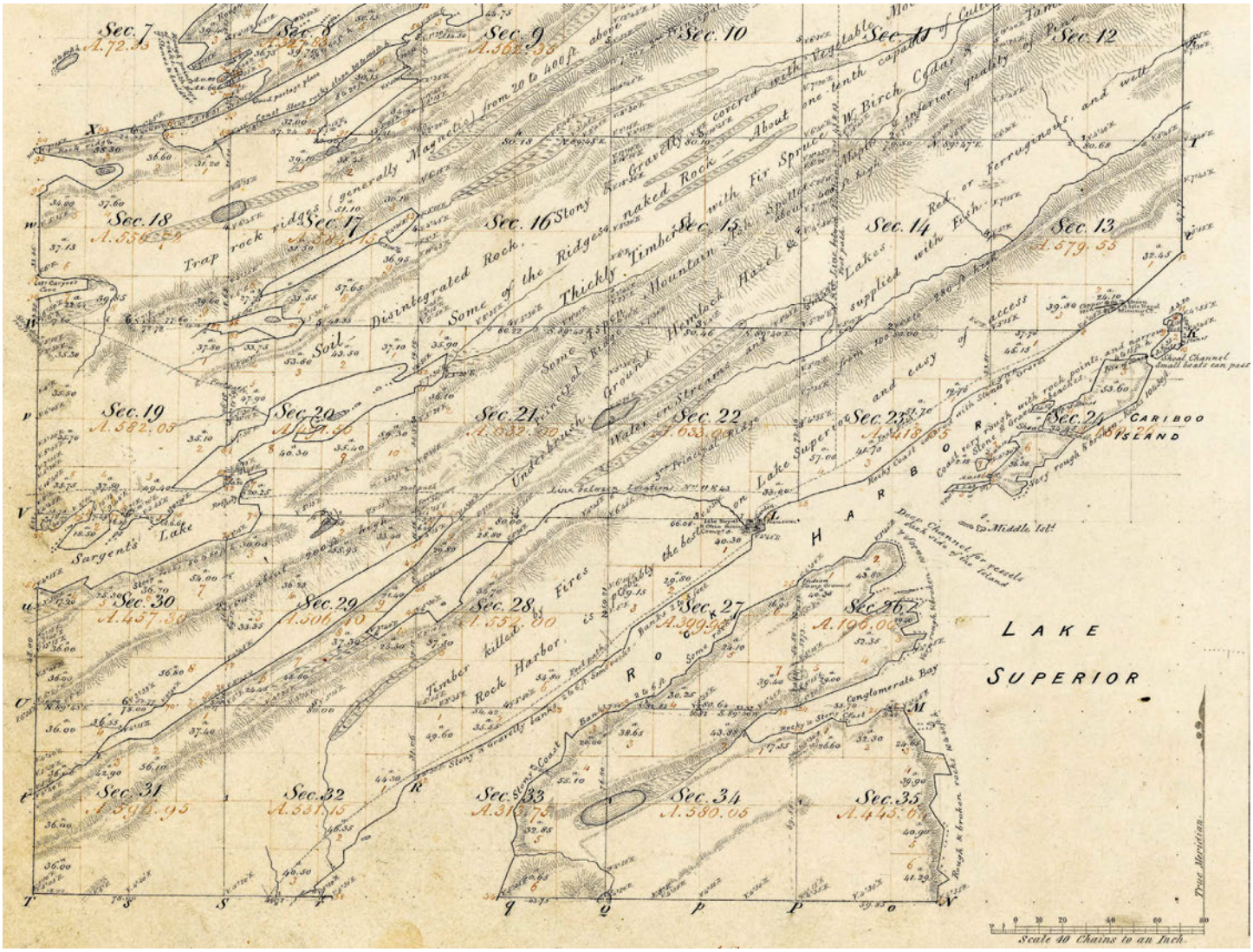


Figure 2. Map derived from the notes of General Land Office surevyor William Ives from 1847. Ives noted "Timber killed by fires" in the Daisy Farm area (Ives 1848). These surveys also described historic vegetation and were used by Rotter and Robertus (2015) to detail changes due to moose herbivory. "Underbrush Ground Hemlock" in Sections 21 and 22 refers to yew (*Taxus canadensis*) which was historically widespread, but is now rare due to protracted moose browse pressure. The surveyor's map also describes slopes that likely supported volcanic bedrock glade. Descriptions suggesting the presence of glade include "Disintegrated Rock", "Trap rock ridge", and "naked Rock". In addition, an "Indian Campground" is noted in Section 26.

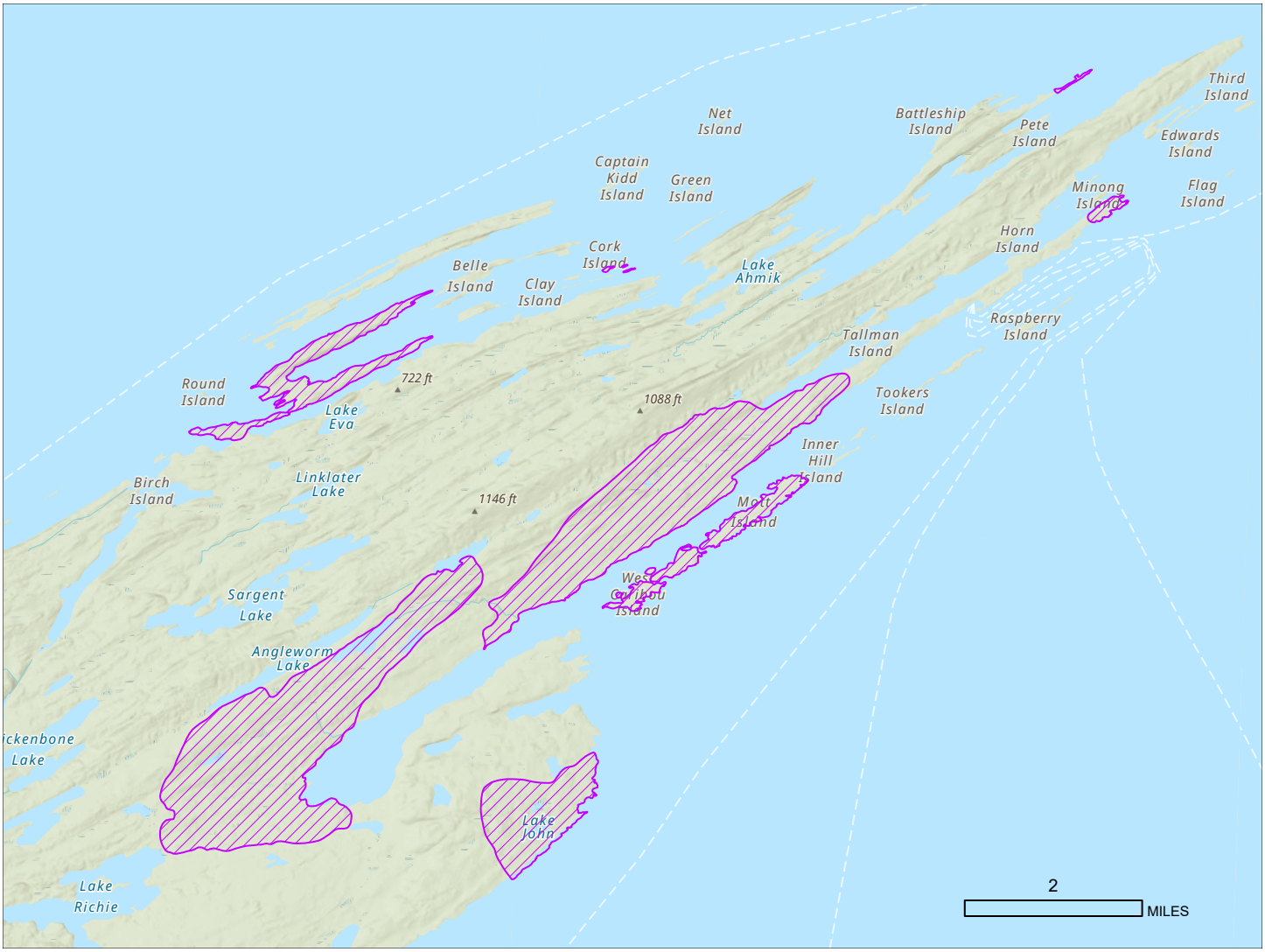


Figure 3. Estimated extent of wildfires observed by General Land Office surevyors in the 1840s (Comer et al. 1995).

contrast, high-severity fires that consumed organic soils and exposed bedrock initiated much slower recovery trajectories resembling primary succession, beginning with glade conditions that support lichens and plants in rock cervices, and then progressing gradually toward forested conditions. Balsam fir (*Abies balsamea*) and white spruce (*Picea glauca*) were consistently eliminated by burning and were slow to reestablish (Cooper 1913).

The largest documented fire on Isle Royale occurred in 1936, following extensive logging near Siskiwit Bay. Accumulated slash from logging from Meade Timber Operations, combined with hot and dry conditions, facilitated a fire that spread across large portions of the island. Despite firefighting efforts, the fire consumed approximately 27,000 acres- over 20% of the island – altering forest age structure, species composition, and landscape heterogeneity (Slavick and Janke 1993, Baldwin 2011). Following the 1936 fire, fire frequency has declined, although periodic wildfires still occur. Most recently, the Horne Fire of 2021 originated from lighting strike and burned approximately 335 acres of boreal forest. This recent fire indicates the continued role of lightning-ignited fire as a relevant ecological process.

Fire interacts with other disturbance agents and abiotic factors on Isle Royale, including windthrow, shallow soils, steep sloping bedrock with southerly aspect, moose and hare herbivory, and beaver-mediated hydrologic changes. Past fire has influenced development of several volcanic bedrock glades and open-canopied boreal forest, particularly where slope, aspect, and thin soils limit regeneration of vegetation. Vegetation patterns across the island reflect a cumulative effect of past fires, subsequent disturbances, and ongoing succession.



The interaction of moose herbivory, wildfire, windthrow, and thin soils maintain open canopy conditions on Isle Royale. Balsam fir (*Abies balsamea*), prefered browse for moose, is locally failing to regenerate. Photos by Joshua G. Cohen (above) and Jesse M. Lincoln (below).



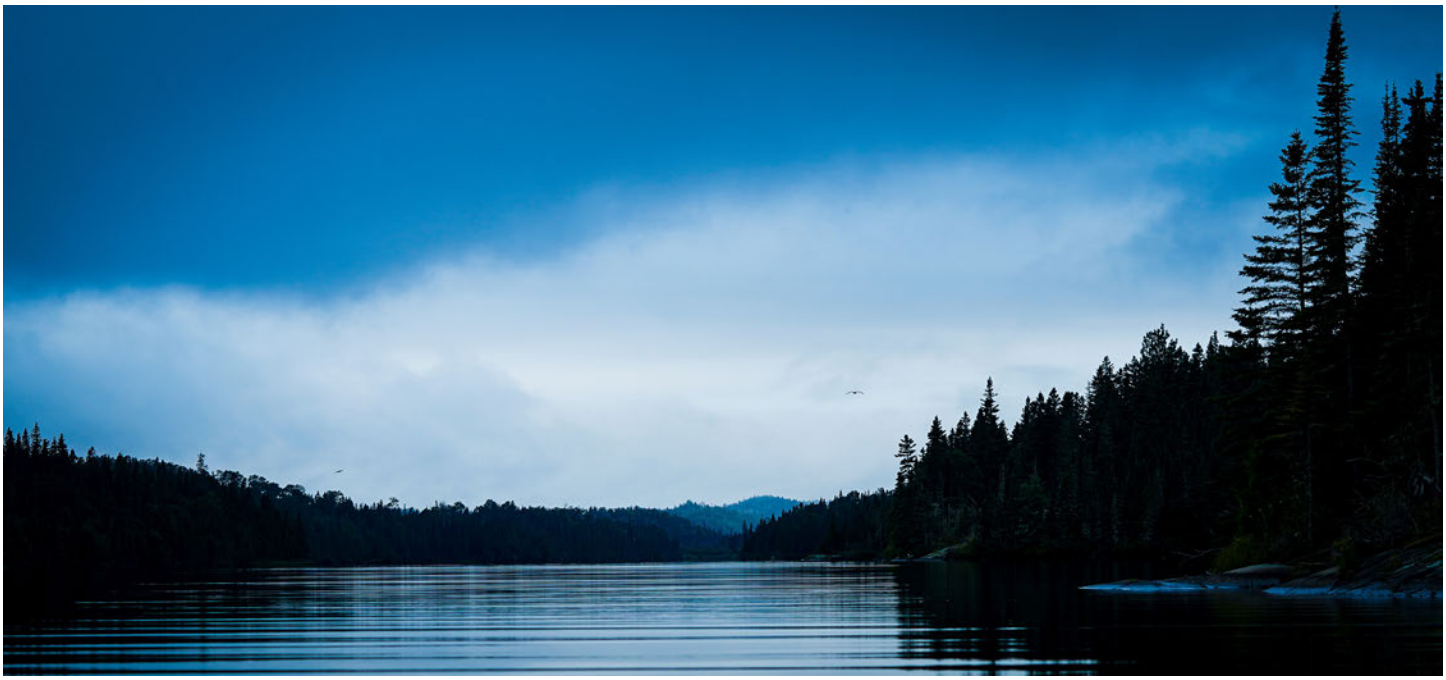
Current Management Context

Isle Royale National Park was established on April 3, 1940, then additionally protected from development by wilderness area designation in 1976, declared a UNESCO International Biosphere Reserve in 1980, and added to the National Register of Historic Places in 2019 as the Minong Traditional Cultural Property. Once the island became a national park, development and resource extraction ended.

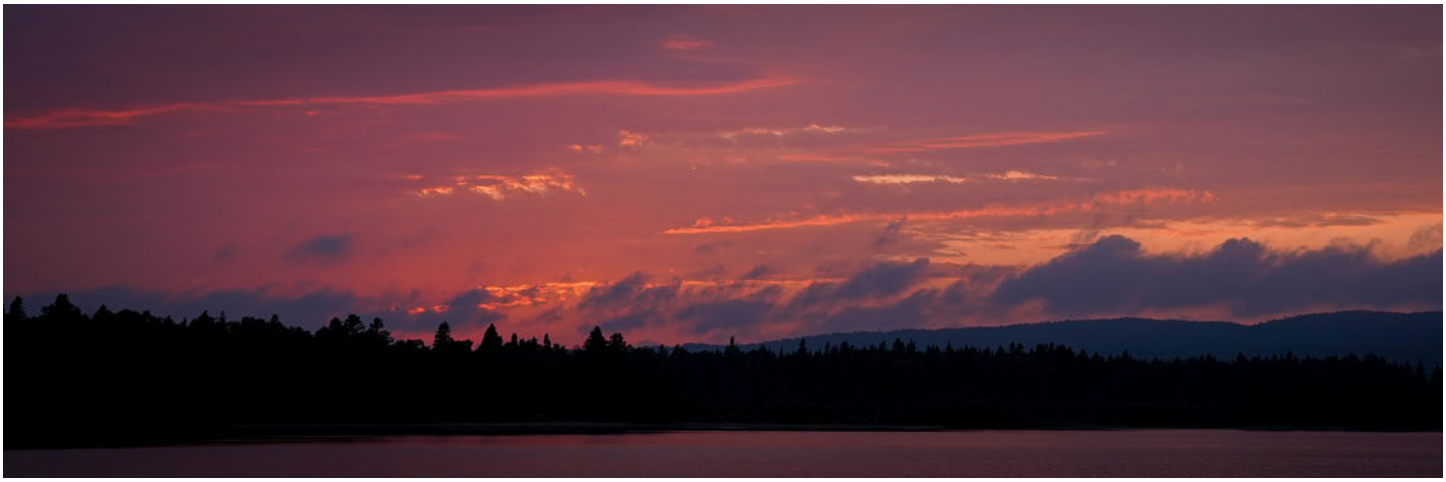
Isle Royale is roadless with a network of trails for hiking connecting numerous campsites with primitive structures and boating docks. National Park buildings and concessions occur at the northeast end of the island in Rock Harbor, Mott Island, and in the southwest end of the island at Washington Harbor.

The stated purpose of Isle Royale National Park is to set apart a remote island archipelago and surrounding waters in Lake Superior as a national park for the benefit and enjoyment of the public and to preserve and protect its wilderness character, cultural and natural resources, scenery, and ecological processes. Additionally, as a unit of the national park system, Isle Royale National Park provides opportunities for recreation, education and interpretation, and scientific study.

This report is intended to describe the unique natural communities of Isle Royale and provide a summary of their ecological integrity. The report provides baseline information about ecological assets to help inform monitoring, site-level biodiversity stewardship, and landscape-level conservation planning. We believe the report will function as a useful reference for resource managers tasked with fulfilling Isle Royale's stated purpose.



This report provides management recommendations on unique ecological attributes of Isle Royale National Park to facilitate stewardship activities to conserve the Park's cultural and natural resources so that visitors can continue to enjoy the ecological integrity of places like Chippewa Harbor (above) and Siskiwit Bay (below). Photos by Jesse M. Lincoln.



Methods

Natural community surveys were conducted on Isle Royale over the course of two field seasons. In 2024, surveys were conducted from August 8th through August 20th. In 2025, surveys were conducted June 7th and June 8th and from August 2nd through August 22nd. Surveys were conducted by foot and canoe and were facilitated by National Park Service staff, who provided logistical and nautical support. Before this survey effort, natural community surveys had never been conducted by MNFI staff on Isle Royale.

Field Survey Prioritization

Prior to on-the-ground-surveys, MNFI ecologists conducted literature review, GIS analysis, and aerial photo interpretation to develop survey targets by delineating potential natural communities for Isle Royale. To assist with delineation, we evaluated multiple series of aerial imagery, including color infrared imagery (1998 and 2017), true color leaf-off imagery (2017), and true color leaf-on imagery (2020), and also Vegetation Circa 1800 (Comer et al. 1995), topographic maps, and LIDAR digital elevation models with shaded relief (Figures 4a and 4b). The delineation of potential natural community types across the island helped focus discussion with National Park Service scientists (Romanski, Potvin, and Egan, personal communication 2024 and 2025) and biologists with long-standing expertise on Isle Royale (Peterson and Peterson, personal communication 2024) to further refine surveys of high-quality natural communities. The MNFI natural community classification system was used as the classification framework (Cohen et al. 2015, Cohen et al. 2025).

The natural community assessments were prioritized based on the rarity and estimated integrity of the potential natural community targets. These targets were then evaluated using the Natural Heritage sampling prioritization principal, which emphasizes that survey efforts should be focused on the rarest and highest quality natural communities (Figure 5) (NatureServe 2002, Rocchio et al. 2018).



Michigan Technological University professor Rolf Peterson and MNFI ecologist Joshua Cohen discussing survey targets and access routes. Photo by Jesse M. Lincoln.

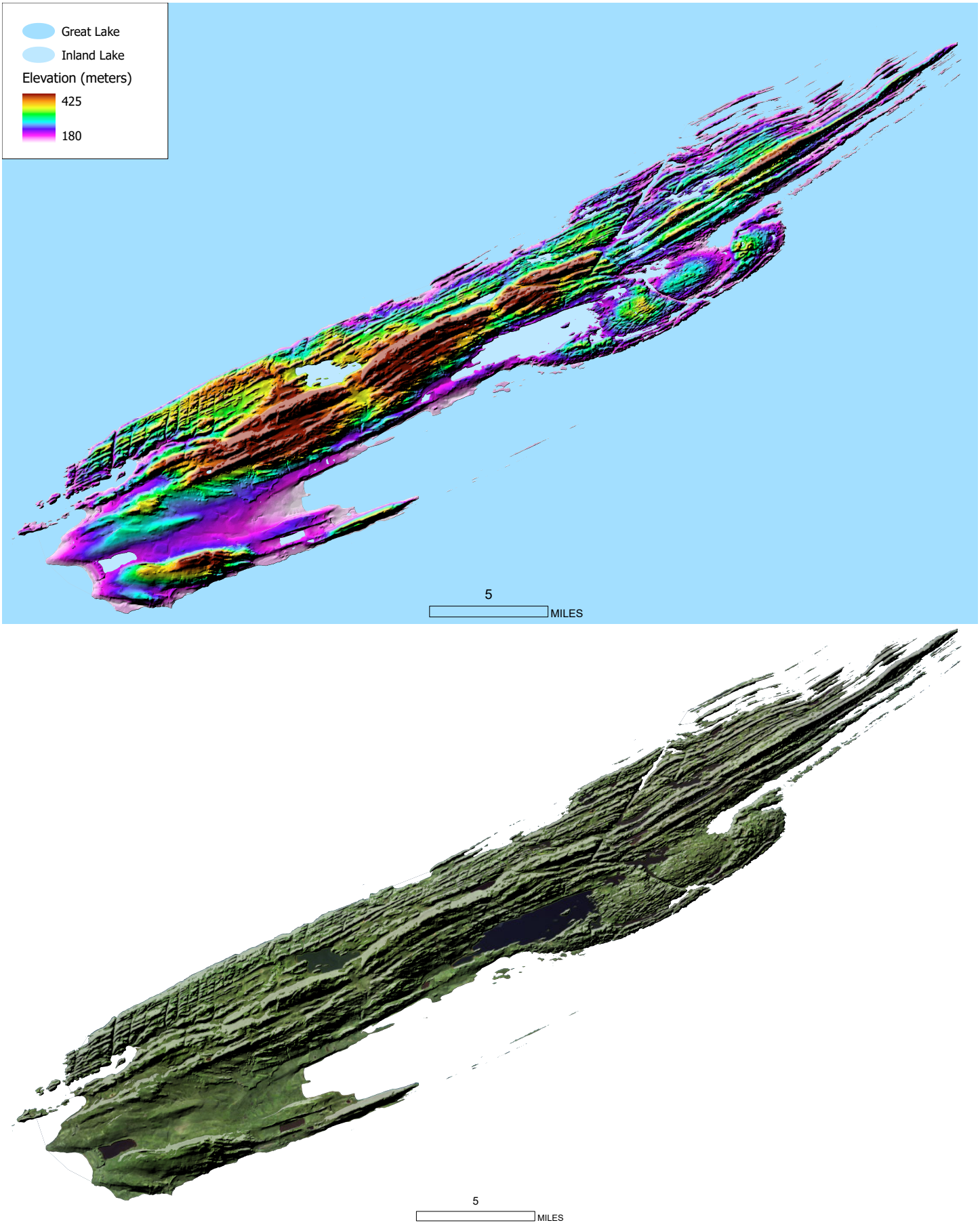


Figure 4a. Spatial data layers and imagery used to prioritize survey effort. Elevation with shaded relief (USGS 2026) (top) and true color leaf-on imagery (2020) (USDA 2020) (bottom).

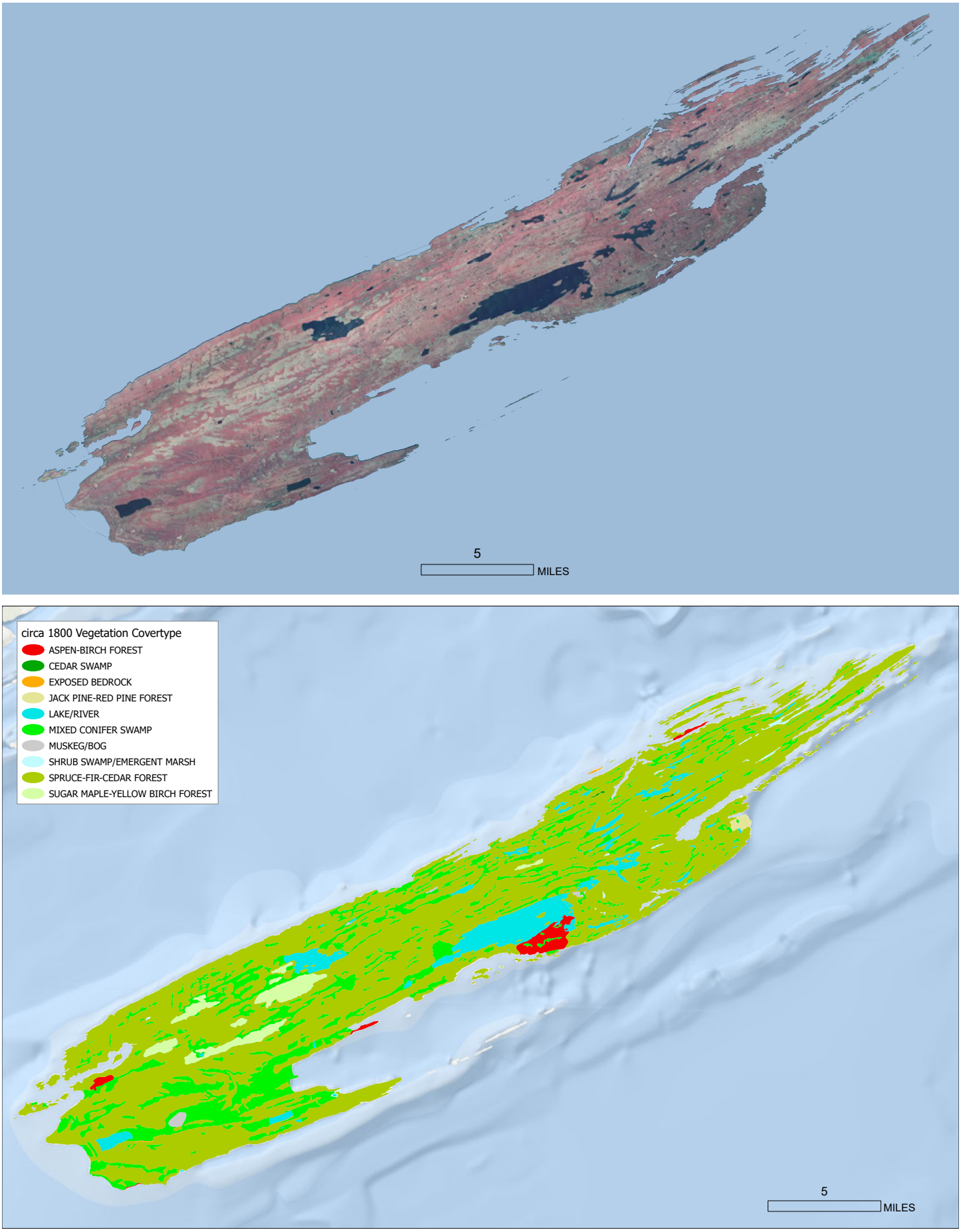


Figure 4b. Spatial data layers and imagery used to prioritize survey effort. Color infrared imagery (2022) (State of Michigan 2022) (top) and Circa 1800 Vegetation (Comer et al. 1995) (bottom).

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 5. Decision matrix to determine natural community survey targets (NatureServe 2002, Rocchio et al. 2018). G = Global Rank, S = State Rank, U = currently unrankable, NR = not ranked; lower numbers are more imperiled than higher numbers. For more information, see Appendix 1.



Tree diameter at breast height (DBH) was measured across forested natural community types. This northern white-cedar (*Thuja occidentalis*) had a 116 cm DBH and was estimated to be over 500 years old. This was the largest and oldest cedar observed on the island, found in a protected valley in the Huginnin Cove boreal forest. Photo by Jesse M. Lincoln.

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, Faber-Langendoen et al. 2016).

Given the logistical complexity of conducting surveys on Isle Royale due to the rugged terrain, lack of roads, extensive area, and limited trail network, MNFI ecologists worked in collaboration with National Park Service staff to identify realistic survey targets given limitations in time and access (Romanski, Potvin, and Egan, personal communication 2024 and 2025). Targets were clustered into logical hitches, and access routes were identified prior to surveys. This included identifying hiking trails, canoe routes, research vessel access points, and camping sites. Given the uncertainty of nautical travel on Lake Superior due to changing wind and wave conditions, we identified numerous contingency plans and survey targets close to central access points (i.e., Rock Harbor, Mott Island, and Washington Harbor). A significant benefit of surveying Isle Royale across two field seasons was the development of relationships with National Park Service staff and a deeper understanding of access and Isle Royale's ecology. The two-year effort also facilitated our ability to visit all priority survey targets with longer survey windows. In 2024, three hitches were based out of the Daisy Farm, Chippewa Harbor, and Siskiwit Bay campgrounds. In 2025, June surveys were based out of the Lane Cove campground. In August of 2025, hitches were based in Malone Bay, Washington Harbor, Huginnin Cove, Siskiwit Bay, and Mott Island.

Natural communities identified through this prioritization process as survey targets included volcanic bedrock glade, volcanic bedrock lakeshore, volcanic lakeshore cliff, volcanic cliff, boreal forest, mesic northern forest, poor fen, patterned fen, dry-mesic northern forest, and wooded dune and swale complex. Following the first year of surveys in 2024, MNFI ecologists in consultation with National Park Service scientists added sandstone community targets (i.e., sandstone bedrock lakeshore, sandstone lakeshore cliff, and sandstone bedrock glade) along Malone Bay, Houghton Ridge, and Houghton Point. Several of the natural community types targeted through the prioritization are rare globally and within Michigan but are relatively common on Isle Royale (i.e., volcanic bedrock glade, volcanic bedrock lakeshore, and volcanic lakeshore cliff). Despite occurring frequently on Isle Royale, these natural community types remained a high priority for surveys because evaluation of these systems increases our understanding of these natural communities and informs their management and conservation across their distribution.



Poor fen and volcanic cliff occurring along Sumner Lake. Photo by Joshua G. Cohen.



The remote location of survey targets required the strategic use of canoes in interior lakes and along the Lake Superior shoreline. Photos by Joshua G. Cohen (above) and Jesse M. Lincoln (below).



Field Survey

A plotless sampling design was employed to survey natural communities on Isle Royale. MNFI ecologists ground-truthed natural community targets using qualitative meander surveys. MNFI ecologists prioritized rare community types but opportunistically surveyed additional natural communities enroute to, adjacent to, or intergrading with priority survey targets. The meander surveys covered a representative sample of each natural community, and involved investigating typical and 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 targets.

According to Natural Heritage Methodology, if a site meets defined requirements for ecological condition, landscape context, and size of the area of interest (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 combination of field surveys, aerial photographic interpretation, and Geographic Information System (GIS) analysis was employed.



Houghton Point sandstone bedrock glade. Ecologists conducted meander surveys to cover a representative sample of each natural community, investigate typical and unique aerial signatures, traverse topographic variation, and visit noticeable vegetation zones, soil moisture types, and geologic features. Photo by Jesse M. Lincoln.

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, ground-water seepage, paludification, wildfire, herbivory, and beaver flooding)

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., ditching, trails, mining, and logging)

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

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

j) taking digital photos and GPS points at significant locations

k) surveying adjacent lands when possible to assess landscape context

l) evaluating the natural community classification and mapping 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

Following completion of the field surveys, the collected 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. This natural community element occurrence mapping is distinct from the preliminary delineation of natural community types that was based solely on GIS analysis and aerial photo interpretation and was used strictly for planning purposes. 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 **Appendix 2**.

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



Feldtmann Ridge volcanic cliff. Floristic Quality Assessments were generated for each natural community Element Occurrence. Photo by Jesse M. Lincoln.





Representative trees were measured and aged across natural community types. Aging northern white-cedar (*Thuja occidentalis*) in the Minong Shores volcanic lakeshore cliff (top left), jack pine (*Pinus banksiana*) in The Glade Coast volcanic bedrock glade (top right), and stunted northern white-cedar in the Feldtmann Fen patterned fen (bottom). Photos by Joshua G. Cohen.





MNFI scientists compiled comprehensive plant species lists and also evaluated soil texture and chemistry for each high-quality natural community element occurrence. Minong Shores volcanic bedrock lakeshore (above) and Stone's Point volcanic lakeshore cliff. Photos by Jesse M. Lincoln.



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). FQI scores greater than 50 indicate exceptional sites with extremely high conservation value (Herman et al. 2001). Species lists for each natural community element occurrence are provided in Appendix 3. Nomenclature of plant species for these lists and throughout the report follows Michigan Flora (Voss and Reznicek 2012). We provide a crosswalk of Ojibwe names to scientific and common names in Appendix 4 for all plant species observed on Isle Royale that are listed in "Plants used by the Great Lakes Ojibwa" (Meeker et al. 1993).

Natural Community Stewardship and Monitoring 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 a threat index. We used the element occurrence rank to determine the ecological integrity rank, with higher scores for higher-ranked element occurrences. The rarity index was calculated 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. The threat index was derived by calculating the average of a threat severity index and a treatment feasibility index. Threats incorporated into this index include invasive species infestation, fire suppression, and herbivory. The threat severity index incorporates knowledge of impacts of threats to natural community types and site-specific information gained during surveys. Higher scores for the threat severity index correspond to increased degradation due to threats. The treatment feasibility index was derived by assigning a score to each natural community element occurrence based on the ease of addressing the threats recorded within that site. Higher scores for the treatment feasibility index correspond to a greater likelihood of successful threat abatement. The threat severity index and treatment feasibility index were assigned based on professional judgement and familiarity with species, systems, and ecological regions. 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 threat index was calculated to sort the natural community element occurrences by their stewardship and monitoring prioritization score (Figure 6). 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.

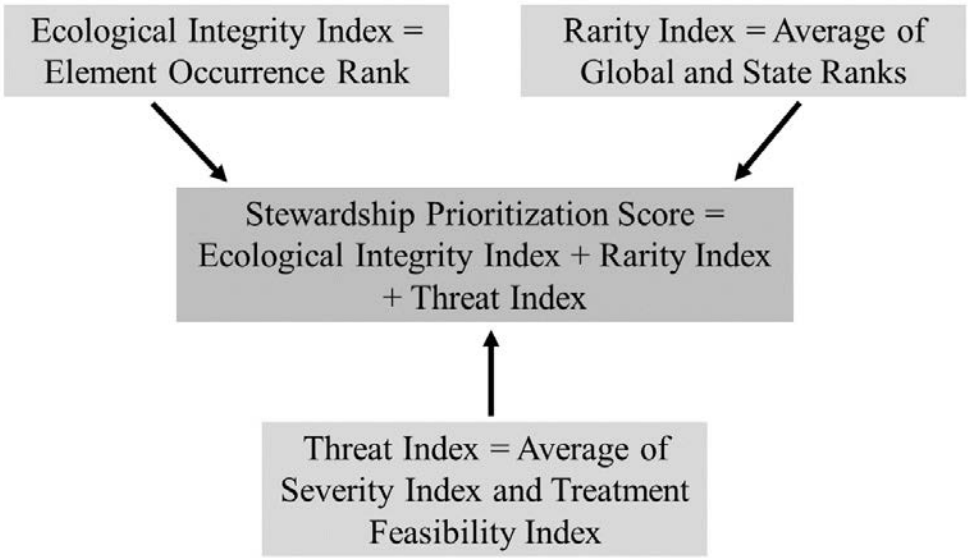


Figure 6. The Stewardship and Monitoring Prioritization score is the sum of the Ecological Integrity Index, Rarity Index, and Threat Index. This prioritization scoring was derived to help focus finite resources for biodiversity stewardship.

Survey Results

Sixty-one high-quality natural communities were documented on Isle Royale during the 2024 and 2025 field seasons representing 18 different natural community types including: boreal forest (4 element occurrences or EOs), dry-mesic northern forest (1 EO), hardwood-conifer swamp (1 EO), mesic northern forest (2 EOs), muskeg (1 EO), patterned fen (1 EO), poor fen (3 EOs), sandstone bedrock glade (2 EOs), sandstone bedrock lakeshore (4 EOs), sandstone cliff (1 EO), sandstone cobble shore (1 EO), sandstone lakeshore cliff (2 EOs), volcanic bedrock glade (19 EOs), volcanic bedrock lakeshore (5 EOs), volcanic cliff (6 EOs), volcanic cobble shore (1 EO), volcanic lakeshore cliff (6 EOs), and wooded dune and swale complex (1 EO). Table 1 lists the visited sites, their element occurrence ranks, and their acreage. Mapped natural community boundaries are provided for each natural community EO in Figure 7. Close-up details for natural community EOs in the western, central, and eastern portions of Isle Royale are provided in Figures 8, 9, and 10, respectively. Appendix 2 includes an overview of the natural community types documented adapted from MNFI's natural community classification (Cohen et al. 2015, Cohen et al. 2025), an accompanying ecoregional distribution map for each natural community type (Albert et al. 2008), and site summaries for each natural community EO organized alphabetically by community type. 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

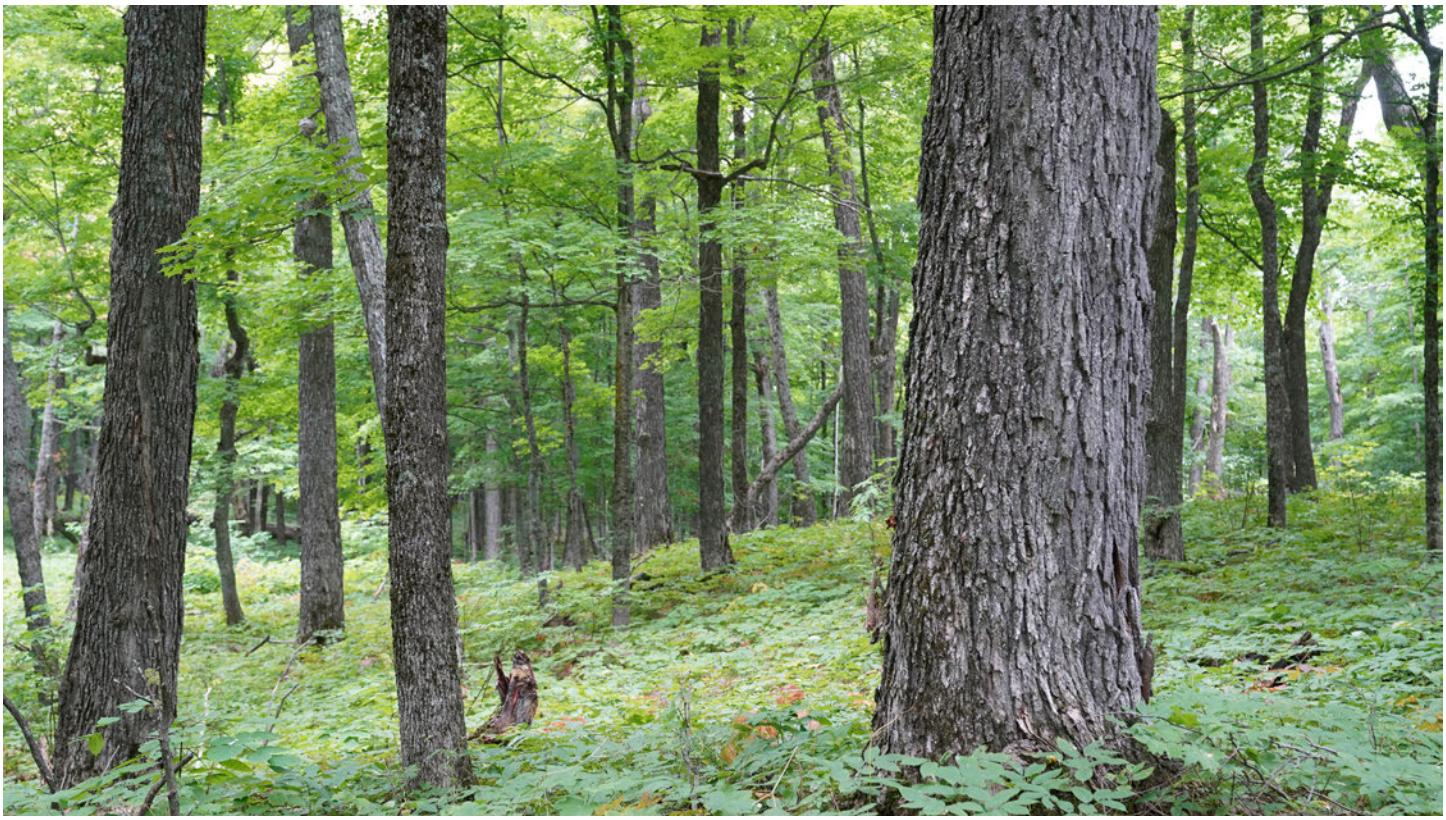
f) locational information

g) digital photographs

h) site description

i) threat assessment

j) management recommendations



Lake Desor mesic northern forest. Photo by Jesse M. Lincoln.

Table 1. Natural community element occurrences (EOs) surveyed in 2024 and 2025 on Isle Royale. EO rank abbreviations are as follows: A, excellent estimated viability; AB, excellent to good estimated viability; B, good estimated viability; BC, good to fair estimated viability; and C, fair estimated viability.

Natural Community Type	Site Name	EO ID	Acreage	EO Rank
Boreal Forest	Chippewa Harbor	27876	46	B
Boreal Forest	Houghton Ridge	28354	151	A
Boreal Forest	Huginnin Cove	28343	97	A
Boreal Forest	Starvation Point	27863	63	B
Dry-Mesic Northern Forest	Lake Harvey	28340	23	C
Hardwood-Conifer Swamp	Feldtmann Ridge	28359	156	A
Mesic Northern Forest	Feldtmann Ridge	28360	242	AB
Mesic Northern Forest	Lake Desor	28369	361	AB
Muskeg	Lake Desor	28370	64	B
Patterned Fen	Feldtmann Fen	27856	153	AB
Poor Fen	Siskiwit Bay	27858	110	B
Poor Fen	Sumner Lake and Newt Lake	27860	44	B
Poor Fen	Tobin Creek	27861	4.2	B
Sandstone Bedrock Glade	Houghton Point	28351	18	A
Sandstone Bedrock Glade	Houghton Ridge	28355	106	B
Sandstone Bedrock Lakeshore	Houghton Point	28352	2.9	A
Sandstone Bedrock Lakeshore	Houghton Ridge	28357	5.5	AB
Sandstone Bedrock Lakeshore	Malone Bay	28338	9.3	AB
Sandstone Bedrock Lakeshore	Wright Island	28334	3.4	C
Sandstone Cliff	Houghton Ridge	28356	5.6	AB
Sandstone Cobble Shore	Wright Island	28335	1.2	B
Sandstone Lakeshore Cliff	Houghton Point	28353	4.5	A
Sandstone Lakeshore Cliff	Malone Bay	28337	1.9	AB
Volcanic Bedrock Glade	Amygdaloid Island	28371	30	B
Volcanic Bedrock Glade	Banksi Glade	27864	74	AB
Volcanic Bedrock Glade	The Glade Coast	27875	506	A
Volcanic Bedrock Glade	Glade of Ages	28350	2.7	B
Volcanic Bedrock Glade	Lake Whittlesey	27874	235	A
Volcanic Bedrock Glade	Lane Cove	28333	60	B
Volcanic Bedrock Glade	Malone Bay	28339	36	BC
Volcanic Bedrock Glade	Moose Lake	28367	21	C
Volcanic Bedrock Glade	Moose Lightning	28346	22	B
Volcanic Bedrock Glade	Mt. Saginaw	27872	26	BC
Volcanic Bedrock Glade	Ojibway	27869	374	BC
Volcanic Bedrock Glade	Scoville Point	28363	10	C
Volcanic Bedrock Glade	Siskiwit Lake	28336	246	C
Volcanic Bedrock Glade	Siskiwit Mine	27865	19	C
Volcanic Bedrock Glade	Stone's Point	28373	7.5	AB
Volcanic Bedrock Glade	Sumner Lake	27870	4.5	BC
Volcanic Bedrock Glade	Three Mile	28366	35	BC
Volcanic Bedrock Glade	Tobin Creek	27866	183	B
Volcanic Bedrock Glade	Tobin Harbor	28368	25	B
Volcanic Bedrock Lakeshore	Minong Shores	27880	214	A
Volcanic Bedrock Lakeshore	Mott Island	28362	9	B
Volcanic Bedrock Lakeshore	Sam Hill	28349	0.7	B
Volcanic Bedrock Lakeshore	Scoville Point	28364	6.8	B
Volcanic Bedrock Lakeshore	Stone's Point	28375	1	B
Volcanic Cliff	Chippewa Harbor	27878	10	A
Volcanic Cliff	Feldtmann Ridge	28358	100	A
Volcanic Cliff	Lake Whittlesey	27881	9.8	A
Volcanic Cliff	McGinty Cove	28345	1.8	AB
Volcanic Cliff	Moose Lightning	28347	2.9	AB
Volcanic Cliff	Sumner Lake	27877	1.6	AB
Volcanic Cobble Shore	Huginnin Cove	28342	1.9	B
Volcanic Lakeshore Cliff	Amygdaloid Island	28372	4.5	B
Volcanic Lakeshore Cliff	Minong Shores	27882	18	A
Volcanic Lakeshore Cliff	Mott Island	28361	3	B
Volcanic Lakeshore Cliff	North Shore	28341	16	A
Volcanic Lakeshore Cliff	Scoville Point	28365	2.9	B
Volcanic Lakeshore Cliff	Stone's Point	28374	7.5	AB
Wooded Dune and Swale Complex	Siskiwit Bay	27857	116	BC

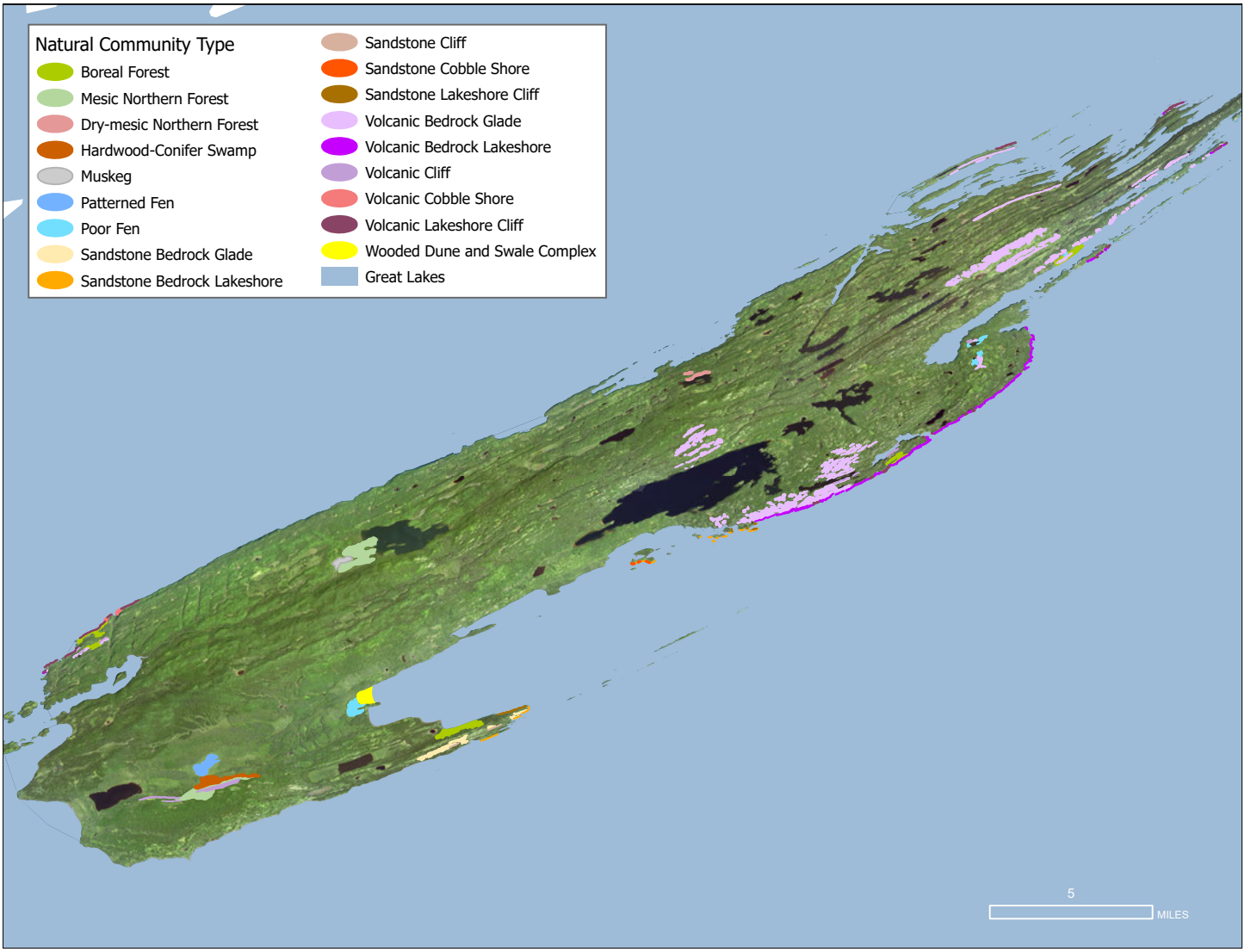


Figure 7. Natural community element occurrences on Isle Royale.



North Shore volcanic lakeshore cliff. Photo by Jesse M. Lincoln.

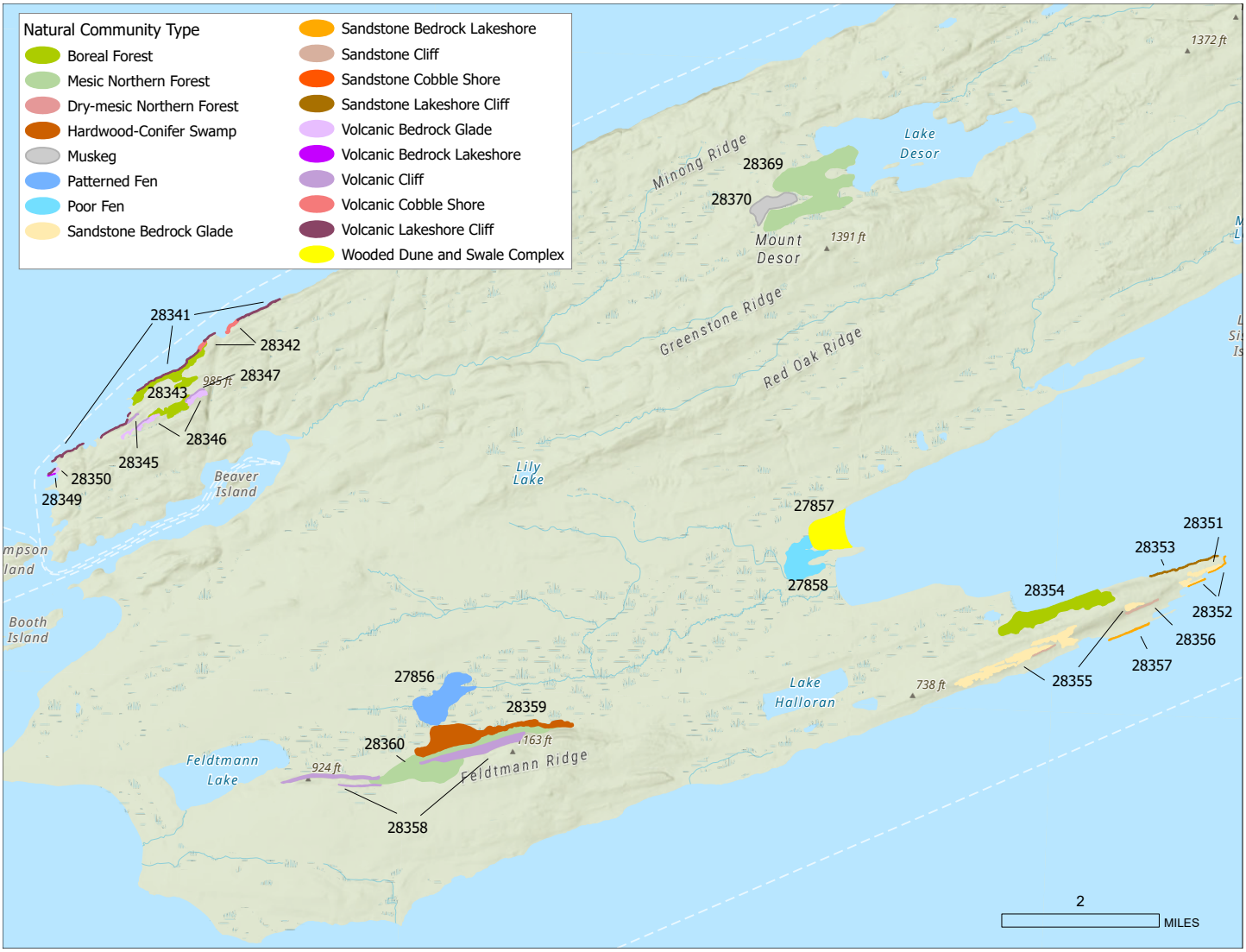


Figure 8. Natural community element occurrences on western third of Isle Royale.



Feldtmann Fen patterned fen (EO ID 27856). Photo by Joshua G. Cohen.

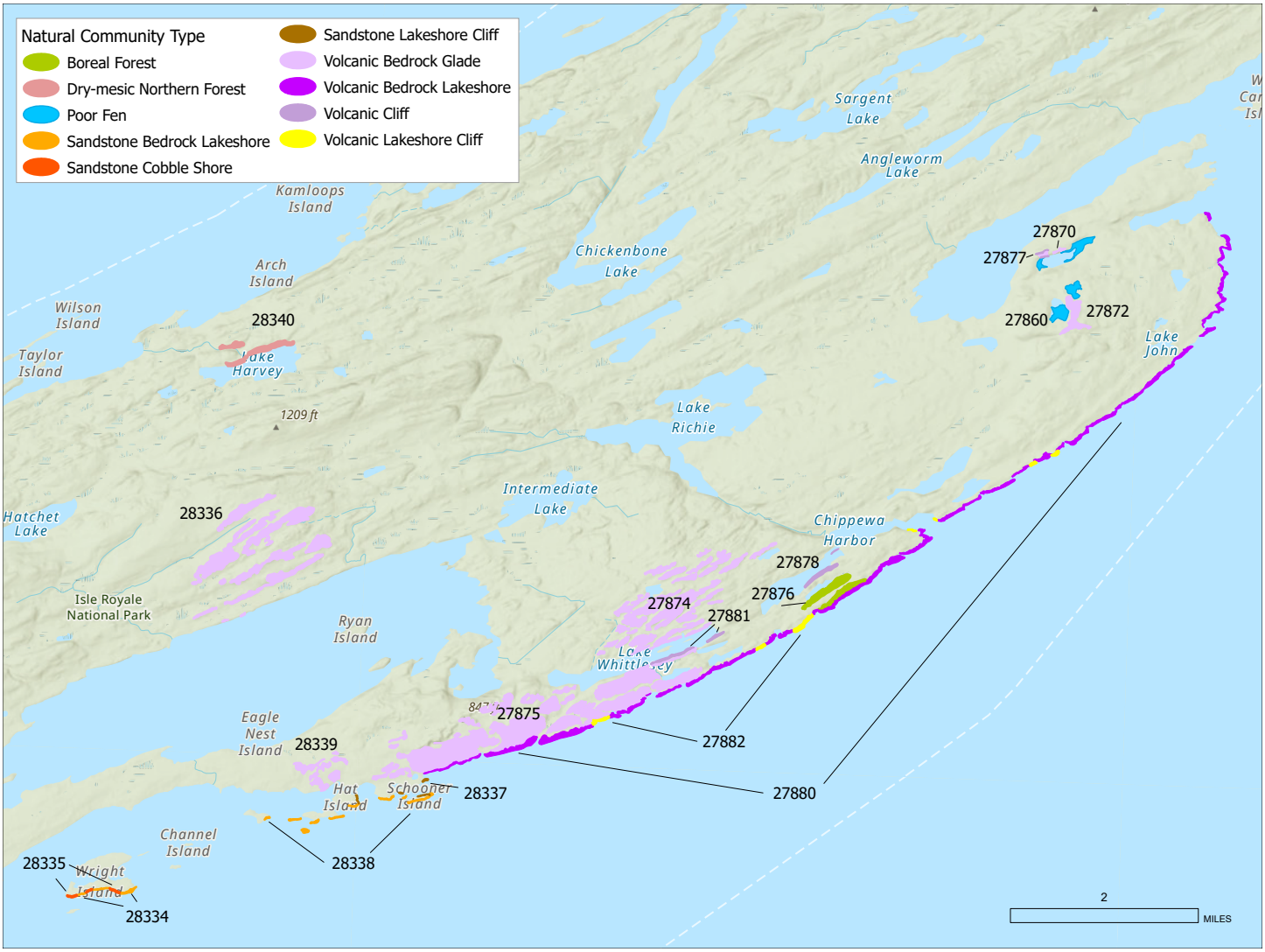


Figure 9. Natural community element occurrences on central third of Isle Royale.



Minong Shores volcanic bedrock lakeshore (EO ID 27880). Photo by Jesse M. Lincoln.

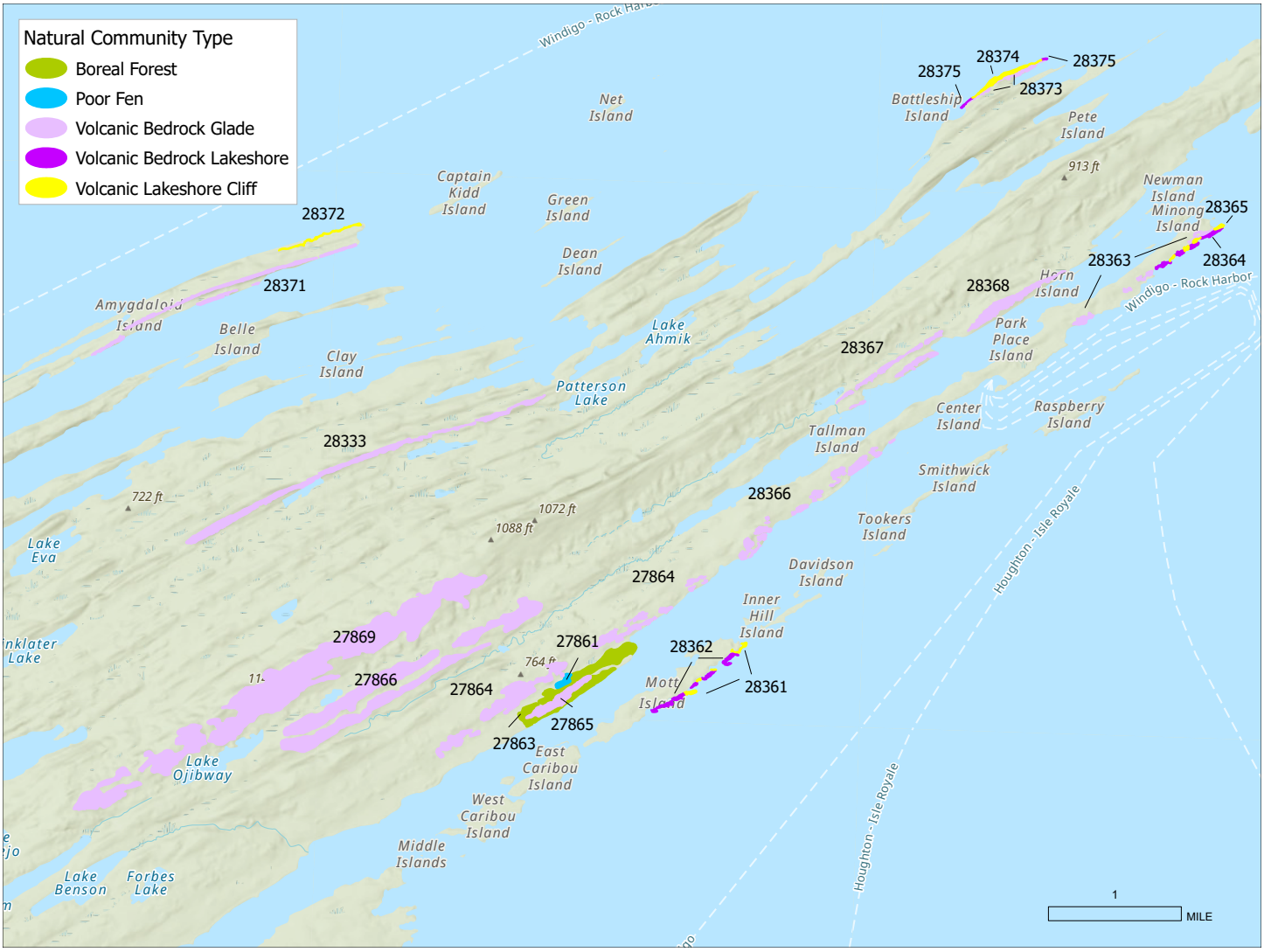


Figure 10. Natural community element occurrences on eastern third of Isle Royale.



Ojibway volcanic bedrock glade (EO ID 27869). Photo by Joshua G. Cohen.

Stewardship and Monitoring Prioritization Results

The stewardship and monitoring prioritization scores for each natural community element occurrence from Isle Royale are presented in Table 2 and graphically displayed in Figure 11. We sorted the element occurrences by their stewardship and monitoring prioritization scores and assigned them a high (≥ 10; red), medium (≥ 8 and < 10; yellow), or low (< 8; blue) stewardship and monitoring priority. The highest ranking natural community element occurrences for stewardship intervention and monitoring on Isle Royale are The Glade Coast volcanic bedrock glade, the Ojibway volcanic bedrock glade, and the Houghton Point sandstone bedrock glade. The top ten highest ranking stewardship and monitoring priorities are all volcanic bedrock glade or sandstone bedrock glade. These sites are rare natural community types; volcanic bedrock glade is imperiled in Michigan (S2) and sandstone bedrock glade is critically imperiled (S1). Only 4 documented sandstone bedrock glades occur in Michigan. In addition, these element occurrences are characterized by high ecological integrity and high native diversity but are locally impacted by non-native plant species. Numerous volcanic lakeshore cliffs with no observed threats or low threat severity scored as high stewardship and monitoring priorities. Given the rarity of this Great Lakes endemic natural community type and the high integrity of these element occurrences, these sites scored as high priorities for monitoring. Low priority sites include more common natural community types (e.g., muskeg, poor fen, and volcanic cobble shore) and/or sites that do not currently have threats that jeopardize their ecological integrity.

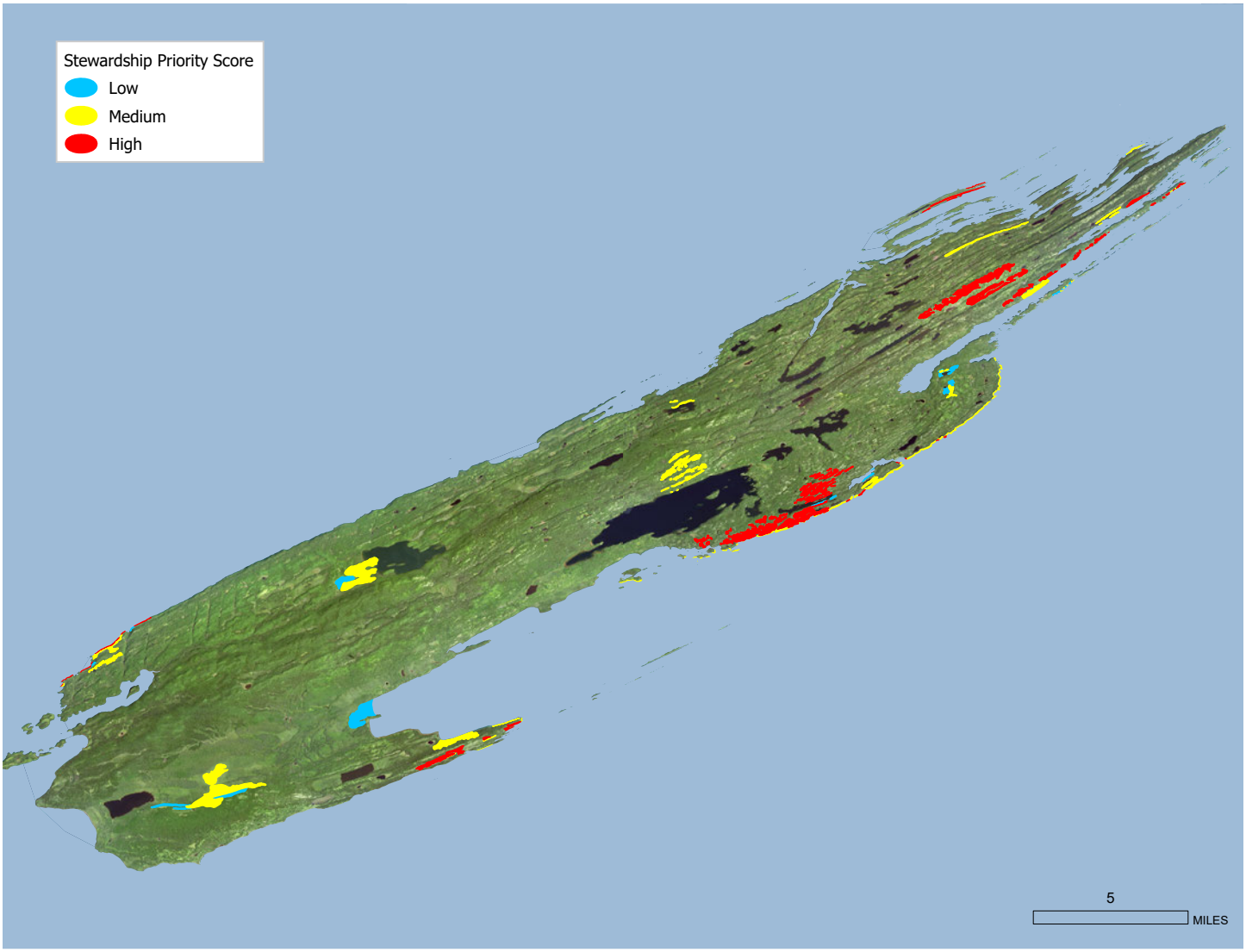


Figure 11. Stewardship prioritization for natural community element occurrences on Isle Royale. Element occurrences are displayed by their stewardship prioritization scores and assigned a high (red), medium (yellow), or low (blue) stewardship priority.

Table 2. Stewardship and monitoring prioritization for natural community element occurrences (EOs) on Isle Royale. EOs are sorted by their stewardship prioritization scores and assigned a high (red), medium (yellow), or low (blue) stewardship priority. Specific management recommendations are provided for each natural community EO in Appendix 2 and general management recommendations are included in the Discusssion section and in **Table 3**.

EO ID	Natural Community	Site Name	EO Rank	Ecological Integrity Index	Gobal Rank	Global Rank Score	State Rank	State Rank Score	Rarity Index	Threat Severity	Treatment Feasability	Threat Index	Stewardship Priority Score
27875	Volcanic Bedrock Glade	The Glade Coast	A	5	GU	4	S2	4	4	2	2	2	11
27869	Volcanic Bedrock Glade	Ojibway	BC	3.5	GU	4	S2	4	4	4	3	3.5	11
28351	Sandstone Bedrock Glade	Houghton Point	A	5	G3G4	2.5	S1	5	3.75	2	2	2	10.75
28366	Volcanic Bedrock Glade	3-Mile	BC	3.5	GU	4	S2	4	4	4	2	3	10.5
28371	Volcanic Bedrock Glade	Amygdaloid Island	B	4	GU	4	S2	4	4	3	2	2.5	10.5
27864	Volcanic Bedrock Glade	Banksi Glade	AB	4.5	GU	4	S2	4	4	2	2	2	10.5
27874	Volcanic Bedrock Glade	Lake Whittlesey	A	5	GU	4	S2	4	4	2	1	1.5	10.5
28363	Volcanic Bedrock Glade	Scoville Point	C	3	GU	4	S2	4	4	4	3	3.5	10.5
27866	Volcanic Bedrock Glade	Tobin Creek	B	4	GU	4	S2	4	4	3	2	2.5	10.5
28355	Sandstone Bedrock Glade	Houghton Ridge	B	4	G3G4	2.5	S1	5	3.75	4	1	2.5	10.25
28339	Volcanic Bedrock Glade	Malone Bay	BC	3.5	GU	4	S2	4	4	3	2	2.5	10
28368	Volcanic Bedrock Glade	Tobin Harbor	B	4	GU	4	S2	4	4	2	2	2	10
28372	Volcanic Lakeshore Cliff	Amygdaloid Island	B	4	GU	5	S1	5	5	1	1	1	10
27882	Volcanic Lakeshore Cliff	Minong Shores	A	5	GU	5	S1	5	5	0	0	0	10
28341	Volcanic Lakeshore Cliff	North Shore	A	5	GU	5	S1	5	5	0	0	0	10
28365	Volcanic Lakeshore Cliff	Scoville Point	B	4	GU	5	S1	5	5	1	1	1	10
28352	Sandstone Bedrock Lakeshore	Houghton Point	A	5	G4G5	1.5	S2	4	2.75	2	2	2	9.75
28357	Sandstone Bedrock Lakeshore	Houghton Ridge	AB	4.5	G4G5	1.5	S2	4	2.75	3	2	2.5	9.75
28338	Sandstone Bedrock Lakeshore	Malone Bay	AB	4.5	G4G5	1.5	S2	4	2.75	3	2	2.5	9.75
27880	Volcanic Bedrock Lakeshore	Minong Shores	A	5	G4G5	1.5	S2	4	2.75	2	2	2	9.75
28340	Dry-Mesic Northern Forest	Lake Harvey	C	3	G4	2	S3	3	2.5	4	4	4	9.5
28333	Volcanic Bedrock Glade	Lane Cove	B	4	GU	4	S2	4	4	2	1	1.5	9.5
28367	Volcanic Bedrock Glade	Moose Lake	C	3	GU	4	S2	4	4	3	2	2.5	9.5
28346	Volcanic Bedrock Glade	Moose Lightning	B	4	GU	4	S2	4	4	2	1	1.5	9.5
28336	Volcanic Bedrock Glade	Siskiwit Lake	C	3	GU	4	S2	4	4	4	1	2.5	9.5
27865	Volcanic Bedrock Glade	Siskiwit Mine	C	3	GU	4	S2	4	4	3	2	2.5	9.5
28373	Volcanic Bedrock Glade	Stone's Point	AB	4.5	GU	4	S2	4	4	1	1	1	9.5
28374	Volcanic Lakeshore Cliff	Stone's Point	AB	4.5	GU	5	S1	5	5	0	0	0	9.5
28335	Sandstone Cobble Shore	Wright Island	B	4	G2G3	3.5	S2	4	3.75	2	1	1.5	9.25
28354	Boreal Forest	Houghton Ridge	A	5	GU	3	S3	3	3	1	1	1	9
28343	Boreal Forest	Huginnin Cove	A	5	GU	3	S3	3	3	1	1	1	9
28337	Sandstone Lakeshore Cliff	Malone Bay	AB	4.5	G3	3	S2	4	3.5	1	1	1	9
27872	Volcanic Bedrock Glade	Mt. Saginaw	BC	3.5	GU	4	S2	4	4	2	1	1.5	9
28361	Volcanic Lakeshore Cliff	Mott Island	B	4	GU	5	S1	5	5	0	0	0	9
28364	Volcanic Bedrock Lakeshore	Scoville Point	B	4	G4G5	1.5	S2	4	2.75	2	2	2	8.75
27863	Boreal Forest	Starvation Point	B	4	GU	3	S3	3	3	2	1	1.5	8.5
28359	Hardwood-Conifer Swamp	Feldtmann Ridge	A	5	G4	2	S3	3	2.5	1	1	1	8.5
27856	Patterned Fen	Feldtmann Fen	AB	4.5	GU	4	S2	4	4	0	0	0	8.5
28353	Sandstone Lakeshore Cliff	Houghton Point	A	5	G3	3	S2	4	3.5	0	0	0	8.5
27870	Volcanic Bedrock Glade	Sumner Lake	BC	3.5	GU	4	S2	4	4	1	1	1	8.5
28334	Sandstone Bedrock Lakeshore	Wright Island	C	3	G4G5	1.5	S2	4	2.75	3	2	2.5	8.25
28356	Sandstone Cliff	Houghton Ridge	AB	4.5	G4G5	1.5	S2	4	2.75	1	1	1	8.25
28347	Volcanic Cliff	Moose Lightning	AB	4.5	G4G5	1.5	S2	4	2.75	1	1	1	8.25
27876	Boreal Forest	Chippewa Harbor	B	4	GU	3	S3	3	3	1	1	1	8
28360	Mesic Northern Forest	Feldtmann Ridge	AB	4.5	G4	2	S3	3	2.5	1	1	1	8
28369	Mesic Northern Forest	Lake Desor	AB	4.5	G4	2	S3	3	2.5	1	1	1	8
28350	Volcanic Bedrock Glade	Glade of Ages	B	4	GU	4	S2	4	4	0	0	0	8
27878	Volcanic Cliff	Chippewa Harbor	A	5	G4G5	1.5	S2	4	2.75	0	0	0	7.75
28358	Volcanic Cliff	Feldtmann Ridge	A	5	G4G5	1.5	S2	4	2.75	0	0	0	7.75
27881	Volcanic Cliff	Lake Whittlesey	A	5	G4G5	1.5	S2	4	2.75	0	0	0	7.75
28345	Volcanic Cliff	McGinty Cove	AB	4.5	G4G5	1.5	S2	4	2.75	0	0	0	7.25
27877	Volcanic Cliff	Sumner Lake	AB	4.5	G4G5	1.5	S2	4	2.75	0	0	0	7.25
27858	Poor Fen	Siskiwit Bay	B	4	GU	3	S3	3	3	0	0	0	7
27860	Poor Fen	Sumner Lake and Newt Lake	B	4	GU	3	S3	3	3	0	0	0	7
27861	Poor Fen	Tobin Creek	B	4	GU	3	S3	3	3	0	0	0	7
28362	Volcanic Bedrock Lakeshore	Mott Island	B	4	G4G5	1.5	S2	4	2.75	0	0	0	6.75
28349	Volcanic Bedrock Lakeshore	Sam Hill	B	4	G4G5	1.5	S2	4	2.75	0	0	0	6.75
28375	Volcanic Bedrock Lakeshore	Stone's Point	B	4	G4G5	1.5	S2	4	2.75	0	0	0	6.75
27857	Wooded Dune & Swale Complex	Siskiwit Bay	BC	3.5	G3	3	S3	3	3	0	0	0	6.5
28370	Muskeg	Lake Desor	B	4	G4G5	1.5	S3	3	2.25	0	0	0	6.25
28342	Volcanic Cobble Shore	Huginnin Cove	B	4	G4G5	1.5	S3	3	2.25	0	0	0	6.25



Based on the stewardship prioritization scoring, the highest ranking natural community element occurrences (EOs) for stewardship intervention and monitoring on Isle Royale are The Glade Coast volcanic bedrock glade and Ojibway volcanic bedrock glade. These sites represent a rare natural community type; volcanic bedrock glade is imperiled in Michigan (S2). In addition, these EOs are characterized by high ecological integrity and native diversity but are locally impacted by non-native plants. Trails bisect the Ojibway volcanic bedrock glade leading to localized populations of non-natives and our primary recommendation is to monitor for and treat invasive species. No trails pass through the Glade Coast and our primary recommendation is to limit recreational development to prevent infestations of invasive species. Detailed stewardhip actions for each site are provided in Appendix 2. Photos by Jesse M. Lincoln (above) and Joshua G. Cohen (below).



Discussion

The survey efforts detailed in this report represent the first targeted natural community surveys on Isle Royale conducted by MNFI ecologists. This type of prioritized inventory to document rare natural communities and evaluate their integrity provides up-to-date information that is requisite for evaluating current threats and informing biodiversity stewardship of ecological assets. Significant finds during the 2024 and 2025 surveys include the documentation of Michigan's largest and highest quality volcanic bedrock glade (The Glade Coast) and sandstone bedrock glades (Houghton Point and Houghton Ridge). Isle Royale supports benchmark examples of numerous natural community types including volcanic bedrock glade, volcanic bedrock lakeshore, volcanic lakeshore cliff, sandstone bedrock lakeshore, sandstone bedrock glade, boreal forest, and mesic northern forest. Results from these surveys inform our understanding of these natural community types across their range. Data collected from these surveys have been incorporated into MNFI's natural community classification and have contributed to the updating of natural community type overviews, lists of characteristic species, and distribution maps (Cohen et al. 2025).

These ecological surveys have resulted in the update of statewide distribution maps for the following natural communities: patterned fen, wooded dune and swale complex, sandstone bedrock glade, sandstone bedrock lakeshore, sandstone cliff, sandstone cobble shore, and sandstone lakeshore cliff. Isle Royale represents the northernmost expression of these natural community types in Michigan. Ecological insights and photographs captured during these surveys have been incorporated in the second edition of A Field Guide to the Natural Communities of Michigan (Cohen et al., In Press).

Specific management recommendations for each natural community element occurrence are provided in Appendix 2. In the remainder of this discussion, we will summarize general stewardship recommendations distilled from these site-specific suggestions related to invasive species, herbivory, and fire. We also provide recommendations regarding future monitoring, research, and surveys priorities. The stewardship and monitoring prioritization that we present offers a framework for targeting biodiversity management. Table 3 synthesizes the stewardship and monitoring actions that we recommend for Isle Royale's high-quality natural communities organized by groups of natural communities (i.e., bedrock glade, bedrock lakeshore, cliffs, forested upland, forested wetland, and peatlands). In general, we recommend maintaining a large buffer of natural cover surrounding high-quality natural communities; avoiding development of trails and infrastructure adjacent to bedrock ecosystems to



Michigan's largest and highest quality sandstone bedrock glades occur on Isle Royale along Houghton Point (above) and Houghton Ridge. Surveys of these sites have expanded our understanding of this critically imperiled natural community type. Photo by Jesse M. Lincoln.

Table 3. Summary of the stewardship and monitoring actions for Isle Royale organized by groups of natural communities. Broadly, we recommend maintaining large buffers surrounding high-quality natural communities; avoiding development of new trails and infrastructure within buffers adjacent to bedrock ecosystems; control and monitoring of invasive plants; monitoring moose herbivory; and evaluating implementation of prescribed fire within fire-dependent forests. Treatment of invasive species should be carried out by experienced professionals to avoid collateral damage.

Natural Community Group	Natural Community Types	Stewardship Action
Bedrock Glade	Sandstone Bedrock Glade Volcanic Bedrock Glade	• Treat invasive species, especially along trails • Monitor for invasive species • Monitor moose herbivory • Limit trails and minimize areas impacted by camping and recreation within glades
Bedrock Lakeshore	Sandstone Bedrock Lakeshore Sandstone Cobble Shore Volcanic Bedrock Lakeshore Volcanic Bedrock Lakeshore	• Prevent trail or infrastructure development along the shorelines • Evaluate treating invasive species • Monitor control efforts
Cliffs	Sandstone Cliff Sandstone Lakeshore Cliff Volcanic Cliff Volcanic Lakeshore Cliff	• Maintain a large buffer of natural cover around cliffs • Limit trail or infrastructure development along cliffs to minimize disturbance • Provide designated lookout areas to limit impacts to vegetation at edge of cliffs • Treat populations of invasive species occurring along the cliffs' upper margins
Forested Upland	Boreal Forest Dry-Mesic Northern Forest Mesic Northern Forest Wooded Dune and Swale Complex	• Maintain a large buffer of natural cover around high-quality forests • Monitor moose herbivory • Evaluate implementation of fire stewardship in fire-dependent forests (i.e., dry-mesic northern forest) • Partner with Tribes to research cultural burning on Isle Royale • Monitor for invasive plants, pests, and diseases
Forested Wetland	Hardwood-Conifer Swamp Wooded Dune and Swale Complex	• Maintain a large buffer of natural cover around wetlands to minimize the threat of hydrological alteration • Monitor moose herbivory • Monitor for invasive plants, pests, and diseases
Peatlands	Muskeg Patterned Fen Poor Fen	• Maintain a large buffer of natural cover around wetlands to minimize the threat of hydrological alteration • Monitor moose herbivory • Monitor for invasive plants

minimize disturbance and spread of invasive plants; control of invasive plant species within bedrock ecosystems; monitoring for invasive species within bedrock ecosystems, peatlands, and forested uplands; monitoring moose herbivory within forested uplands, forested wetlands, and bedrock glades; and evaluating implementation of prescribed fire within fire-dependent forests. Implementation of stewardship efforts within prioritized areas will need to be followed by monitoring to gauge the success of biodiversity management actions and adjust future stewardship prioritization efforts.

Controlling Invasive Species

Biological invasions are a critical driver of ecosystem degradation and the global decline of biodiversity (Vitousek et al. 1996). Invasive plants affect ecosystem processes through their patterns of resource acquisition and degrade native biodiversity by altering the fundamental structure and function of ecosystems (Ehrenfield 2010). Non-native invasive species often have no natural predators and can therefore spread aggressively. By outcompeting and replacing native species, invasive species can change floristic composition of natural communities, alter vegetative structure, and reduce native species diversity, often causing local or even complete extinction of some native species (Harty 1986). Invasive species can also upset delicately balanced ecological processes such as trophic relationships, interspecific competition, nutrient cycling, soil erosion, hydrologic balance, and disturbance regimes (Bratton 1982). In addition, invasive species compromise pollinator services, change microclimates, despoil recreational resources, and degrade the economy of the Great Lakes states (Zavaleta 2000, Pimentel et al. 2005, Huang and Asner 2009, Ehrenfeld 2010). Environmental damages and losses caused by invasive species within the United States were estimated to be over $120 billion per year (Pimentel et al. 2005). Invasive infestations are projected to increase as the landscape continues to be fragmented (Vila and Ibanez 2011) and the climate changes.

Control of invasive plants and the mitigation of their spread within Isle Royale's bedrock ecosystems are stewardship priorities. Invasive hawkweeds (*Hieracium aurantiacum*, *H. caespitosum*, and *H. piloselloides*) and bluegrasses (*Poa canadensis*, *P. nemoralis*, and *P. pratensis*) were present in many glade systems surveyed, especially around highly trafficked trail corridors. Volcanic bedrock glade, volcanic bedrock lakeshore, volcanic lakeshore cliff, volcanic cliff, sandstone bedrock glade, sandstone bedrock lakeshore, sandstone lakeshore cliff, and sandstone cliff are all characterized by frequent disturbance, stressful growing conditions, and shallow soils. These factors make them susceptible to both native and non-native weedy species. The Great Lakes shoreline natural community types are especially disturbance-prone given frequent wind and wave action and ice abrasion. These natural

community types also support high concentrations of rare plants, including numerous arctic-alpine disjunct species. Because of the shallow soils of these bedrock systems and the presence of rare plant populations and native hawkeeds and bluegrasses, efforts to control invasives should be implemented with extreme care. Substantial risk for collateral damage exists since non-native species occur locally and the bedrock community types support high concentrations of rare plants. Invasive plant control on Isle Royale is also complicated by several issues related to feasibility. Many of the high-quality bedrock natural community EOs documented during are located in remote areas, with terrain ranging from rugged to vertical.

Given these factors and the need to avoid undesired secondary impacts to high-quality natural communities and resident rare plants, we provide the following recommendations. To minimize new infestations and prevent the increase of a weedy seed source, we promote the establishment of buffers adjacent to high-quality natural communities and the prevention of additional trails and campsites within these buffers. To avoid collateral damage, any control efforts should be executed by experienced professionals trained in the identification of both invasive and rare plants. To inform adaptive management, control efforts should be carefully monitored. Monitoring for and treatment of invasive species should be an ongoing endeavor to prevent new outbreaks. One of the most effective means of invasive species control is early detection and rapid response. We therefore stress the importance of treating incipient infestations. We also recommend increasing educational signage about invasive species at entry points and maintaining or establishing boot brushes at all access points. To limit the spread of invasive plants, we recommend focusing treatment of invasive infestations in areas of high foot traffic and along high-volume hiking trails. We also recommend evaluating the efficacy of controlling non-native species along bedrock lakeshore systems. Because of the secondary impacts of herbicide application and hand pulling in bedrock systems, we recommend investigating biocontrols.

During the 2024 and 2025 surveys, MNFI ecologists observed higher concentrations of non-native species, particularly invasive hawkweeds, bluegrasses, and mullein (*Verbascum thapsus*), in volcanic bedrock glades that have recently burned or are impacted by higher moose traffic (i.e., along ridgelines and gently sloping exposures). We hypothesize that disturbance factors including wildfire, moose traffic, and moose herbivory interact and influence the establishment and spread of invasive plant species. In other parts of the boreal region, moose have been implicated in the spread and establishment of non-native plants (Rose and Hermanutz 2004). Research to evaluate the factors determining the establishment and spread of invasive plants on Isle Royale is merited, particularly in the context of extreme moose densities and social trails. Emergent and submergent marshes should additionally be monitored for aquatic invasive species, as spread may be facilitated by moose visitation and foraging during the summer months.



Non-natives plants such as mullein (*Verbascum thapsus*) occur locally within the Ojibway volcanic bedrock glade, especially in proximity to the Greenstone Trail (mullein is pictured in the lower right of this photo). To reduce the spread of invasive plants, we recommend prioritizing treatment of infestations in areas with heavy foot traffic and along frequently used hiking trails. Photo by Joshua G. Cohen.



Non-native plant species pose a threat to Isle Royale's bedrock natural communities, especially bedrock glades and lakeshores. Mullein (*Verbascum thapsus*) is locally common along the upper slopes of many glades including the Siskiwit Lake volcanic bedrock glade (above). Canada bluegrass (*Poa canadensis*) is abundant along the Scoville Point hiking trail that passes through volcanic bedrock glade (below). To mitigate the impacts of invasive plants, we provide the following recommendations: establish buffers adjacent to high-quality natural communities and prevent additional trails and infrastructure within these buffers; utilize experienced professionals trained in the identification of both invasive and rare plants to execute control measures; monitor stewardship actions to inform adaptive management; increase educational signage about invasive species at entry points; and maintain or establish boot brushes at all access points. Photos by Jesse M. Lincoln.



Herbivory

The drastic impacts that mammalian herbivory can have on the floristic composition, structure, and successional trajectory of ecosystems can be amplified on islands (Cohen 2017, Cohen et al. 2022a, Cohen et al. 2022b, Cohen et al. 2023, Cohen et al. 2024a). An essential component of holistic management of Great Lakes islands should include documentation of the variable impacts of different mammalian browsers (i.e., moose, deer, and snowshoe hair), and consideration of the deleterious consequences of overbrowsing and what actions should be taken to abate those threats. The subsequent discussion will focus on ungulate herbivory by deer and moose but a better understanding of the impacts of hare browse pressure and what their browse preferences are is also needed (Sanders and Kirschbaum 2023).

The negative effects of white-tailed deer herbivory on floristic composition, vegetative structure, tree recruitment, and reproductive capacity are well documented. Concentrated herbivory can lead to regeneration failure of trees and shrubs, reduction of forb reproductive capacity and plant size, and even to the local extirpation of sensitive plants (Alverson et al. 1988, Rooney and Dress 1997, Augustine and Frelich 1998, Rooney and Waller 2003). Indirect impacts of deer herbivory can include the reduction of pollinators and seed dispersers of sensitive herbs (Waller and Alverson 1997, Ruhren and Handel 2003). MNFI ecologists accustomed to region-wide homogenization of forest flora from high deer densities across Michigan were struck by the abundance, diversity, and robustness within the forested uplands and wetlands of Isle Royale of numerous browse-preferred forbs and plants that never outgrow the zone of accessibility or "molar zone" (Alverson et al. 1988, Waller and Alverson 1997). A comparative study of the herbaceous diversity and reproductive success of the flora of Isle Royale compared to nearby mainland forests with high deer densities would be valuable.

Deer have not established breeding populations on Isle Royale, however deceased deer have been documented along the northern shoreline (Rolf Peterson, personal communication). Because of the potential negative impacts to floristic composition and structure, preventing establishment of deer on Isle Royale is imperative. In addition, deer are the primary carrier of moose brain worm (*Parelaphostrongylus tenuis*), a parasite that is deadly to moose. While it is likely that the resident wolves and the distance of Isle Royale from the mainland limit the likelihood of deer establishment, we stress the importance of continued monitoring for deer migration.

Across the boreal region, moose can impart strong control over the structure and function of vegetative communities (Sanders and Kirschbaum 2023). While moose have occupied Isle Royale since the early 20th century, the disturbance effects of intensive moose herbivory are relatively new in terms of Isle Royale's natural communities, which became established following



A critical research need is to evaluate how moose herbivory impacts the integrity, diversity, and resilience of natural communities across Isle Royale. Photo by Joshua G. Cohen.



The complex interplay of wildfire, windthrow, and moose herbivory can lead to the failure of woody species regeneration and the expansion of moose savanna across Isle Royale. Photo by Joshua G. Cohen.

the last glacial retreat 10,000 years ago. For over a century, moose have profoundly impacted the natural communities of Isle Royale. As the moose herd has fluctuated over time, this impact has varied, but sustained browse on Isle Royale's woody plants has significantly altered floristic composition, vegetative structure, and successional trajectories. In addition to regeneration failure of balsam fir, moose herbivory has also limited recruitment potential of sugar maple and quaking aspen (Sanders and Kirschbaum 2023) and moose, through their browsing and trampling, can act as a primary conduit for non-native plant invasion and dispersal (Rose and Hermanutz 2004). Interactions of windthrow, fire, and moose herbivory have converted areas once occupied by boreal forest to moose savanna or moose glade (Rotter and Robertus 2015).

Long-term studies of moose-wolf population dynamics on Isle Royale have elucidated faunal species relationships and highlighted impacts to tree and shrub species. However, there has been limited evaluation of the impacts to the resilience and health of whole systems. Our surveys suggest that sustained moose herbivory has negatively impacted the ecological integrity of natural communities across Isle Royale, with the most prevalent impacts evident in boreal forest, mesic northern forest, and volcanic bedrock glade. We recommend the integration of holistic ecological integrity assessments into longitudinal studies. It is important to evaluate what the carrying capacity of Isle Royale is for moose and wolf populations, not just in terms of mammalian species but also in terms of the natural communities they occupy. For example, research should investigate at what level browse pressure or moose density restrict regenerative capacity, floristic diversity, and resilience of different natural communities. We believe that because the focus of research has been on the two keystone mammalian species and because Isle Royale is a designated wilderness area, management considerations have focused on their population dynamics, and solutions to carrying capacity issues have revolved around relying on wolf numbers to drive down moose numbers. Starting in 2018, over the course of a 15-month period, 19 wolves from three source populations were introduced to Isle Royale in an attempt to restore a top-down, predator-influenced system (Isle Royale National Park 2018). In addition to predator-mediated population control, we also recommend evaluating the implementation of human-based hunting of moose on Isle Royale. We encourage engagement with Tribal communities to investigate traditional harvest of moose.

We recognize that moose hunting on Isle Royale is complicated and potentially controversial given the ongoing longitudinal studies, the public's association of Isle Royale with moose and wolves, and visitor's expectation of seeing moose and perception of Isle Royale as wilderness. Baldwin (2011) noted that the designation of Isle Royale as "wilderness" can "obscure a fascinating and complex history of people interacting with and changing their environment". The long history of Indigenous People stewarding Isle Royale over hundreds of years emphasizes the need to incorporate Tribal community perspectives to address complex ecological problems, such as overbrowsing by moose, invasive plant infestations, and fire suppression.

Fire

Fire is an important disturbance factor that has shaped spatial patterns, species composition, and successional dynamics of Isle Royale's natural communities. Following Eurocolonization of the upper Great Lakes, displacement of Indigenous peoples and institutionalized fire suppression lead to dramatic shifts in the fire regime with widespread cultural burning stopping in the late 1800s and suppression of wildfires prioritized by state and federal agencies in the early 1900s. Subsequently, a pervasive fire deficit persists across North American forests. As a result of increased fuel loading, contemporary wildfires are characterized by unprecedented severity (Parks et al. 2025) and can cause shift to novel ecosystems. By causing widespread tree mortality and recruitment failure, contemporary wildfires can cause ecological transformation or vegetation type conversion and act as a destabilizing force. Implementation of fire stewardship or prescribed fire in the face of this fire deficit can function as a stabilizing feedback with low-severity fire consuming live and dead fuels and reducing the risk of high-severity fire (Parks et al. 2025) and create more fire-resilient landscapes.

More research is needed to determine the historic fire regime on Isle Royale and the role Indigenous Peoples played in determining fire frequency and the location of ignitions. The highest-priority site that we identified for the application of fire stewardship is the Lake Harvey dry-mesic northern forest. Lake Harvey occurs in close proximity to Todd Harbor. Both Todd Harbor and McCargoe Cove were traditional portals to Isle Royale for Indigenous Peoples. These harbors are the shortest distance from the Minnesota mainland and offer protection from southern winds (Cochrane 2009). The presence of a fire-dependent community, proximity to known access points, fire scars on living white pine and red pine, and stumps with evidence of multiple, short-interval fires suggest Indigenous cultural fire may have played an important role in shaping the Lake Harvey dry-mesic northern forest. Two cross-sections of red pine stumps were sampled from the Lake Harvey dry-mesic northern forest and processed by Michigan State University dendrochronologist Kurt Kipfmueller. While both samples are heavily degraded from rot and have few growth rings, both appear to have multiple fire scars that indicate a fire return interval much



The application of fire stewardship within pine-dominated ecosystems on Isle Royale should be evaluated. In addition, we recommend engaging with Tribal partners to learn about cultural burning practices on Isle Royale. Fire is a critical disturbance in red pine–dominated systems and the Lake Harvey dry-mesic northern forest ranked as the highest priority site for fire stewardship. Fire scars were observed on several red pine stumps and snags within the site. Photo by Joshua G. Cohen.

more frequent than would be expected from lightning strike alone. These scars are annotated in Figure 12. Sample one has four fire scars with 7 to 8 years occurring between each of the fires. Sample two has four fire scars with between 4 and 12 years between each fire.

Continued inventory across Isle Royale for old red pine trees and fire-scarred stumps can help elucidate the island's fire history. In addition, we also recommend engaging with Tribal partners to evaluate fire stewardship opportunities and learn about cultural burning practices on Isle Royale. This inquiry is needed to help inform where and how frequently application of fire stewardship might be implemented on Isle Royale. We also recommend an evaluation of what areas and natural communities should be allowed to burn without suppression intervention during future wildfires and what climactic conditions permit allowing wildfires to burn.



MNFI ecologist Joshua Cohen cutting a beaver-felled red pine stump (above). Sample 1 in Figure 12 is derived from this stump. Numerous red pine stumps were observed at Lake Harvey (below) as well as within the Sumner Lake volcanic bedrock glade. Additional surveys for red pine stumps are merited. Photos by Jesse M. Lincoln.



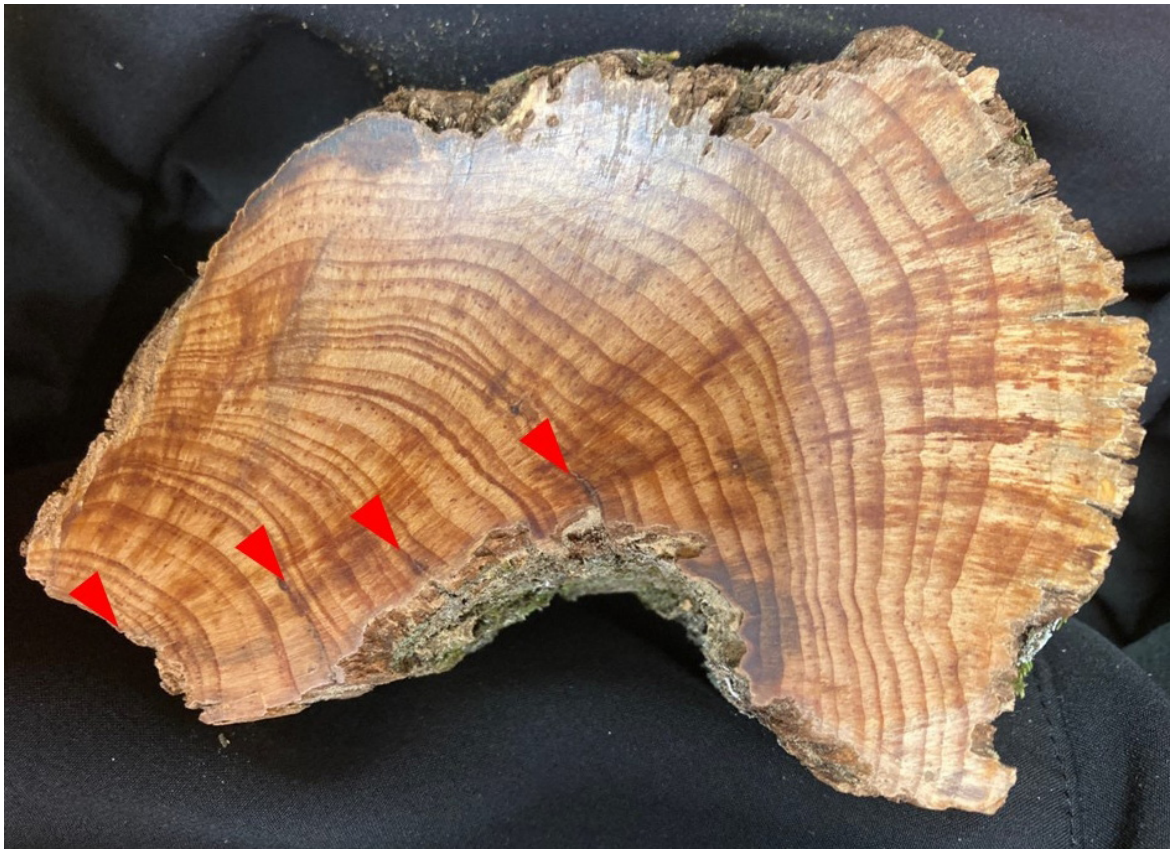
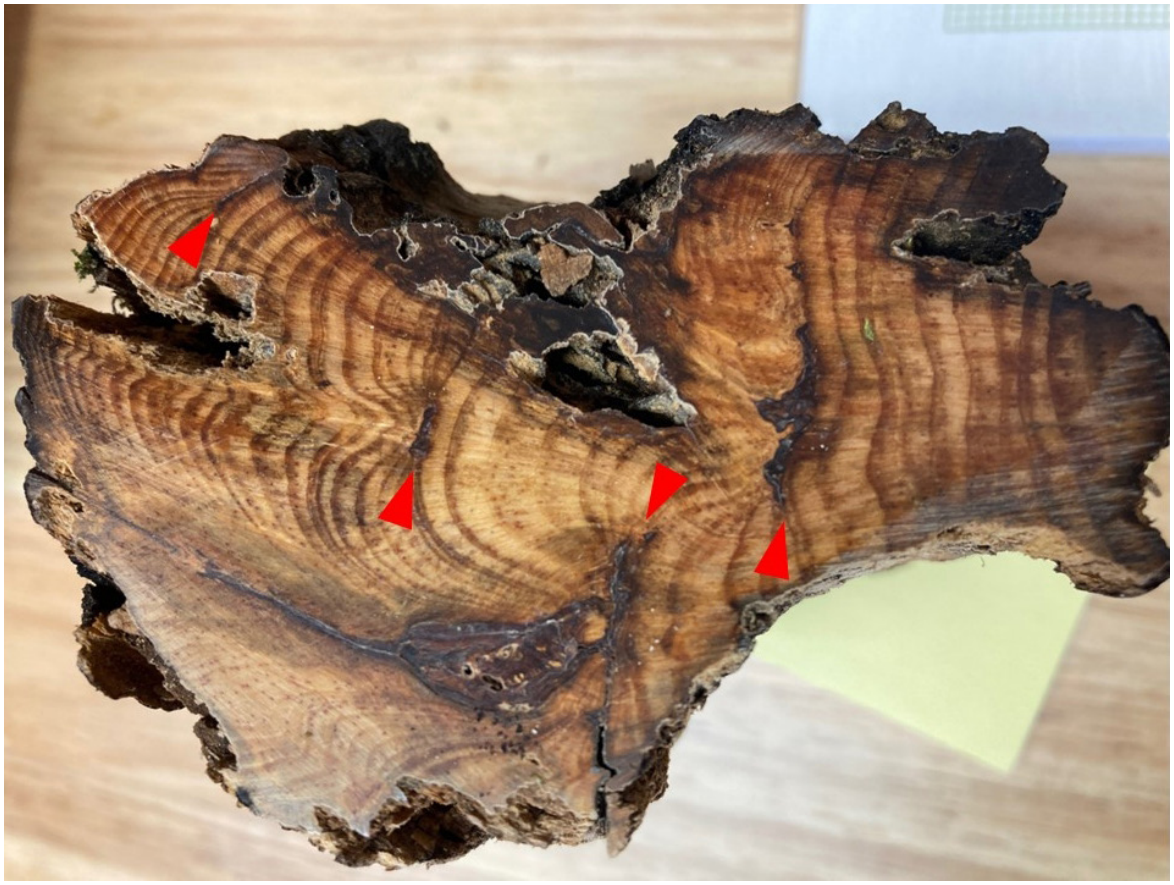


Figure 12. Two cross-sections of red pine stumps collected from the Lake Harvey dry-mesic northern forest. Multiple potential fire scars on both samples suggest that frequent, low-intensity/low-severity fire was an important ecologial process in this red pine–dominated forest. Sample one (above) has four fire scars with 7 to 8 years occurring between each of the fires. Sample two (below) has four fire scars with between 4 and 12 years between each fire. Photos by Kurt Kipfmueller.



Future Work

The 2024 and 2025 natural community surveys can be used to inform future natural features inventory work on Isle Royale and surrounding islands. In 2026, MNFI zoologists will use the natural community survey data and input from NPS staff to help target surveys for rare pollinators. Throughout the course of the natural community surveys, MNFI ecologists opportunistically documented rare plants species. Appendix 5 provides a table of the rare plants recorded and organized by natural community stype and site. These natural community surveys can help direct systematic surveys to evaluate and map rare plant populations. While our initial priority natural community targets were visited during the course of this project, additional surveys for high-quality natural communities on Isle Royale and surrounding islands are warranted. Additional surveys of volcanic lakeshore cliff along the north shore of Isle Royale are merited but are logistically complicated because of wind and wave patterns and the lack of safe harbor along the north shore. To facilitate access along more stretches of this shoreline, we recommend using a research vessel equipped with sea kayaks and/or zodiac boats. In addition, due to the vertical nature of lakeshore cliff systems, a more thorough evaluation of floristic composition and vegetative structure could be accomplished utilizing uncrewed automated vehicles or drones. However, a use exemption would need to be acquired to utilize drones in this capacity within the National Park. We recommend additional surveys for volcanic lakeshore cliff along Blake Point and the Palisades; boreal forest and bedrock shoreline systems along Passage Island; sandstone bedrock glade and sandstone bedrock lakeshore southwest of Houghton Ridge; mesic northern forest around Lake Desor and Feldtmann Ridge; bedrock systems along Long Island; bedrock shoreline systems along Smithwick Island; volcanic bedrock glade along Stanley Ridge; dry-mesic northern forest and volcanic bedrock glade east and southeast of Huginnin Cove; recently burned glades around Monument Rock; and mesic northern forest around Lily Lake and Red Oak Ridge (Table 4). In addition, an island-wide assessment of forested swamps dominated by black ash (*Fraxinus nigra*) is merited. Great Lakes islands provide refugia from insect pests including emerald ash borer (*Agrilus planipennis*) and these islands function as the last strongholds in Michigan for ash-dominated swamps.

Data collected through this two-year survey effort has been utilized to update Michigan's natural community classification and, as noted above, has been incorporated in the second edition of A Field Guide to the Natural Communities of Michigan (Cohen et al., In Press). With over 25,000 visitors a year, Isle Royale functions as a hub for increasing literacy about native biodiversity and conservation. The development of a field guide specific to the natural communities of Isle Royale would enlighten these visitors about the ecological context of Isle Royale and also potentially attract future visitors. A broader effort to create natural community field guides across multiple National Parks would bring light to the importance of these public lands in conserving native biodiversity, connecting people to land, and fostering a conservation ethic.



The Palisades, on the north side of Blake Point are a top priority for additional natural community surveys to evalute the volcanic lakeshore cliff. Photo by Jesse M. Lincoln.

Table 4. Additional natural community survey targets. Based on our two-year survey effort, aerial photograph interpretation, and continued engagement with National Park Service scientists, we strongly recommend the continuation of natural community surveys across Isle Royale and surrounding islands.

Survey Site	Potential Natural Community Types
Blake Point and The Palisades	Volcanic Lakeshore Cliff
Passage Island	Boreal Forest Volcanic Bedrock Lakeshore Volcanic Lakeshore Cliff
Houghton Ridge Southwest	Sandstone Bedrock Lakeshore Sandstone Bedrock Glade
Lake Desor	Mesic Northern Forest
Feldtmann Ridge	Mesic Northern Forest
Long Island	Volcanic Bedrock Glade Volcanic Bedrock Lakeshore Volcanic Lakeshore Cliff
Smithwick Island	Volcanic Bedrock Lakeshore Volcanic Lakeshore Cliff
Stanley Ridge	Volcanic Bedrock Glade
Huginnin Cove East/Southeast	Dry-Mesic Northern Forest Volcanic Bedrock Glade
Monument Rock	Volcanic Bedrock Glade
Lily Lake and Red Oak Ridge	Mesic Northern Forest



Nautical reconnaissance while traveling to natural community survey targets along Isle Royale's North Shore highlighted the potential of Long Island to support high-quality volcanic bedrock lakeshore, volcanic bedrock glade, and associated rare plants. Photo by Jesse M. Lincoln.



During the course of the natural community surveys, rare plants were opportunistically documented. including lingonberry (*Vaccinium vitis-idaea*, State Endangered) in the Siskiwit Bay poor fen (above) and northern fairy-bells (*Prosartes trachycarpa*, State Threatened) in the Huginnin Cove boreal forest (below). The lingonberry documentation is the first record of this species on Isle Royale. Systematic surveys to evaluate and map rare plant populations are merited and the data from the natural community surveys can help inform this effort (See Appendix 5). Photos by Joshua G. Cohen.



With the exception of two days in June of 2025, natural community surveys were conducted during the late growing season (i.e., August). Additional natural community surveys during the early growing season are recommended to correspond with the phenological window of spring and early-summer flowering and fruiting plants, such as orchids and sedges. This will bolster the Floristic Quality Assessments for the natural community element occurrences. Focused rare plant surveys should occur across the growing season. Pictured here are calypso (*Calypso bulbosa*, State Threatened) (above), scabrous black sedge (*Carex atratiformis*, State Threatened) (bottom left), and ram's head lady-slipper (*Cypripedium arietinum*, State Special Concern) (bottom right). Photos by Jesse M. Lincoln.





Conclusion

Great Lakes Islands like Isle Royale provide critical learning environments where conservation scientists can study pattern and process to inform ecosystem management and conservation design. Across the Great Lakes region, natural habitats are declining due to habitat destruction and are eroding in ecological integrity due to habitat fragmentation. Threats associated with habitat fragmentation include invasive species infestation, ungulate herbivory, predation by mesopredators, and fire suppression. Great Lakes islands, especially roadless and uninhabited ones like Isle Royale, provide unique and essential refuges for native biodiversity. Though these islands face less pressure from habitat destruction and fragmentation, they are still susceptible to the threats prevalent on the mainland. Biodiversity stewardship actions within these isolated and less disturbed settings have a high likelihood of success if they are prompt and decisive.

In the absence of shoreline development, dynamic coastal ecosystems on Isle Royale can change in spatial extent, floristic composition, and vegetative structure as the Great Lakes water levels fluctuate. The long-term conservation of Great Lakes coastal ecosystems depends in part on their capacity to change through time and space. Isle Royale contains a multitude of high-quality shoreline natural communities and near-shore systems with processes dependent on their proximity to the Lake Superior shoreline. Lakeshore floristic assemblages, especially those containing arctic flora, are largely dependent on the natural conditions perpetuated by Lake Superior, and their continued persistence is linked to the careful stewardship of the greater systems in which they occur.

Through this project we evaluated the ecological integrity of high-quality natural communities on Isle Royale. Isle Royale supports exemplary bedrock and forest natural community types that enhance our understanding of these ecosystems and provide valuable reference points for interpreting and managing similar natural communities throughout their broader range. Data collected during these surveys have been used to refine Michigan Natural Features Inventory's natural community classification by directly informing updated natural community type overviews, lists of characteristic species, and distribution maps. Over the course of two field seasons, we documented 61 new element occurrences: 4 boreal forests, 1 dry-mesic northern forest, 1 hardwood-conifer swamp, 2 mesic northern forests, 1 muskeg, 1 patterned fen, 3 poor fens, 2 sandstone bedrock glades, 4 sandstone bedrock lakeshores, 1 sandstone cliff, 1 sandstone cobble shore, 2 sandstone lakeshore cliffs, 19 volcanic bedrock glades, 5 volcanic bedrock lakeshores, 6 volcanic cliffs, 1 volcanic cobble shore, 6 volcanic lakeshore cliffs, and 1 wooded dune and swale complex.



Isle Royale supports Michigan's highest concentration of volcanic bedrock lakeshore (above), volcanic lakeshore cliff, and volcanic bedrock glade. Photo by Jesse M. Lincoln.

This report provides site-based assessments of these 61 natural community element occurrences. Threats, management and monitoring needs, and restoration opportunities specific to each individual site are discussed in Appendix 2. 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 avoiding development of trails and infrastructure adjacent to high-quality natural communities; controlling and monitoring invasive plant species within bedrock ecosystems; monitoring moose herbivory and evaluating implementation of population management to mitigate browse pressure; evaluating application of fire stewardship within fire-dependent forests, particularly along Harvey Lake; and engaging Tribal partners in discussions about stewardship priorities. Stewardship actions should be followed by monitoring to evaluate their effectiveness and inform adaptive management.



Isle Royale National Park supports a unique assemblage of globally rare natural communities. While the remote nature of Isle Royale and its designation as wilderness affords a level of protection to these natural communities, their sustained integrity also relies on careful monitoring and the thoughtful application of deliberate stewardship. Photo by Jesse M. Lincoln.

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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.

GNR = Global rank not yet assessed. Unranked.

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.

SNR = State rank not yet assessed. Unranked.

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.



Stone's Point supports critically imperiled (S1) volcanic lakeshore cliff and imperiled (S2) volcanic bedrock glade. Photo by Jesse M. Lincoln.

Appendix 2 - Sites Summaries

Appendix 2 includes an overview of the natural community types documented adapted from MNFI's natural community classification (Cohen et al. 2015, Cohen et al. 2025), an accompanying ecoregional distribution map for each natural community type (Albert et al. 2008, Cohen et al. 2025), and site summaries for each natural community element occurrence organized alphabetically by community type. Species lists for each natural community element occurrence are provided in Appendix 3

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 photographs

h) site description

i) threat assessment

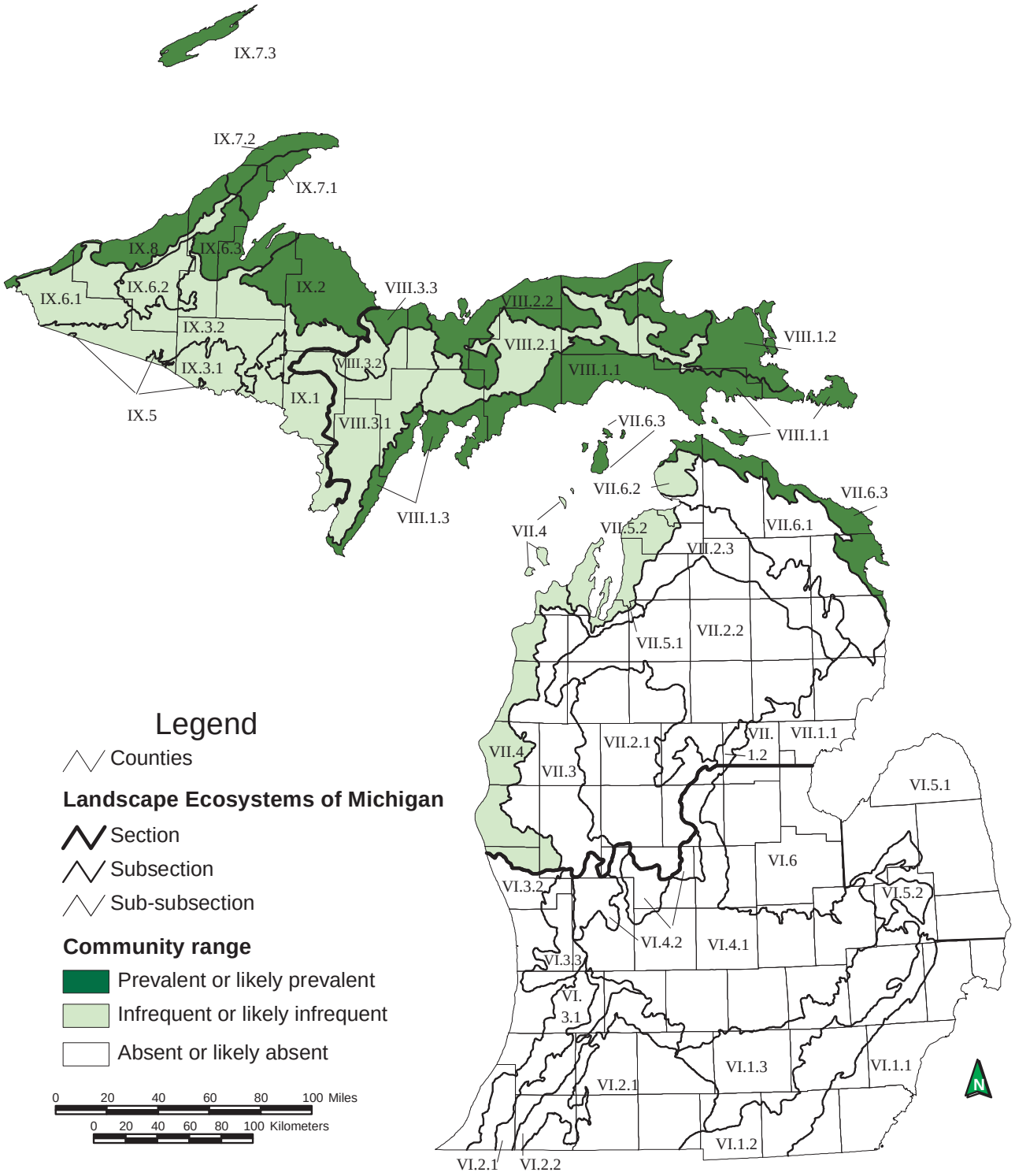
j) management recommendations



Surveying the Stone's Point volcanic lakeshore cliff and adjacent volcanic bedrock glade with Isle Royale National Park ecologist Lynette Potvin. Photo by Jesse M. Lincoln.

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

1. Chippewa Harbor
Natural Community Type: Boreal Forest
Rank: GU S3, uncertain globally and vulnerable within the state
Element Occurrence Rank: B
Size: 46 acres (19 hectares)
Element Occurrence Identification Number: 27876

Site Description: The Chippewa Harbor boreal forest is composed of two polygons of boreal forest between Chippewa Harbor and the Lake Superior shoreline. The boreal forest intergrades locally with volcanic bedrock glade and the southernmost polygon occurs immediately adjacent to volcanic bedrock lakeshore. The Chippewa Harbor boreal forest is an uneven-aged boreal forest that is subject to frequent disturbance including windthrow, infrequent localized fire from lightning strikes, moose herbivory, beaver-felled trees, and intense snowfall. Shoreline forests on Isle Royale are frequently subject to summer fog. The shallow soils of the boreal forest occur over Portage Lake Volcanics. The soils are shallow (typically 2-8 cm), acidic (pH 4.5-5.0), fine-textured organics and loams overlying volcanic bedrock and cobble. The southwest to northeast orientation of Isle Royale and its position in unprotected waters of Lake Superior result in the island experiencing frequent high winds. Windthrow is prevalent and generates many areas of open-canopied boreal forest. As a result, the boreal forest is characterized by high volumes of coarse woody debris including both snags and downed logs. The coarse woody debris load is composed primarily of small-diameter and fast-decomposing early-successional species. High turnover rates within this system result in an open canopy with young canopy ages, complex vertical structure, and uneven-aged patches of boreal forest. A 30 cm white spruce (*Picea glauca*) was cored and estimated to be over 131 years old (121 growth rings counted).



Chippewa Harbor boreal forest delineated in yellow on 2022 imagery.

The Chippewa Harbor boreal forest is characterized by a filtered to closed canopy (65-85%). The canopy is dominated by white spruce with canopy associates including balsam fir (*Abies balsamea*), paper birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*), and northern white-cedar (*Thuja occidentalis*). Shallow soils, frequent windthrow, and moose herbivory likely impart a competitive advantage to white spruce. Canopy trees typically range in diameter from 15 to 40 cm. The understory layer is open (5-15%) with balsam fir, quaking aspen, pin cherry (*Prunus pensylvanica*), and red-berried elder (*Sambucus racemosa*). Intense moose herbivory throughout the boreal forests on the island limits recruitment of preferred browse species. The low shrub layer is patchy to dense (10-15%) with common species including thimbleberry (*Rubus parviflorus*), wild red raspberry (*Rubus strigosus*), skunk currant (*Ribes glandulosum*), squashberry (*Viburnum edule*, State Threatened), round-leaved dogwood (*Cornus rugosa*), and seedling balsam fir, paper birch, and mountain-ash (*Sorbus decora*). The ground cover is patchy to dense (40-60%) with characteristic species including twinflower (*Linnaea borealis*), wild sarsaparilla (*Aralia nudicaulis*), star-flower (*Trientalis borealis*), bunchberry (*Cornus canadensis*), Canada mayflower (*Maianthemum canadense*), feathermoss, bluebead-lily (*Clintonia borealis*), big-leaved aster (*Eurybia macrophylla*), pipsissewa (*Chimaphila umbellata*), and bracken fern (*Pteridium aquilinum*).

The Chippewa Harbor boreal was surveyed August 15, 2024. Forty-seven plant species were documented with no non-native species recorded. The total FQI was 34.3 and the total mean C value was 5.0.

Threats: Species composition and structure are patterned by natural processes but have been impacted by moose herbivory. No non-native species were documented during the course of the survey.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and to maintain a natural buffer surrounding the boreal forest. We recommend monitoring the species composition and vegetative structure to determine how moose herbivory is impacting the forest.



Chippewa Harbor boreal forest. Photo by Joshua G. Cohen.



Chippewa Harbor boreal forest. Photos by Jesse M. Lincoln.



2. Houghton Ridge
Natural Community Type: Boreal Forest
Rank: GU S3, uncertain globally and vulnerable within the state
Element Occurrence Rank: A
Size: 151 acres (61 hectares)
Element Occurrence Identification Number: 28354

Site Description: The Houghton Ridge boreal forest is a large block of boreal forest that occurs along the north side of Houghton Ridge and borders the south side of Siskiwit Bay. Portions of the boreal forest closer to Siskiwit Bay are afforded protection from severe and frequent wind events and are characterized by a dense canopy dominated by large and old northern white-cedar (*Thuja occidentalis*). Along the higher slopes heading south towards Houghton Ridge, wind disturbance and signs of moose herbivory become more prevalent, and early-successional tree species increase in importance with white spruce (*Picea glauca*), quaking aspen (*Populus tremuloides*), and balsam fir (*Abies balsamea*) becoming more prevalent than cedar. Shoreline forests on Isle Royale are frequently subject to summer fog. The boreal forest backs sandstone lakeshore cliff and sandstone cobble shore on the lakeward side and occurs on rolling to steep topography. Heading south to Houghton Ridge, the boreal forest includes small exposures of sandstone cliff and occurs adjacent to sandstone bedrock glade. The soils are characterized by 10 cm of acidic (pH 5.0-5.5) organics and loams overlying sandstone cobble.

Old-growth cedars occur along the lower slopes of this boreal forest complex. Numerous large diameter cedar with twisted and gnarled boles with lichens and mosses occur within these old-growth groves. A 59 cm cedar was cored and estimated to be over 300 years old (273 growth rings counted on a partial core); a 66.3 cm cedar was cored and estimated to be over 150 years old (131 growth rings counted on a partial core); and a 56.5 cm white spruce was cored and estimated to be over 150 years old (143 growth rings counted).



Houghton Ridge boreal forest delineated in yellow on 2022 imagery.

The Houghton Ridge boreal forest is characterized by a closed canopy (75-90%). The lower slopes of the boreal forest that experience greater protection from severe wind events are dominated by northern white-cedar. Heading south towards Houghton Ridge, white spruce, quaking aspen, balsam fir, and paper birch (*Betula papyrifera*) increase in importance along the steeper slopes that experience greater wind disturbance. Canopy trees typically range in diameter from 40 to 60 cm with larger quaking aspen and white spruce frequently reaching over 70 cm and forming a supercanopy. We documented a 25-meter-tall balsam fir in the higher-elevation section of the boreal forest. The understory layer is sparse to patchy (10-15%) with northern white-cedar, white spruce, paper birch, mountain-ash (*Sorbus decora*), mountain maple (*Acer spicatum*), and red-berried elder (*Sambucus racemosa*). The low shrub layer is patchy (20-40%) with common species including thimbleberry (*Rubus parviflorus*), mountain maple, bush-honeysuckle (*Diervilla lonicera*), Canadian fly honeysuckle (*Lonicera canadensis*), yew (*Taxus canadensis*), wild red raspberry (*Rubus strigosus*), and squashberry (*Viburnum edule*, State Threatened), and seedling northern white-cedar, paper birch, and balsam fir. Black twinberry (*Lonicera involucrata,* State Threatened) occurs locally.

The ground cover is diverse and patchy to dense (40-60%) with characteristic species including bluebead-lily (*Clintonia borealis*), naked miterwort (*Mitella nuda*), oak fern (*Gymnocarpium dryopteris*), Canada mayflower (*Maianthemum canadense*), dwarf raspberry (*Rubus pubescens*), star-flower (*Trientalis borealis*), dolls-eyes (*Actaea pachypoda*), gay wings (*Polygala paucifolia*), lesser pyrola (*Pyrola minor*), twinflower (*Linnaea borealis*), big-leaved aster (*Eurybia macrophylla*), common horsetail (*Equisetum arvense*), white lettuce (*Prenanthes alba*), wood millet (*Milium effusum*), dwarf scouring rush (*Equisetum scirpoides*), fragrant bedstraw (*Galium triflorum*), creeping rattlesnake plantain (*Goodyera repens*), wild sarsaparilla (*Aralia nudicaulis*), sedge (*Carex deweyana*), pipsissewa (*Chimaphila umbellata*), rose twisted-stalk (*Streptopus lanceolatus*), and cow-parsnip (*Heracleum maximum*). Lesser pyrola (*Pyrola minor*, State Special Concern) was documented in nearshore areas of the boreal forest.

The Houghton Ridge boreal was surveyed August 14, 2025. Sixty plant species were documented with no non-native species recorded. The total FQI was 40.3 and the total mean C value was 5.2.

Threats: Species composition and structure are patterned by natural processes but have been impacted by moose herbivory, especially along the higher slopes. No non-native species were documented during the course of the survey.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and to maintain a natural buffer surrounding the boreal forest. We recommend monitoring the species composition and vegetative structure to determine how moose herbivory is impacting the forest.



Houghton Ridge boreal forest. Photo by Jesse M. Lincoln.



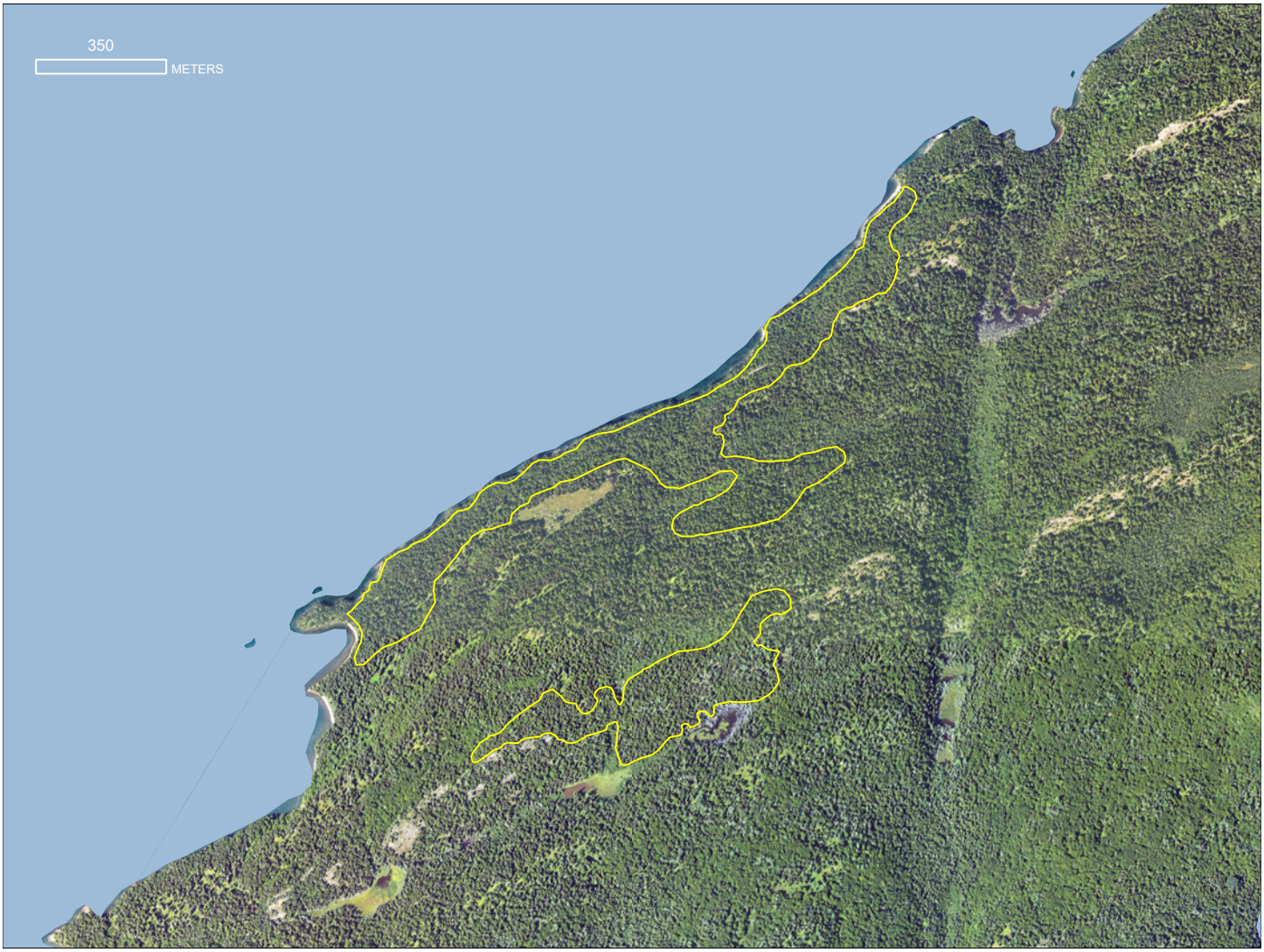
Houghton Ridge boreal forest is a uneven-aged, cedar-dominated forest on the north slopes of Houghton Ridge. The canopy trees range from 150 to 300 years old. Large, supercanopy quaking aspen occur infrequently throughout and were often over 70 cm in diameter. Photos by Joshua G. Cohen.



3. Huginnin Cove
Natural Community Type: Boreal Forest
Rank: GU S3, uncertain globally and vulnerable within the state
Element Occurrence Rank: A
Size: 97 acres (39 hectares)
Element Occurrence Identification Number: 28343

Site Description: The Huginnin Cove boreal forest is composed of two polygons of boreal forest that occur between Huginnin Cove and McGinty Cove. The boreal forest backs volcanic lakeshore cliff, volcanic bedrock lakeshore, and volcanic cobble shore on the lakeward side and occurs on steep topography of varying aspects. Inland, the boreal forest intergrades locally with volcanic bedrock glade and includes several volcanic cliff escarpments. This boreal forest is uneven-aged and is subject to frequent disturbance including windthrow, moose herbivory, beaver-felled trees, and intense snowfall. The boreal forest occurs along the northwest shore of Isle Royale, which is subject to frequent storm events and summer fog, but exposure is moderated by the large sloping bedrock features. As a result, the boreal forest is characterized by low to moderate volumes of coarse woody debris including both snags and downed logs. The coarse woody debris load is composed primarily of small-diameter and fast-decomposing, early-successional species (i.e., paper birch and white spruce) but there are local pockets with older and larger downed northern white-cedar (*Thuja occidentalis*) and white spruce (*Picea glauca*).

This boreal forest includes numerous pockets of old-growth northern white-cedar groves that are found in valleys protected from wind disturbance. A 53.4 cm cedar was cored and estimated to be over 320 years old (308 growth rings counted); a 91.3 cm cedar was cored and estimated to be over 320 years old (309 growth rings counted); and a 116.2 cm



Huginnin Cove boreal forest delineated in yellow on 2022 imagery.

cedar was cored and estimated to be over 500 years old (269 growth rings were counted on a core that reached midway to the center of the tree). This tree was the oldest tree that we documented on Isle Royale. To the south of the boreal forest on the upper slopes and bedrock ridges windthrow is more prevalent. These areas are also influenced by moose browsing. The combination of extreme windthrow and sustained moose herbivory generates moose-spruce savanna, or moose glades.

The soils of the boreal forest are underlain by the Portage Lake Volcanics. Large volcanic boulders and cliff exposures occur locally within the forest. The soils are of variable depth with up to 10 cm of organics (pH 4.5-5.5), loams (pH 5.5-6.0), and silty loams (pH 5.0-5.5) overlying Portage Lake Volcanics.

The Huginnin Cove boreal forest is characterized by a filtered to closed canopy (65-90%). The canopy is dominated by northern white-cedar with canopy associates including balsam fir (*Abies balsamea*), paper birch (*Betula papyrifera*), white spruce (*Picea glauca*), and quaking aspen (*Populus tremuloides*). White spruce and trembling aspen locally form a supercanopy. Canopy trees typically range in diameter from 40 to 60 cm with larger cedar frequently reaching over 70 cm. We documented 91.3 cm and 116 cm cedars and an 82 cm quaking aspen. The understory layer is sparse to patchy (10-20%) with cedar, paper birch, mountain-ash (*Sorbus decora*), mountain maple (*Acer spicatum*), and red-berried elder (*Sambucus racemosa*). Intense moose herbivory throughout the boreal forest on the island limits recruitment of preferred browse species. The low shrub layer is sparse to patchy (10-20%) with common species including mountain maple, Canadian fly honeysuckle (*Lonicera canadensis*), yew (*Taxus canadensis*), and seedling white spruce, balsam fir, and mountain-ash. The ground cover is patchy to dense (40-60%) with characteristic species including bluebead-lily (*Clintonia borealis*), wild sarsaparilla (*Aralia nudicaulis*), star-flower (*Trientalis borealis*), bunchberry (*Cornus canadensis*), Canada mayflower (*Maianthemum canadense*), big-leaved aster (*Eurybia macrophylla*), rose twisted-stalk (*Streptopus lanceolatus*), and twinflower (*Linnaea borealis*). Ferns are common within the boreal forest and include fragile fern (*Cystopteris fragilis*), spinulose woodfern (*Dryopteris carthusiana*), crested shield fern (*D. cristata*), oak fern (*Gymnocarpium dryopteris*), and northern beech-fern (*Phegopteris connectilis*). Feathermoss is prevalent throughout the



Huginnin Cove boreal forest. Photo by Joshua G. Cohen.



This 116 cm northern white-cedar (*Thuja occidentalis*) was estimated to be over 500 years old. Photo by Joshua G. Cohen.

boreal forest on tree boles and boulders and Usnea is common on tree boles and branches. A small population of northern fairy-bells (*Prosartes trachycarpa*, State Threatened) was documented to along a ridgetop within the boreal forest. This rare plant is a primarily western species disjunct to the Upper Great Lakes region. In addition, small-flowered wood rush (*Luzula parviflora*, State Threatened) was also documented within the boreal forest.

The Huginnin Cove boreal forest was surveyed August 8 and August 9, 2025. Sixty plant species were documented with 59 native species and 1 non-native species. The total FQI was 41.8 and the total mean C value was 5.4.

Threats: Species composition and structure are patterned by natural processes but have been impacted by moose herbivory. One non-native species, bluegrass (*Poa nemoralis*), was documented during the course of the survey.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and to maintain a natural buffer surrounding the boreal forest. We recommend monitoring the species composition and vegetative structure to determine how moose herbivory is impacting the boreal forest.



The Huginnin Cove boreal forest occurs on steep slopes above Lake Superior. Photo by Joshua G. Cohen.



Huginnin Cove boreal forest occurs on steep slopes above volcanic lakeshore cliff along Lake Superior's north shore. The forest is a uneven-aged and characterized by old-growth northern white-cedar (*Thuja occidentalis*) and supercanopy white spruce (*Picea glauca*). Photo by Jesse M. Lincoln.

4. Starvation Point
Natural Community Type: Boreal Forest
Rank: GU S3, uncertain globally and vulnerable within the state
Element Occurrence Rank: B
Size: 63 acres (25 hectares)
Element Occurrence Identification Number: 27863

Site Description: The Starvation Point boreal forest occurs along Rock Harbor south of the Tobin Creek drainage, north of the Rock Harbor Trail, and east of Starvation Point. The boreal forest occurs adjacent to high-quality volcanic bedrock glade and poor fen. The Starvation Point boreal forest is an uneven-aged boreal forest that is subject to frequent summer fog and disturbance including windthrow and intense snowfall. The soils are shallow (typically 5-10 cm), acidic, fine-textured organics (2-5 cm, pH 5.0-5.5) and loams (pH 5.0) overlying volcanic bedrock. The position of Isle Royale in unprotected waters of Lake Superior results in the island experiencing frequent high winds. Windthrow is prevalent and generates many areas of open-canopied boreal forest. As a result, the boreal forest is characterized by high volumes of coarse woody debris including both snags and downed logs. The coarse woody debris load is composed primarily of small-diameter and fast-decomposing, early-successional species. A 49.5 cm white spruce (*Picea glauca*) was cored and estimated to be over 130 years old (120 growth rings counted) and a 50.8 cm paper birch (*Betula papyrifera*) was cored and estimated to be over 150 years old (79 growth rings counted on a partial core).

The Starvation Point boreal forest is characterized by a filtered to closed canopy (70-90%). The canopy is dominated by white spruce with canopy associated including balsam fir (*Abies balsamea*), paper birch, quaking aspen (*Populus tremuloides*), and northern white-cedar (*Thuja occidentalis*). Shallow soils, frequent windthrow, and moose herbivory



Starvation Point boreal forest delineated in yellow on 2022 imagery.

likely impart a competitive advantage to white spruce. Canopy trees typically range in diameter from 20 to 40 cm with white spruce and paper birch reaching 40 to 50 cm. The understory layer is sparse (5-10%) with balsam fir, white spruce, and mountain-ash (*Sorbus decora*). Intense moose herbivory throughout the boreal forests on the island limits recruitment of preferred browse species. The low shrub layer is patchy to dense (30-50%) with common species including thimbleberry (*Rubus parviflorus*), bush-honeysuckle (*Diervilla lonicera*), Canadian fly honeysuckle (*Lonicera canadensis*), squashberry (*Viburnum edule*), and seedling quaking aspen, balsam fir, paper birch, and mountain-ash. The ground cover is patchy to dense (40-60%) with characteristic species including big-leaved aster (*Eurybia macrophylla*), oak fern (*Gymnocarpium dryopteris*), pipsissewa (*Chimaphila umbellata*), sedge (*Carex pedunculata*), cow-wheat (*Melampyrum lineare*), bunchberry (*Cornus canadensis*), Canada mayflower (*Maianthemum canadense*), twinflower (*Linnaea borealis*), wild sarsaparilla (*Aralia nudicaulis*), star-flower (*Trientalis borealis*), and bluebead-lily (*Clintonia borealis*).

The Starvation Point boreal was surveyed August 10, 2024. Fifty-four plant species were documented with 53 native species and 1 non-native species recorded. The total FQI was 37.5 and the total mean C value was 5.1.

Threats: Species composition and structure are patterned by natural processes. The non-native yellow hawkweed (*Hieracium piloselloides*) was observed within the boreal forest.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and to maintain a natural buffer surrounding the boreal forest. We recommend monitoring the species composition and vegetative structure to determine how moose herbivory is impacting the boreal forest.



Starvation Point boreal forest. Photo by Joshua G. Cohen.

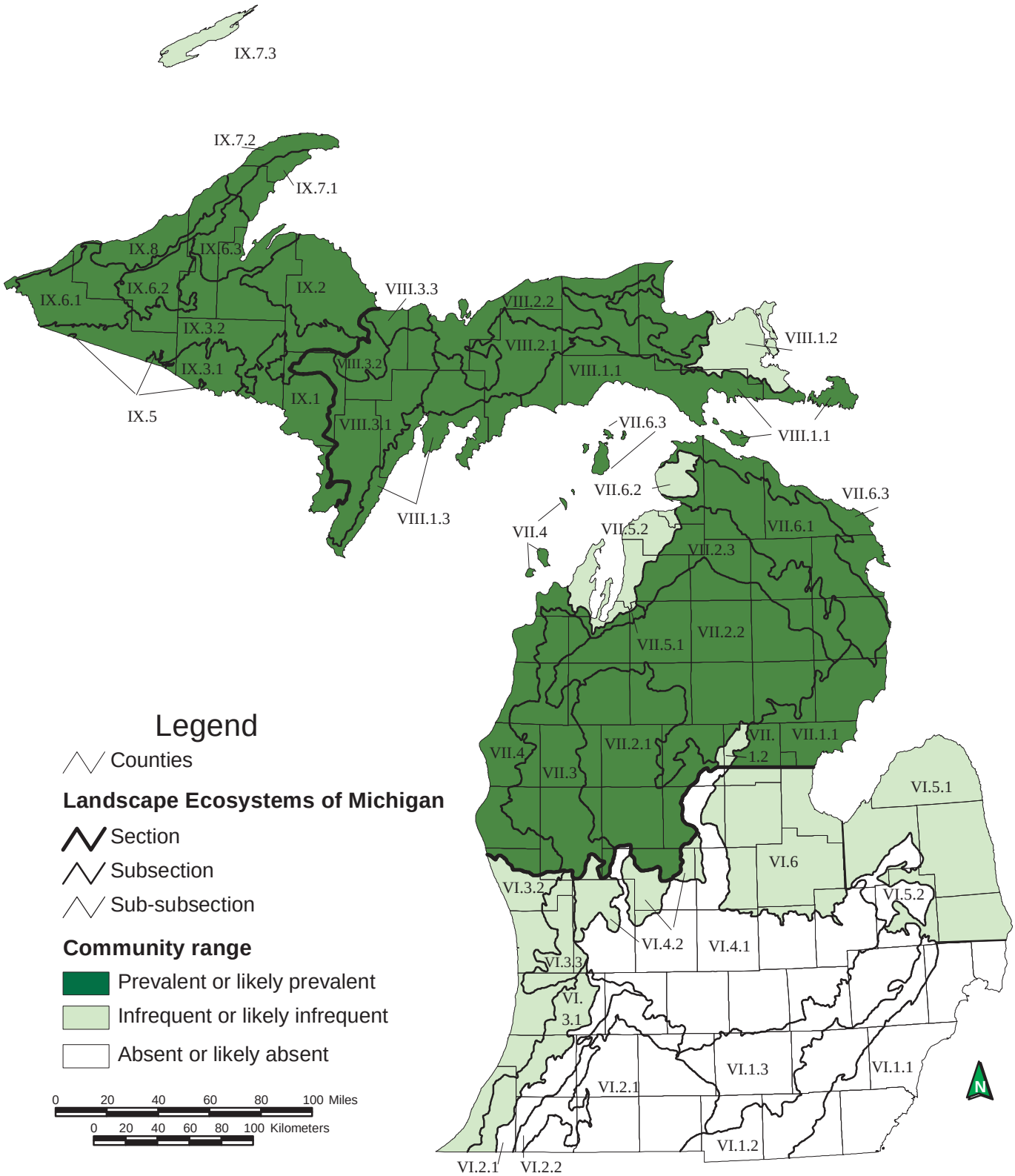


The lack of white-tailed deer on Isle Royale is particularly evident in the herbaceous diversity of the boreal forests where the abundance, richness, and robustness of the ground cover is visibly elevated compared to examples of boreal forest on the mainland. Photos by Joshua G. Cohen (above) and Jesse M. Lincoln (below).



DRY-MESIC NORTHERN FOREST

Overview: Dry-mesic northern forests are pine- or pine/hardwood-dominated communities found on sand or loamy sand soils and occurring principally on sandy glacial outwash, sandy glacial lake plains, and less often on thin glacial drift over bedrock, inland dune ridges and coarse-textured end moraines. Prior to European colonization, dry-mesic northern forest typically originated in the wake of catastrophic fire and was maintained by frequent, low-intensity ground fires (Cohen et al. 2015, Cohen et al. 2025).



Map 2. Distribution of dry-mesic northern forest in Michigan (Albert et al. 2008).

5. Lake Harvey
Natural Community Type: Dry-mesic Northern Forest
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: C
Size: 23 acres (9.3 hectares)
Element Occurrence Identification Number: 28340

Site Description: Dry-mesic northern forest occurs primarily on the north shore of Lake Harvey on gently sloping topography. Three distinct polygons of dry-mesic northern forest are nested within a large block of boreal forest. Both beaver and moose are maintaining the open understory of this forest. Beaver are preferentially felling understory quaking aspen (*Populus tremuloides*), and moose are browsing balsam fir (*Abies balsamea*). Moose trails were observed throughout the forest. The soils are characterized by a shallow (5-10 cm) organic or mor humus (coniferous leaf litter) that is acidic (pH 5.0-5.5) and overlies silty loams that are slightly acidic to circumneutral (pH 6.5-7.0).

The dry-mesic northern forest is relatively young and has been impacted by fire and logging. Several canopy dominants were cored across the dry-mesic northern forest to help determine the age range of the canopy. A 50.5 cm and 46.6 cm red pine (*Pinus resinosa*) were estimated to be over 90 years old (ring counts of 80 years); a 23 cm red pine was estimated to be over 75 years old (ring count of 65 years); and a 43.9 cm red pine was estimated to be over 80 years old (ring count of 70 years). A 83.2 cm white pine (*P. strobus*) with 2 fire scars on the bole was documented. Infrequent white pine locally form a supercanopy but were unable to be aged due to extensive rot. No older trees were observed and there was no red pine regeneration. Despite the relatively uniform age of the forest and unusual landscape position, we are confident this is a natural grove of red pine based on the presence of red pine stumps with multiple fire scars.



Lake Harvey dry-mesic northern forest delineated in yellow on 2022 imagery.

Fire scars were observed on red pine stumps and snags within the site. Two cross-sections of red pine stumps were sampled from the Lake Harvey dry-mesic northern forest and processed by Michigan State University dendrochronologist Kurt Kipfmueller. While both samples are heavily degraded from rot and have few growth rings, both appear to have multiple fire scars. These scars are annotated in Figure 12. One sample has three fire scars with 7 to 8 years occurring between each of the fires. The second sample has four fire scars with fire occurring between 4 to 12 years between each fire. Although this is limited data, it is possible that this site was historically intentionally burned by Indigenous peoples to maintain open understories for foraging, hunting, resin production, and camping. Lake Harvey occurs in close proximity to Todd Harbor. Both Todd Harbor and McCargoe Cove were traditional portals to Isle Royale for Indigenous peoples. These harbors are the shortest distance from the Minnesota mainland and offer protection from southern winds (Cochrane 2009). The presence of a fire-dependent community, proximity to known access points, fire scars on living white pine and red pine, and stumps with evidence of multiple, low intensity fires suggest Indigenous cultural fire may have played an important role in shaping this site.

The dry-mesic northern forest is dominated by red pine with canopy associates including white pine, paper birch (*Betula papyrifera*), quaking aspen, and northern white-cedar (*Thuja occidentalis*). Canopy coverage ranges from 65 to 85% and canopy trees typically range in diameter from 40 to 60 cm with some white pine reaching over 80 cm and forming a supercanopy over the red pine. The subcanopy ranges from 10 to 25% with white pine, red pine, paper birch, and northern white-cedar. The understory is sparse to patchy (5-10%) with northern white-cedar, white spruce, white pine, red pine, round-leaved dogwood (*Cornus rugosa*), and quaking aspen. The low shrub layer is sparse to patchy (10-20%) with bearberry (*Arctostaphylos uva-ursi*), soapberry (*Shepherdia canadensis*), thimbleberry (*Rubus parviflorus*), bush-honeysuckle (*Diervilla lonicera*), common juniper (*Juniperus communis*), prairie willow (*Salix humilis*), and choke cherry (*Prunus virginiana*).

The ground cover is dense (60-75%) with prevalent species including bracken fern (*Pteridium aquilinum*), Canada mayflower (*Maianthemum canadense*), starflower (*Trientalis borealis*), wild sarsaparilla (*Aralia nudicaulis*), cow-wheat (*Melampyrum lineare*), pale vetchling (*Lathyrus ochroleucus*), wood millet (*Milium effusum*), rough-leaved rice-grass (*Oryzopsis asperifolia*), rice-grass (*Piptatherum pungens*), false melic (*Schizachne purpurascens*), poverty grass (*Danthonia spicata*), slender wheatgrass (*Elymus trachycaulus*), northern wild comfrey (*Cynoglossum boreale*), low bindweed (*Calystegia spithamaea*), hair grass (*Avenella flexuosa*), pipsissewa (*Chimaphila umbellata*), twinflower



Lake Harvey dry-mesic northern forest occurs on the north shore of Harvey Lake, southeast of Todd Harbor. Photo by Jesse M.Lincoln.

(*Linnaea borealis*), big-leaved aster (*Eurybia macrophylla*), gay-wings (*Polygala paucifolia*), bunchberry (*Cornus canadensis*), northern heart-leaved aster (*Symphyotrichum ciliolatum*), western fescue (*Festuca occidentalis*), northern hawkweed (*Hieracium umbellatum*), and bluebead-lily (*Clintonia borealis*).

The Lake Harvey dry-mesic northern forest was surveyed August 6, 2025. Sixty-one plant species were documented with 58 native species and 3 non-native species. The total FQI was 36.7 and the total mean C value was 4.7.

Threats: Species composition and vegetative structure are patterned by natural processes. Scattered non-natives include Canada bluegrass (*Poa compressa*), red clover (*Trifolium pratense*), and yellow hawkweed (*Hieracium caespitosum*).

Management Recommendations: The main management recommendations are to explore the site for fire-scarred stumps and engage with Tribal communities in an attempt to learn about cultural burning practices on Isle Royale. Fire is critical for maintaining red pine in a landscape position that will otherwise trend towards more mesic conditions. We also recommend allowing the forest to continue maturing, retaining an intact buffer of natural communities surrounding the dry-mesic northern forest, and monitoring for invasive species. This site is the highest priority natural community to consider for the application of prescribed fire.



Lake Harvey dry-mesic northern forest occurs along moderate slopes above Lake Harvey. Photo by Joshua G. Cohen.

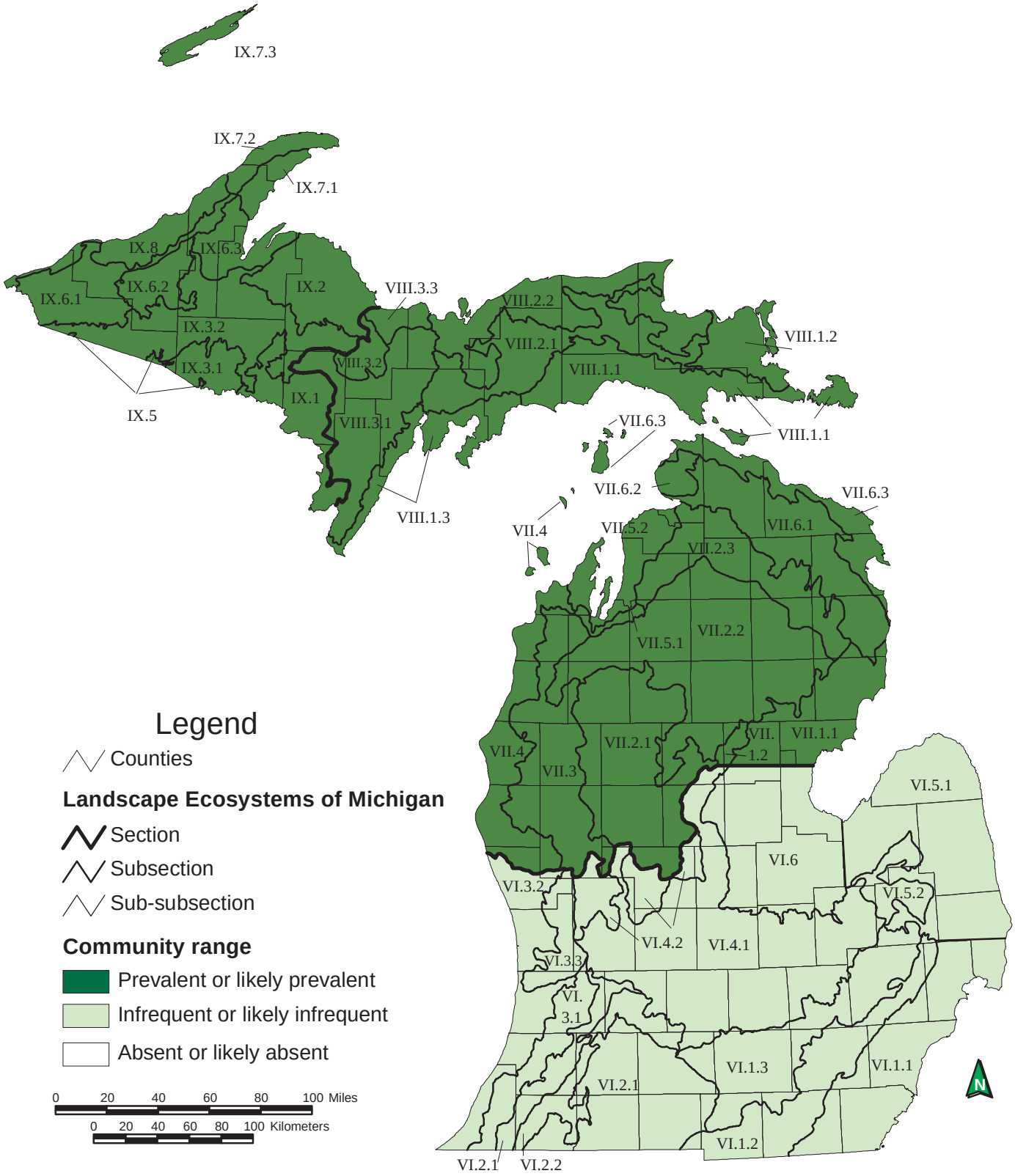


With fire being absent for the last 80 years, the Lake Harvey dry-mesic northern forest is undergoing mesophication with fire-sensitive species becoming more prevalent in the understory. We recommend application of fire stewardship to maintain this cover type, which is the rare on Isle Royale. Photos by Jesse M. Lincoln.



HARDWOOD-CONIFER SWAMP

Overview: Hardwood-conifer swamp is a minerotrophic forested wetland dominated by a mixture of lowland hardwoods and conifers, occurring on organic (i.e., peat) and poorly drained mineral soils throughout Michigan. The community occurs on a variety of landforms, often associated with headwater streams and areas of groundwater discharge. Species composition and dominance patterns can vary regionally. Windthrow and fluctuating water levels are the primary natural disturbances that structure hardwood-conifer swamp (Cohen et al. 2015, Cohen et al. 2025).



Map 3. Distribution of hardwood-conifer swamp in Michigan (Albert et al. 2008).

6. Feldtmann Ridge
Natural Community Type: Hardwood-Conifer Swamp
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: A
Size: 156 acres (63 hectares)
Element Occurrence Identification Number: 28359

Site Description: Old-growth hardwood-conifer swamp occurs in the drainage at the base of Feldtmann Ridge east of Feldtmann Lake and west of Siskiwit Bay. Old-growth mesic northern forest occurs up slope of the hardwood-conifer swamp. Small upland inclusions of boreal forest dominated by northern white-cedar (*Thuja occidentalis*) and white spruce (*Picea glauca*) are nested within the swamp. The larger wetland complex also includes rich conifer swamp, northern fen, and patterned fen. Species composition and structure are patterned by groundwater seepage from the ridge and gap-phase dynamics. Numerous small-scale canopy gaps and high volumes of coarse woody debris occur within the swamp, which is characterized by complex horizontal and vertical structure. The coarse woody debris load is characterized by diverse species composition, diameter ranges, and decay classes. Nurse logs provide important establishment and growth sites for seedling yellow birch (*Betula alleghaniensis*) and northern white-cedar. Diverse mosses and lichens are prevalent on tree boles and coarse woody debris throughout the swamp. Mosses and lichens are especially prevalent on the largest diameter trees. The uneven-aged swamp includes numerous old-growth individuals: a 69.5 cm northern white-cedar was cored and 222 rings were counted on a partial core; a 60 cm northern white-cedar was cored and 90 rings were counted on a partial core (estimated to be over 180 years old); and a 50.8 cm northern white-cedar was cored and 150 rings were counted on a partial core.



Feldtmann Ridge hardwood-conifer swamp delineated in yellow on 2022 imagery.

A prevalent moose trail occurs along the toe slope in the mesic northern forest just above the hardwood-conifer swamp. Moose browse was noted throughout the adjacent mesic northern forest. The soils of the hardwood-conifer swamp are characterized by deep alkaline peats (> 50 cm deep, pH 7.3-7.5).

The hardwood-conifer swamp is characterized by diverse and variable canopy composition with northern white-cedar, white spruce, balsam poplar (*Populus balsamifera*), yellow birch, paper birch (*Betula papyrifera*), and balsam fir (*Abies balsamea*). Canopy coverage ranges from 70 to 90%. Canopy trees typically range in diameter from 40 to 60 cm with larger yellow birch and northern white-cedar reaching 60 to 80 cm and tree diameters increasing with proximity to the upland margin. Scattered (10-15%) paper birch occur in the subcanopy. The understory layer is sparse (5-15%) with quaking aspen (*Populus tremuloides*), yellow birch, and northern white-cedar. The low shrub layer is patchy to dense (40-60%) with thimbleberry (*Rubus parviflorus*), mountain maple (*Acer spicatum*), balsam poplar, and quaking aspen. The ground cover is diverse and patchy (20-40%) with characteristic species including spotted touch-me-not (*Impatiens capensis*), spinulose woodfern (*Dryopteris carthusiana*), oak fern (*Gymnocarpium dryopteris*), star-flower (*Trientalis borealis*), fowl manna grass (*Glyceria striata*), skunk-cabbage (*Symplocarpus foetidus*), dwarf raspberry (*Rubus pubescens*), naked miterwort (*Mitella nuda*), bunchberry (*Cornus canadensis*), twinflower (*Linnaea borealis*), and small enchanter's-nightshade (*Circaea alpina*).

The Feldtmann Ridge hardwood-conifer swamp was surveyed August 15, 2025. Twenty-one plant species were documented with no non-native species recorded. The total FQI was 20.2 and the total mean C value was 4.4.

Threats: Species composition, vegetative structure, and successional trajectory have been influenced by gap-phase dynamics and groundwater seepage. No invasive plants were documented during the course of the survey.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered, retain an intact buffer of natural communities surrounding the hardwood-conifer swamp, and monitor invasive species and moose herbivory.



Feldtmann Ridge hardwood-conifer swamp. Photo by Joshua G. Cohen.

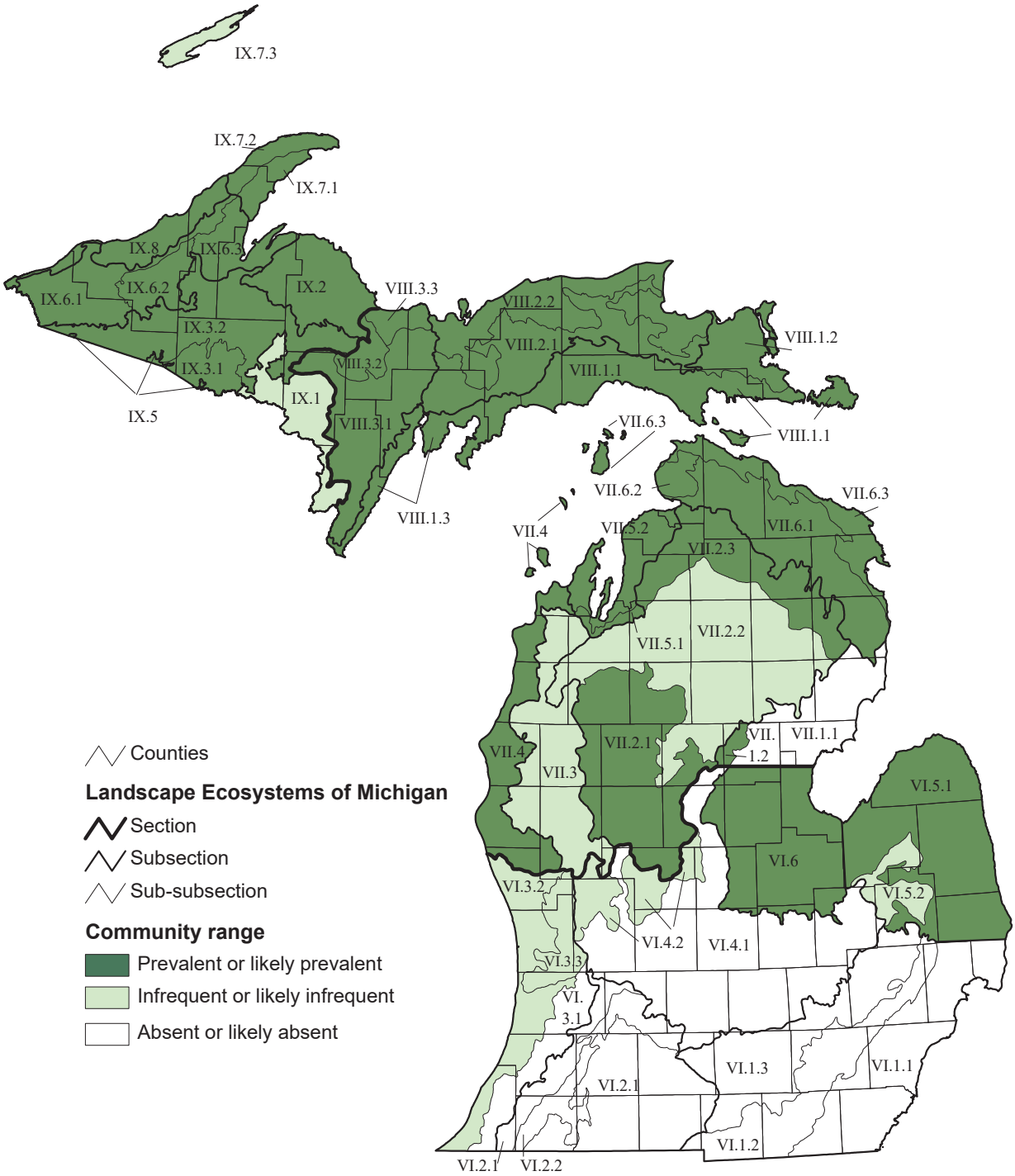


Feldtmann Ridge hardwood-conifer swamp. Photos by Joshua G. Cohen.



MESIC NORTHERN FOREST

Overview: Mesic northern forest is a forest type of moist to dry-mesic sites lying mostly north of the climatic tension zone, characterized by the dominance of northern hardwoods, particularly sugar maple (*Acer saccharum*) and American beech (*Fagus grandifolia*). Conifers such as hemlock (*Tsuga canadensis*) and white pine (*Pinus strobus*) are frequently important canopy associates. This community type breaks into two broad classes: northern hardwood forest and hemlock-hardwood forest. It is primarily found on coarse-textured ground and end moraines, and soils are typically loamy sand to sandy loam. The natural disturbance regime is characterized by gap-phase dynamics; frequent, small windthrow gaps allow for the regeneration of the shade-tolerant canopy species. Catastrophic windthrow occurs infrequently with several generations of trees passing between large-scale, severe disturbance events. Historically, mesic northern forest occurred as a matrix system, dominating vast areas of mesic uplands in the Great Lakes region. These forests were multi-generational, with old-growth conditions lasting many centuries (Cohen et al. 2015, Cohen et al. 2025).



Map 4. Distribution of mesic northern forest in Michigan (Albert et al. 2008).

7. Feldtmann Ridge
Natural Community Type: Mesic Northern Forest
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: AB
Size: 98 acres (40 hectares)
Element Occurrence Identification Number: 28360

Site Description: Old-growth mesic northern forest occurs north of the Feldtmann Escarpment along moderate to steep slopes beneath the vertical exposure of conglomerate and also on the terraces between the stair-stepped cliffs and above portions of the cliff. To the south and west, bedrock exposures along the Feldtmann Ridge support volcanic cliff and volcanic bedrock glade. Further to the north, high-quality hardwood-conifer swamp, rich conifer swamp, northern fen, and patterned fen occur in the wetland associated with the Feldtmann Lake drainage. The hardwood-conifer swamp abuts the mesic northern forest directly to the north. A prevalent moose trail occurs along the toe slope. Moose browse was noted throughout the mesic northern forest. Seepy drains occur locally thoughout the forest. The soils of the mesic northern forest are characterized by shallow organics (pH 5.5) over sandy loam (pH 5.5-6.0).

Species composition and structure are patterned by gap-phase dynamics. Numerous small-scale canopy gaps, high volumes of coarse woody debris, and shade-tolerant regeneration are evidence of centuries of small windthrow events. Several multiple tree-fall gaps also occur within the forest and increase the structural complexity. The coarse woody debris load is characterized by a range of diameter and decay classes. Numerous large diameter snags and nurse logs were noted throughout. Nurse logs provide important establishment and growth sites for seedling yellow birch (*Betula alleghaniensis*) and northern white-cedar (*Thuja occidentalis*). Diverse mosses and lichens are prevalent on tree boles and



Feldtmann Ridge mesic northern forest delineated in yellow on 2022 imagery.

coarse woody debris throughout the forest. Mosses and lichens are especially prevalent on the largest diameter trees. The uneven-aged forest includes numerous old-growth individuals: a 69 cm yellow birch was cored and estimated to be over 300 years old (counted 230 rings on a partial core), and a 60 cm northern white-cedar was cored and estimated to be over 180 years old (counted 90 rings on a partial core).

The uneven-aged, old-growth mesic northern forest is dominated by yellow birch with canopy associates including northern white-cedar, paper birch (*Betula papyrifera*), and white spruce (*Picea glauca*). Sugar maple (*Acer saccharum*) becomes more prevalent in the canopy along the upper slopes. Canopy coverage typically ranges from 80 to 90% with some local patches having more open canopy (60-75%) where blowdown is more prevalent or where seepy drainages occur. Drainages support pockets of northern white-cedar and tree-sized black ash (*Fraxinus nigra*). Canopy trees typically range in diameter from 60 to 80 cm with scattered yellow birch reaching over 90 cm. An estimated 40% of the canopy is in this largest size class and likely between the ages of 200 to 300 years old. The subcanopy ranges from 20 to 60% and is dominated by yellow birch with balsam fir (*Abies balsamea*), northern white-cedar, white spruce, pin cherry (*Prunus pensylvanica*) and paper birch throughout. The understory layer is sparse to patchy (5-10%) and characterized by an abundance of robust thimbleberry (*Rubus parviflorus*) and beaked hazelnut (*Corylus cornuta*) along with red-berried elder (*Sambucus racemosa*), mountain maple (*Acer spicatum*), mountain-ash (*Sorbus decora*), round-leaved dogwood (*Cornus rugosa*), and white spruce. The low shrub layer is patchy to dense (10-20%) and is dominated by thimbleberry. Additional low shrubs include yew (*Taxus canadensis*), mountain maple, wild red raspberry (*Rubus strigosus*), bush-honeysuckle (*Diervilla lonicera*), and Canadian fly honeysuckle (*Lonicera canadensis*).

The ground cover is patchy to dense (20-60%) with characteristic forb species including bunchberry (*Cornus canadensis*), star-flower (*Trientalis borealis*), wild sarsaparilla (*Aralia nudicaulis*), spotted touch-me-not (*Impatiens capensis*), bluebead-lily (*Clintonia borealis*), rose twisted-stalk (*Streptopus lanceolatus*), dwarf raspberry (*Rubus pubescens*), Canada mayflower (*Maianthemum canadense*), naked miterwort (*Mitella nuda*), big-leaved aster (*Eurybia macrophylla*), twinflower (*Linnaea borealis*), small enchanter's-nightshade (*Circaea alpina*), doll's-eyes (*Actaea pachypoda*), red baneberry (*Actaea rubra*), fragrant bedstraw (*Galium triflorum*), northern wood-sorrel (*Oxalis acetosella*), nodding trillium (*Trillium cernuum*), and hairy sweet-cicely (*Osmorhiza claytonii*). Characteristic ferns and fern allies include spinulose woodfern (*Dryopteris carthusiana*), oak fern (*Gymnocarpium dryopteris*), dwarf scouring rush (*Equisetum scirpoides*), shining clubmoss (*Huperzia lucidula*), and tree clubmoss (*Dendrolycopodium dendroideum*). Characteristic graminoids include wood millet (*Milium effusum*), wood reedgrass (*Cinna latifolia*), sedges (*Carex intumescens*, *C.*



Feldtmann Ridge mesic northern forest. Photo by Joshua G. Cohen.



Old-growth yellow birch (*Betula alleghaniensis*) occurs throughout the Feldtmann Ridge mesic northern forest. Photo by Joshua G. Cohen.

pedunculata, and *C. arctata*), and native bluegrass species (*Poa alsodes* and *P. saltuensis*). The non-native bluegrass (*P. nemoralis*) was recorded locally along the portions of the Feldtmann Trail passing through the forest. Seepy drains are characterized by concentrations of spotted touch-me-not and skunk-cabbage (*Symplocarpus foetidus*).

The Feldtmann Ridge mesic northern forest was surveyed on August 15, 2025. Sixty-four plant species were documented with 63 native species and 1 non-native species. The total FQI was 38.4 and the total mean C value was 4.8.

Threats: Species composition, vegetative structure, and successional trajectory have been influenced by gap-phase dynamics but have also been impacted by moose herbivory. No invasive plants were documented within the forest. The non-native bluegrass (*P. nemoralis*) was recorded within the western portion of the forest along the trail.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered, retain an intact buffer of natural communities surrounding the mesic northern forest, monitor moose herbivory, and monitor for invasive species.



The Feldtmann Ridge mesic northern forest occurs north of the Feldtmann Escarpment along moderate to steep slopes beneath the vertical exposure of conglomerate. Photo by Joshua G. Cohen.

8. Lake Desor
Natural Community Type: Mesic Northern Forest
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: AB
Size: 361 acres (146 hectares)
Element Occurrence Identification Number: 28369

Site Description: Uneven-aged, old-growth mesic northern forest occurs on gentle to moderate topography on moraine southwest of Lake Desor. The forest occurs on variable terrain with a series of hills over 30 m tall. The mesic northern forest contains pockets of northern hardwood swamp in depressions with clay lenses in the soil profile and wraps around a large wetland complex in a poorly drained channel that supports rich conifer swamp, poor conifer swamp, and muskeg. Species composition and structure are patterned by gap-phase dynamics, and pit-and-mound topography occurs throughout. Some pits function seasonally as vernal pools and support wetland species. The forest is afforded protection from extreme wind events due to its position between the Minong ridge to the south and a smaller ridge to the north. As a result, the forest is characterized by complex age structures with a high proportion of trees in older age classes. Numerous small-scale canopy gaps, high volumes of coarse woody debris, shade-tolerant regeneration, and tip-up mounds are evidence of centuries of small windthrow events. Regeneration of sugar maple is localized and moose browse is present throughout, resulting in a sparsely vegetated subcanopy and understory. Several multi-tree-fall gaps also occur within the forest and increase the structural diversity. The coarse woody debris load is characterized by diverse species composition, diameter ranges, and decay classes. Numerous large-diameter snags and nurse logs were noted throughout, including a 93.4 cm northern white-cedar (*Thuja occidentalis*) snag. Nurse logs provide important establishment and growth sites for seedling yellow birch (*Betula alleghaniensis*) and northern white-cedar. Living



Lake Desor mesic northern forest delineated in yellow on 2022 imagery.

trees are characterized by large rotting limbs in the canopy and large cavities on the boles. Fungi, lichen, and mosses are prevalent on coarse woody debris and the forest floor as well as on the boles of living and dead trees. Mosses and lichens are especially prevalent on the largest diameter trees. The uneven-aged forest includes numerous old-growth individuals: a 64.7 cm sugar maple (*Acer saccharum*) was cored and estimated to be over 250 years old (counted 199 rings), and a 67.2 cm sugar maple was cored and estimated to be over 250 years old (counted 202 rings). Moose trails and browse were noted throughout the mesic northern forest. The soils of the mesic northern forest are characterized by shallow organics (5-10 cm, pH 5.5) over sandy loam (pH 5.5-6.0) overlaying glacial till. Northern hardwood swamp pockets occured where clay lenses facilitate the seasonal pooling of water. Large, moss-covered glacial erratics occur throughout the forest and often have their own plant assemblages.

The uneven-aged, old-growth mesic northern forest is dominated by sugar maple with canopy associates including yellow birch, northern white-cedar, and red oak (*Quercus rubra*). Sugar maple is the most dominant canopy species with yellow birch occurring infrequently and red oak increasing in importance in higher slope positions. Canopy coverage typically ranges from 75 to 85% with some local patches having more open canopy (65-75%) where blowdown is more prevalent. Canopy trees typically range in diameter from 60 to 80 cm with numerous old-growth sugar maple and yellow birch ranging from 90 to 110 cm. Low depressions within the mesic northern forest support pockets of northern hardwood swamp dominated by canopy black ash (*Fraxinus nigra*). The subcanopy of the mesic northern forest ranges from 10 to 25% and is characterized by sugar maple and northern white-cedar with black ash along the margins of depressions. The understory layer is sparse to patchy (5-10%) with robust sugar maple, black ash, juneberry (*Amelanchier arborea*), red-berried elder (*Sambucus racemosa*), alternate-leaved dogwood (*Cornus alternifolia*), and beaked hazelnut (*Corylus cornuta*). The low shrub layer is patchy to dense (30-60%) and is dominated by sugar maple with characteristic species including Canadian fly honeysuckle (*Lonicera canadensis*), thimbleberry (*Rubus parviflorus*), wild red raspberry (*Rubus strigosus*), red-berried elder, yew (*Taxus canadensis*), pin cherry (*Prunus pensylvanica*), and mountain-ash (*Sorbus decora*).

The ground cover is patchy (30-50%) with characteristic species including sweet-cicely (*Osmorhiza berteroi*), spinulose woodfern (*Dryopteris carthusiana*), wild sarsaparilla (*Aralia nudicaulis*), Canada mayflower (*Maianthemum canadense*), bluebead-lily (*Clintonia borealis*), rose twisted-stalk (*Streptopus lanceolatus*), downy Solomon seal (*Polygonatum pubescens*), spikenard (*Aralia racemosa*), dolls-eye's (*Actaea pachypoda*), red baneberry (*Actaea rubra*), oak fern (*Gymnocarpium dryopteris*), Jack-in-the-pulpit (*Arisaema triphyllum*), spotted touch-me-not (*Impatiens capensis*), tall



Lake Desor mesic northern forest is an uneven-aged, old-growth sugar maple–dominated forest. Photo by Jesse M. Lincoln.

lettuce (*Lactuca canadensis*), fragrant bedstraw (*Galium triflorum*), wood reedgrass (*Cinna latifolia*), nodding trillium (*Trillium cernuum*), sweet white violet (*Viola blanda*), Canada violet (*V. canadensis*), and sedges (*Carex deweyana, C. intumescens,* and *C. pedunculata*). Wetland species in clayey zones, especially tip-ups and small troughs between large slopes, include skunk-cabbage (*Symplocarpus foetidus*), fowl manna grass (*Glyceria striata*), spotted touch-me-not, flowered buttercup (*Ranunculus abortivus*), and sedges (*Carex crinita* and *C. projecta*). Non-natives recorded infrequently in the ground cover include helleborine (*Epipactis helleborine*) and Kentucky bluegrass (*Poa pratensis*).

The Lake Desor mesic northern forest was surveyed on August 20, 2025. Sixty-six plant species were documented with 64 native species and 2 non-native species. The total FQI was 34.9 and the total mean C value was 4.3.

Threats: Species composition, vegetative structure, and successional trajectory have been influenced by gap-phase dynamics but have also been impacted by moose herbivory. Non-natives recorded infrequently in the ground cover include helleborine (*Epipactis helleborine*) and Kentucky bluegrass (*Poa pratensis*).

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered, retain an intact buffer of natural communities surrounding the mesic northern forest, monitor moose herbivory, and monitor for invasive species.

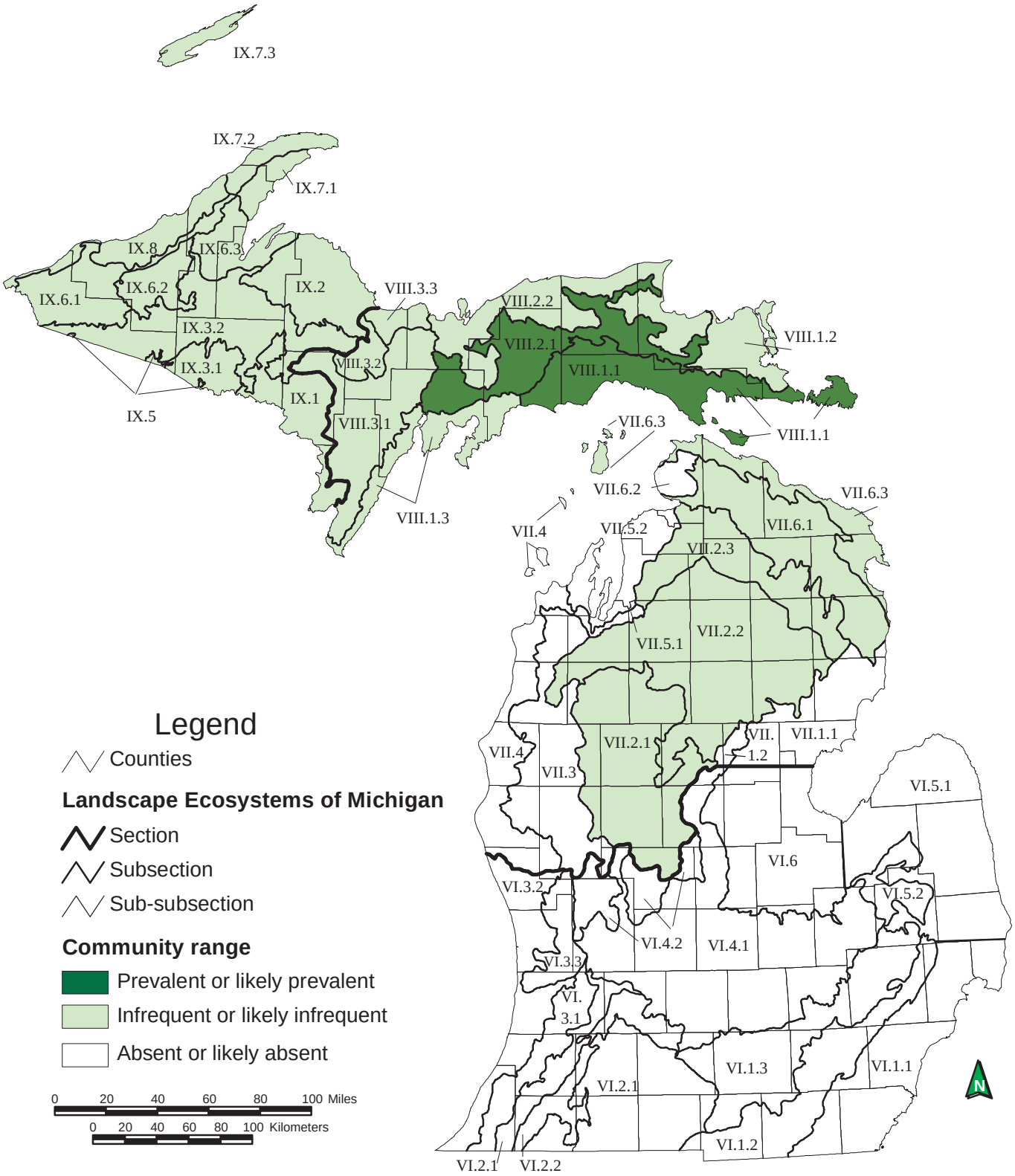


Lake Desor mesic northern forest occurs on gentle to moderate topography on moraine southwest of Lake Desor. Photos by Joshua G. Cohen.



MUSKEG

Overview: Muskeg is a nutrient-poor peatland characterized by acidic, saturated peat, and scattered or clumped, stunted conifer trees set in a matrix of sphagnum mosses and ericaceous shrubs. Black spruce (*Picea mariana*) and tamarack (*Larix laricina*) are typically the most prevalent tree species. The community primarily occurs in large depressions on glacial outwash and sandy glacial lakeplains. Fire occurs naturally during periods of drought and can alter the hydrology, mat surface, and floristic composition of muskegs. Windthrow, beaver flooding, and insect defoliation are also important disturbance factors that influence species composition and structure. (Cohen et al. 2015, Cohen et al. 2025).



Map 5. Distribution of muskeg in Michigan (Albert et al. 2008).

9. Lake Desor
Natural Community Type: Muskeg
Rank: G4G5 S3, apparently secure to secure globally and vulnerable within the state
Element Occurrence Rank: B
Size: 63 acres (25 hectares)
Element Occurrence Identification Number: 28370

Site Description: This small muskeg occurs southwest of Lake Desor between two lobes of rolling moraine with old-growth mesic northern forest. The muskeg occurs in a poorly drained channel that also supports poor conifer swamp and rich conifer swamp. A 12.2 cm black spruce (*Picea mariana*) was cored and estimated to be over 220 years old (212 ring count) and a 21.3 cm tamarack (*Larix laricina*) was cored and estimated to be over 78 years old (68 ring count). The soils are characterized by deep (> 1 m), acidic (pH 4.5) saturated peats. The fibric peats on the top of the sphagnum hummocks are more acidic than the underlying hemic and sapric peats. Acidity decreases with increasing peat depth and within the interior of the peatland. Fine-scale gradients in soil composition and soil moisture associated with the well-developed sphagnum hummocks and hollows as well as distance from the upland margin generate small-scale microhabitats within the muskeg and increase the overall species diversity.

The open canopy of the muskeg is characterized by scattered and stunted black spruce and tamarack with white pine (*Pinus strobus*) as a canopy associate. Canopy trees range from 5 to 20 cm diameter and 1 to 5 m in height. The understory (10-20%) is characterized by sapling black spruce and tamarack. The low shrub layer is dense (60-80%) and is characterized by leatherleaf (*Chamaedaphne calyculata*), Labrador-tea (*Rhododendron groenlandicum*), bog-laurel (*Kalmia polifolia*), bog rosemary (*Andromeda glaucophylla*), Canada blueberry (*Vaccinium myrtilloides*), and chokeberry (*Aronia prunifolia*) with black spruce and tamarack seedlings. The ground cover (30-50%) is floristically homogenous and



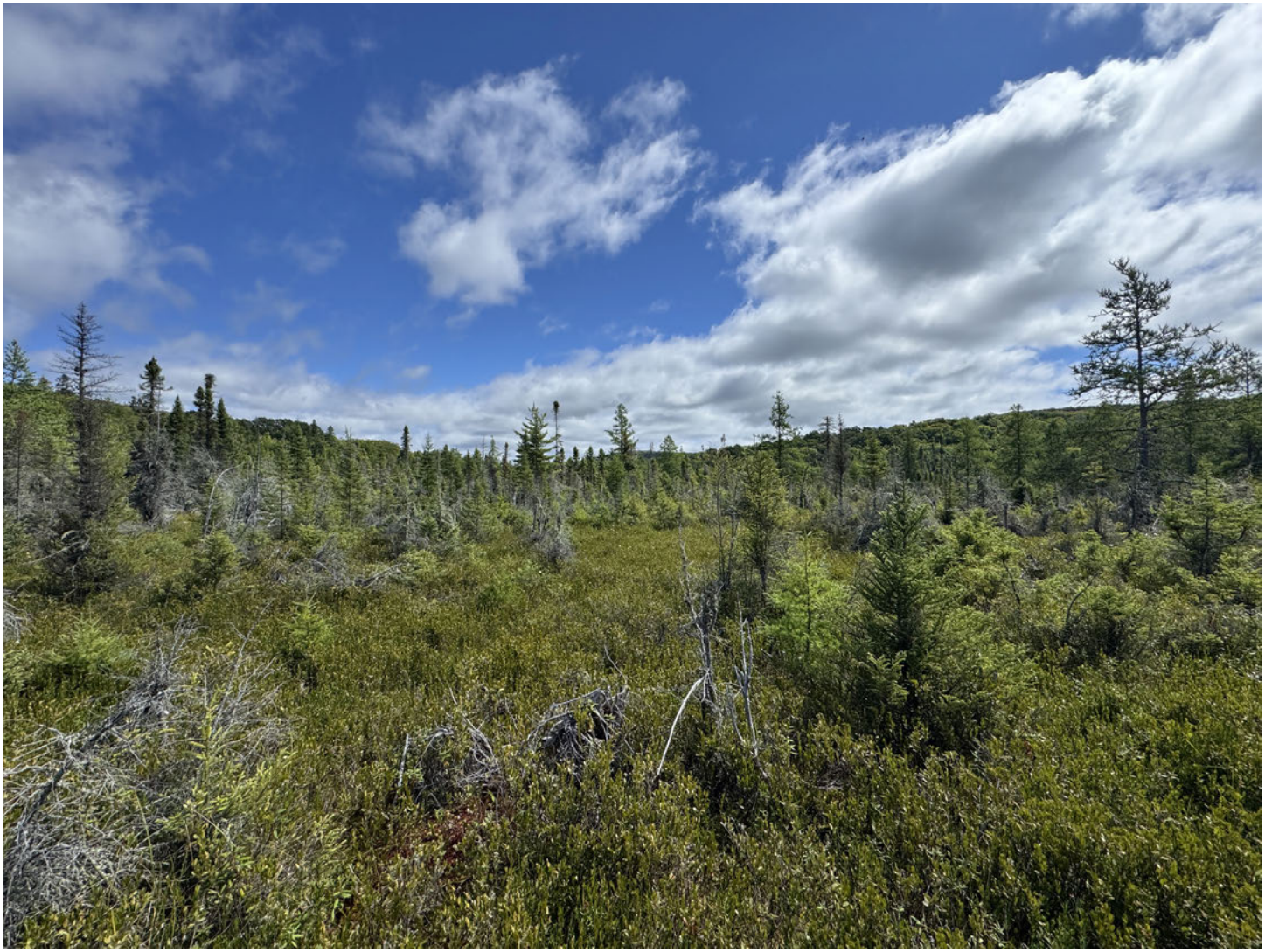
Lake Desor muskeg delineated in yellow on 2022 imagery.

characterized by Sphagnum species, false mayflower (*Maianthemum trifolium*), narrow-leaved cotton-grass (*Eriophorum angustifolium*), cotton-grass (*E. vaginatum*), small cranberry (*Vaccinium oxycoccos*), sedge (*Carex pauciflora*), and pitcher-plant (*Sarracenia purpurea*).

Along the margin of the muskeg where there is a slight minerotrophic influence, the following species are locally common: northern white-cedar (*Thuja occidentalis*), black ash (*Fraxinus nigra*), tag alder (*Alnus incana*), false mayflower, skunk-cabbage (*Symplocarpus foetidus*), goldthread (*Coptis trifolia*), sedges (*Carex stricta*, and *C. magellanica*), creeping snowberry (*Gaultheria hispidula*), wild blue flag (*Iris versicolor*), cinnamon fern (*Osmundastrum cinnamomeum*), royal fern (*Osmunda spectabilis*), and blue-joint (*Calamagrostis canadensis*).
The Lake Desor muskeg was surveyed on August 20, 2025. Twenty-eight plant species were documented with no non-native species. The total FQI was 35.5 and the total mean C value was 6.7.

Threats: Species composition and zonation are patterned by natural processes. No threats were documented during the survey.

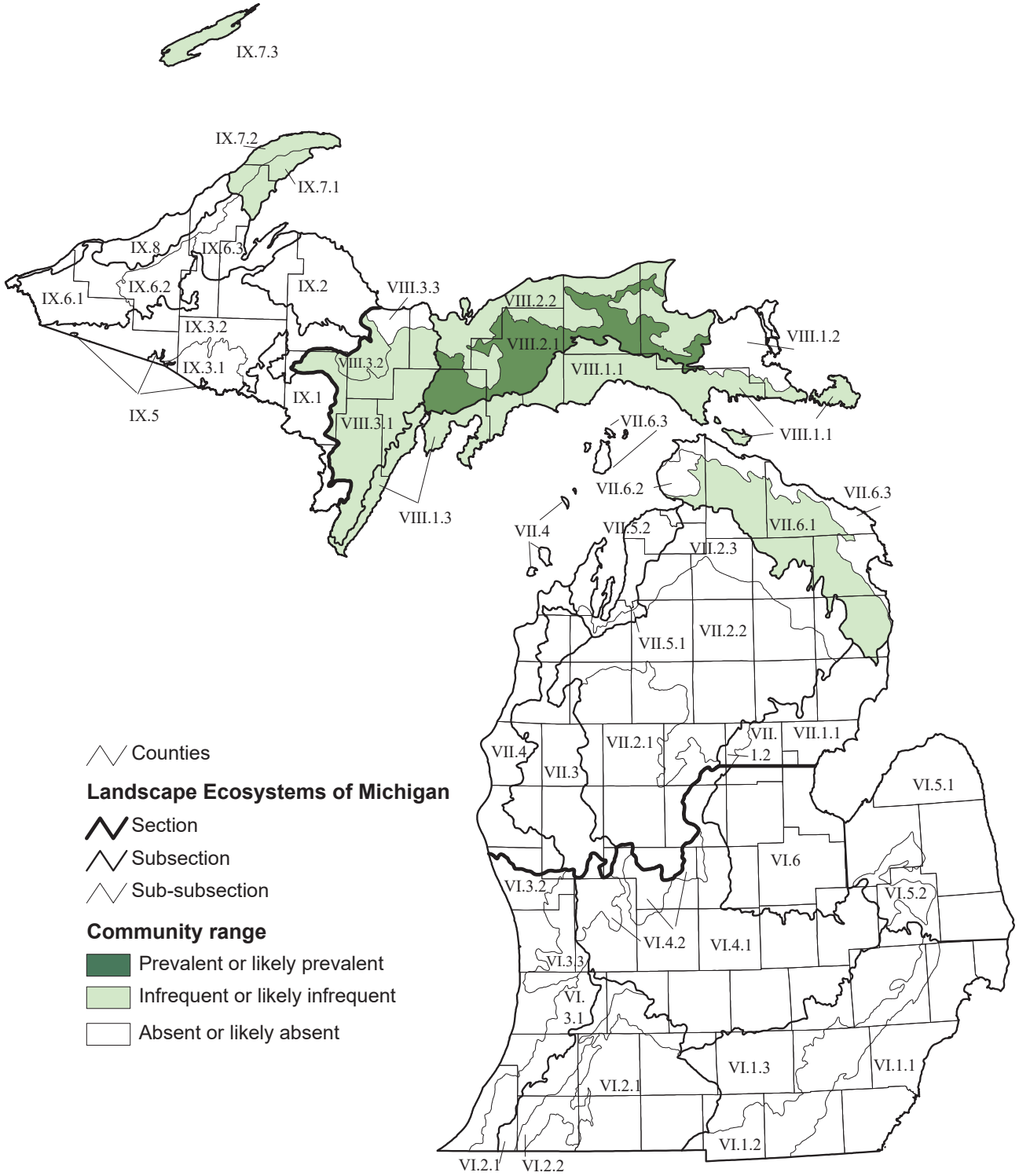
Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to retain an intact buffer of natural communities surrounding the muskeg to minimize the threat of hydrological alteration.



The Lake Desor muskeg is characterized by a scattered and stunted conifer canopy and a dense ericaceous shrub layer. Photo by Joshua G. Cohen.

PATTERNED FEN

Overview: Patterned fen is a minerotrophic shrub- and herb-dominated peatland mosaic characterized by a series of peat ridges (strings) and hollows (flarks) oriented parallel to the slope of the landform and perpendicular to the flow of groundwater. The strings vary in height, width, and spacing, but are generally less than one meter tall, resulting in a faint wave-like pattern. The flarks are saturated to inundated open lawns of sphagnum mosses, sedges, and rushes, while the strings are dominated by sedges, shrubs, and scattered, stunted trees. Patterned fen occurs on broad, poorly drained glacial lakeplain and poorly drained outwash channels adjacent to lakeplain. The development of patterned fen is driven by peat accumulation, seasonal flooding, surface water and groundwater flow regimes, and periodic wildfire (Cohen et al. 2015, Cohen et al. 2025).

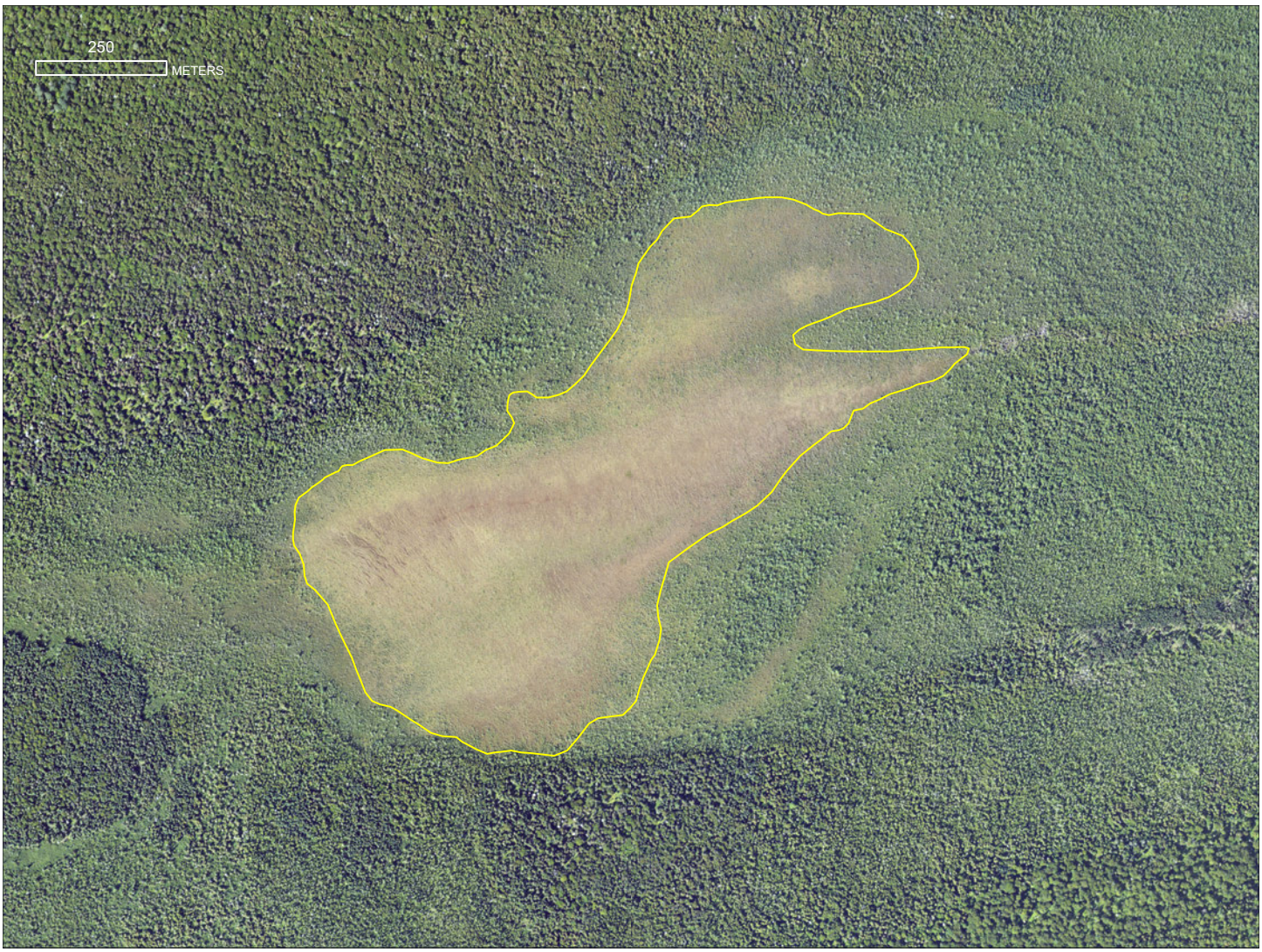


Map 6. Distribution of patterned fen in Michigan (Cohen et al. 2025).

10. Feldtmann Fen
Natural Community Type: Patterned Fen
Rank: GU S2, uncertain globally and imperiled within the state
Element Occurrence Rank: AB
Size: 152 acres (61 hectares)
Element Occurrence Identification Number: 27856

Site Description: The Feldtmann Fen occurs in a poorly drained basin 1.75 miles east of Feldtmann Lake. This relatively small, patterned fen is found within a larger minerotrophic peatland complex that includes both northern fen and rich conifer swamp. The patterned fen is an open minerotrophic wetland with subtle and limited string and flark or ribbed patterning concentrated in the northwestern and central portion of the fen. The patterning ranges from distinct to diffuse and is visible both on the ground and on the aerial imagery. Areas of patterning are flanked by shrubby northern fen. High-quality rich conifer swamp, hardwood-conifer swamp, and mesic northern forest occur to the south of the peatland at the base of Feldtmann Ridge, which supports a volcanic cliff escarpment.

The fen occurs on slightly acidic peats overlying sands. The peats are saturated to inundated, range from fibric to hemic to sapric peats, and are likely greater than 1 meter in depth. Peats within the flarks are inundated sapric peats that are slightly acidic (pH 6.5). Peats within the strings are saturated, acidic, fibric peats (pH 4.5) at the tops of the hummocks. Areas of northern fen/shrub fen on the margins of the patterned fen are characterized by saturated to inundated peats of variable depth. These peats range from fibric to hemic to sapric and are slightly acidic (pH 6.5-6.8) with more acidic conditions found along sphagnum hummocks (pH 6.0). Scattered sphagnum hummocks and hollows are prevalent within this shrub fen zone. A floating mat was noted locally within the northern fen zone.



Feldtmann Fen patterned fen delineated in yellow on 2022 imagery.

Within the area of patterning, the flarks and strings are narrow (flarks are 2-3 m wide and strings are 1-2 m wide) and the strings are shallow (<1 m tall). String and flark patterning, sphagnum hummocks, and numerous animal trails provided microscale gradients in soil moisture and chemistry and contribute to the peatland's overall floristic diversity. Water flow or sheet flow likely trends northeast to southwest over subtly sloping topography that creates the faint northwest-southeast string and flark patterning perpendicular to the sheet flow. The site is shaped by natural processes and is buffered by a large peatland complex.

Old-growth conifers occur throughout the fen and many exhibit stunted, bonsai-like growth form. Numerous trees were cored throughout the peatland: a particularly gnarled and stunted 1.5 m tall, 13.5 cm diameter northern white-cedar (*Thuja occidentalis*) was cored and estimated to be over 300 years old (285 growth rings counted); a stunted 14 cm northern white-cedar was cored and estimated to be over 122 years old (112 growth rings counted); a 9.5 cm black spruce (*Picea mariana*) was cored and estimated to be over 110 years old (101 growth rings); and a 9.4 cm bonsai-like tamarack (*Larix laricina*) was cored and estimated to be over 140 years old (130 growth rings).

Moose sign was evident throughout the fen and included trails and browsed vegetation. Moose browse of woody species is likely an important disturbance factor contributing to the open physiognomy of the fen. Animal tracks were noted throughout the peatland. Moose sign was also prevalent in the adjacent boreal forest and rich conifer swamp.

The strings are characterized by scattered and particularly stunted conifers and are sphagnum- and shrub-dominated. Conifers include northern white-cedar, tamarack, and black spruce. Canopy coverage ranges from 5 to 10%. Conifers range in diameter from 2 to 15 cm and 1 to 5 meters tall and occur in both the overstory and understory. Tag alder (*Alnus incana*) is also locally common in the understory layer, which ranges from 5 to 20%. Characteristic low shrubs (20-



The Feldtmann Fen patterned fen is characterized by a series of peat ridges (strings) and hollows (flarks) oriented parallel to the slope of the landform and perpendicular to the flow of groundwater. Photo by Joshua G. Cohen.

40%) found along the strings include sweet gale (*Myrica gale*), bog rosemary (*Andromeda glaucophylla*), sheep-laurel (*Kalmia angustifolia*), shrubby cinquefoil (*Dasiphora fruticosa*), leatherleaf (*Chamaedaphne calyculata*), creeping juniper (*Juniperus horizontalis*), and seedling northern white-cedar and black spruce.

The ground cover of the strings is characterized by tufted bulrush (*Trichophorum cespitosum*), bog goldenrod (*Solidago uliginosa*), false asphodel (*Triantha glutinosa*), marsh grass-of-Parnassus (*Parnassia palustris*, State Threatened), wiregrass sedge (*Carex lasiocarpa*), small cranberry (*Vaccinium oxycoccos*), star-flower (*Trientalis borealis*), royal fern (*Osmunda spectabilis*), pitcher-plant (*Sarracenia purpurea*), and white beak-rush (*Rhynchospora alba*) along with sphagnums (*Sphagnum* spp.) and feathermosses.

Flarks are dominated by graminoids with coverage ranging from 90 to 100%. Characteristic species include livid sedge (*Carex livida*), pitcher-plant, beak-rush (*Rhynchospora fusca*), buckbean (*Menyanthes trifoliata*), round-leaved sundew (*Drosera rotundifolia*), spatulate-leaved sundew (*D. intermedia*), horned bladderwort (*Utricularia cornuta*), and twig-rush (*Cladium mariscoides*). Species found on the flarks often grow on strings in lower densities.

Areas of shrubby northern fen which flank the patterned fen are characterized by a scattered coniferous canopy (5-10%) with northern white-cedar, black spruce, and tamarack. These conifers are also prevalent in the understory (5-20%) along with tag alder. Sphagnum hummocks and hollows are well developed within this zone. Conifers and shrubs are concentrated on the sphagnum hummocks. The low shrub zone is diverse and patchy to dense (20-40%) with prevalent species including leatherleaf, sweet gale, Labrador-tea (*Rhododendron groenlandicum*), bog rosemary, mountain fly honeysuckle (*Lonicera villosa*), sheep-laurel, shrubby cinquefoil, Canada blueberry (*Vaccinium myrtilloides*), alder-leaved buckthorn (*Rhamnus alnifolia*), creeping juniper, and seedling northern white-cedar and black spruce. Herbaceous coverage ranges from 90 to 100% cover. Prevalent ground cover species within the northern fen zone include yellow sedge (*Carex flava*), false asphodel, marsh grass-of-Parnassus, buckbean, marsh wild-Timothy (*Muhlenbergia glomerata*), wiregrass sedge, bog goldenrod, tufted bulrush, white beak-rush, narrow-leaved cotton-grass (*Eriophorum angustifolium*), alpine bulrush (*Trichophorum alpinum*), pitcher-plant, horned bladderwort, beak-rush (*Rhynchospora fusca*), twig-rush, royal fern, flat-topped white aster (*Doellingeria umbellata*), spatulate-leaved sundew, and skunk-cabbage (*Symplocarpus foetidus*).

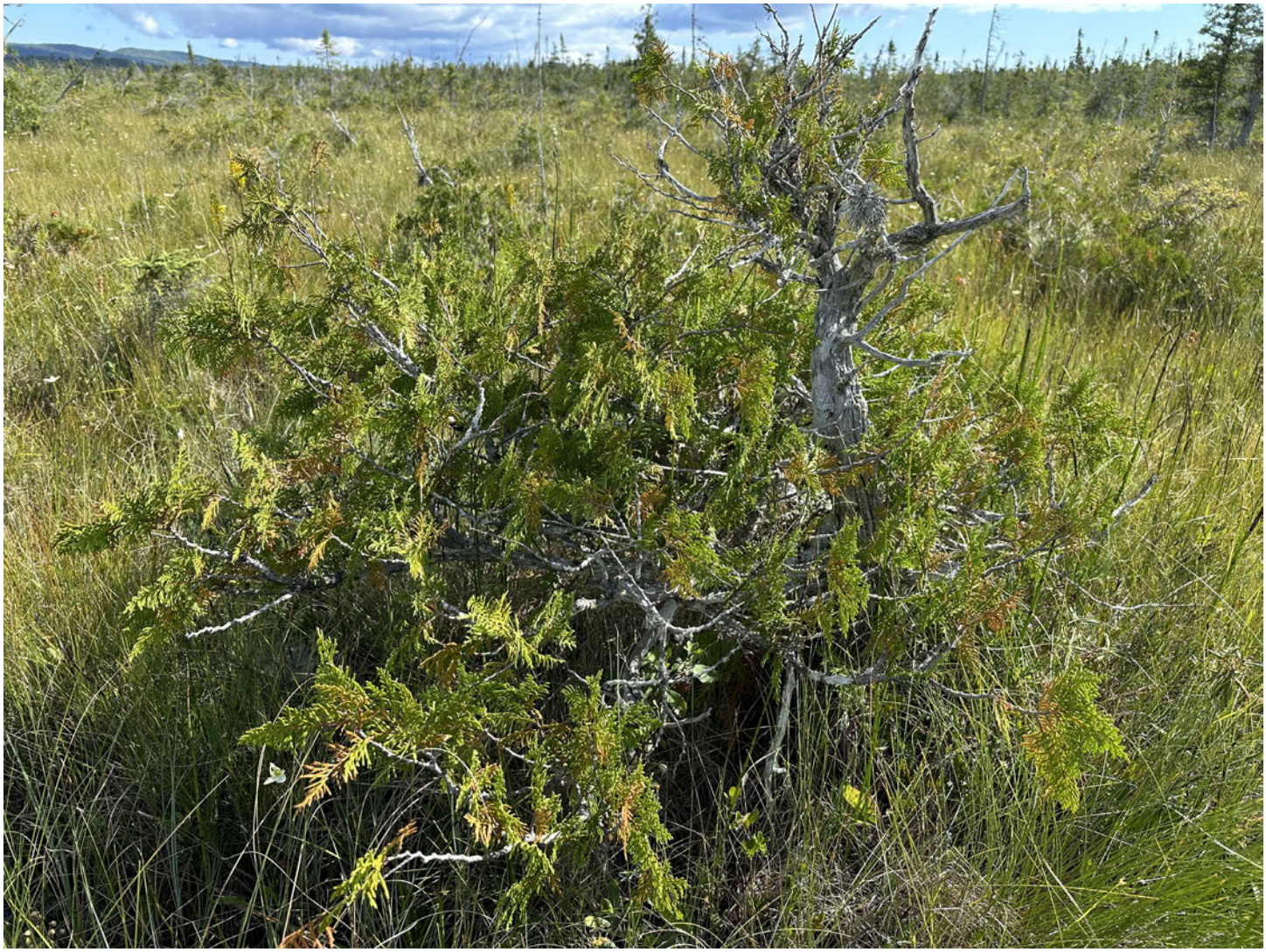
The Feldtmann Fen patterned fen was surveyed August 20, 2024. Sixty-four plant species were documented with no non-native species recorded. The total FQI was 59.2 and the total mean C value was 7.4.



Scattered and stunted conifers and shrubs are restricted to the sphagnum strings. Photo by Joshua G. Cohen.

Threats: Species composition and zonation are patterned by natural processes. No threats were observed during the course of the survey.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to retain an intact buffer of natural communities surrounding the patterned fen to minimize the threat of hydrological alteration.



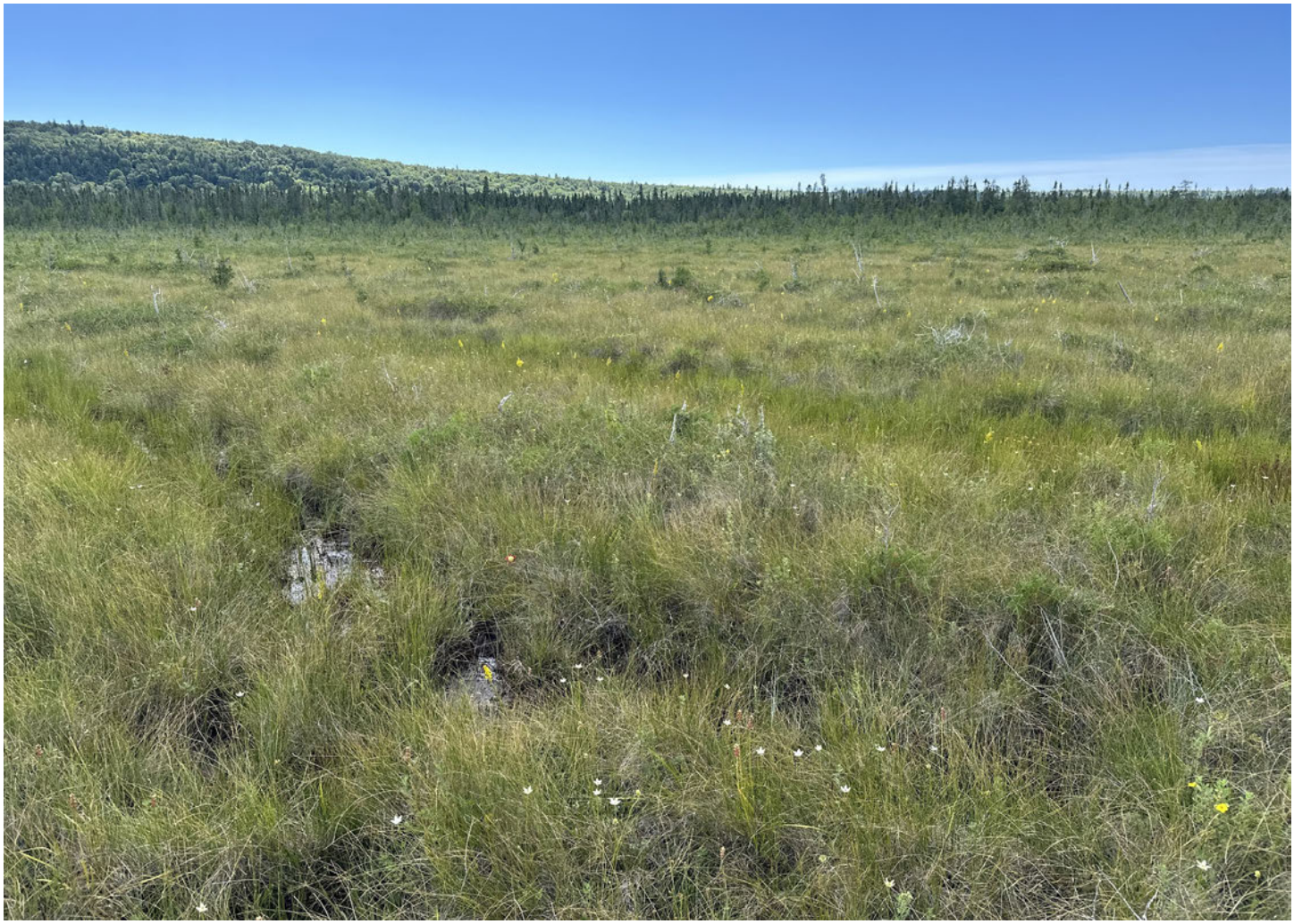
Old-growth conifers occur throughout the fen and many exhibit stunted, bonsai-like growth form. This gnarled and stunted 1.5 m tall, 13.5 cm diameter northern white-cedar (*Thuja occidentalis*) was cored and estimated to be over 300 years old (285 growth rings counted). Photo by Jesse M. Lincoln.



The Feldtmann Fen patterned fen occurs in an extensive poorly drained basin east of Feldtmann Lake and north of the Feldtmann Ridge. The wetland complex is locally refered to as the “Swamp of Sadness” because of the challenges of accessing the wetland. Photo by Joshua G. Cohen.

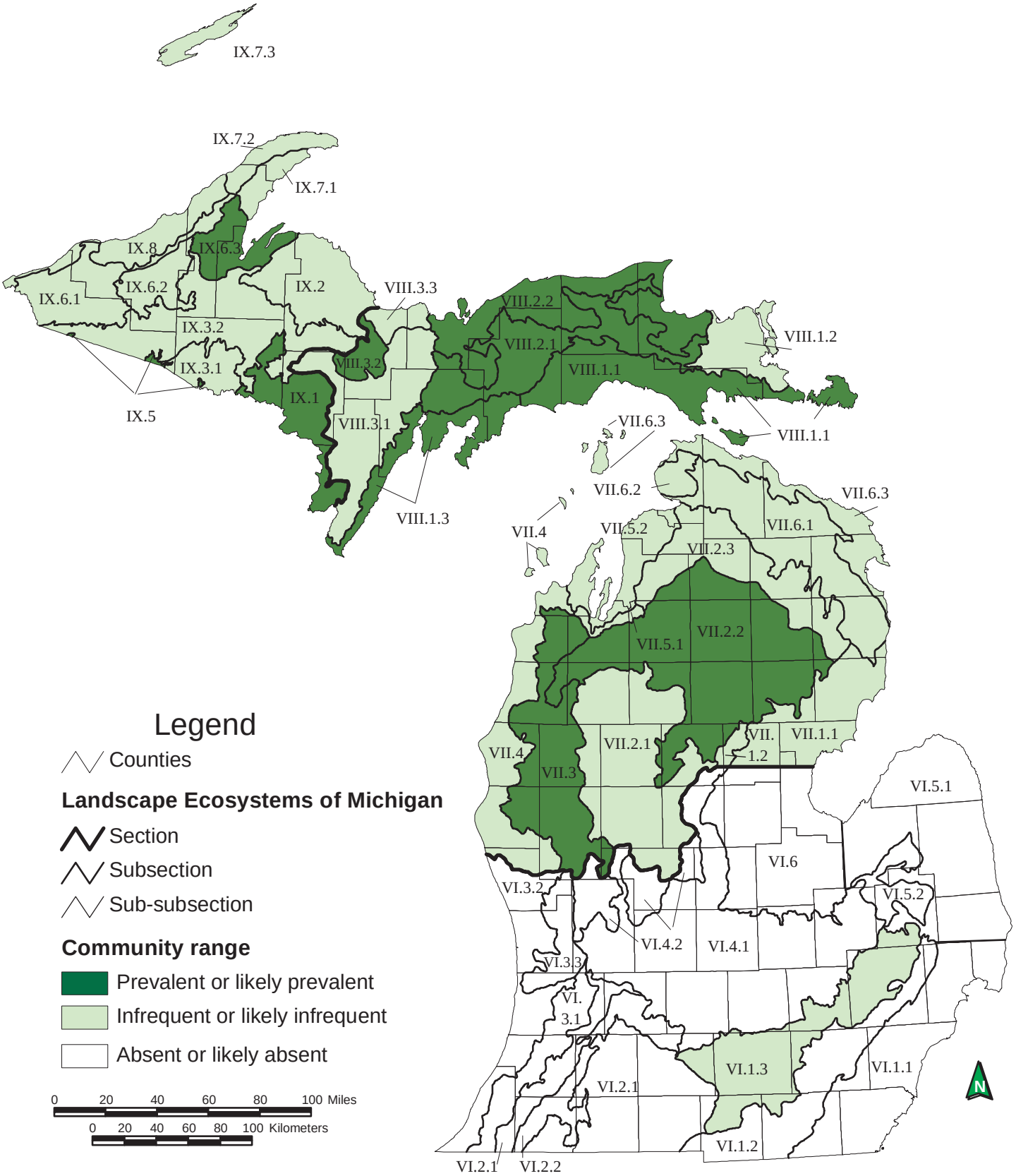


Marsh grass-of-Parnassus (*Parnassia palustris*, State Threatened) is locally abundant throughout the Feldtmann Fen. Photos by Joshua G. Cohen (above) and Jesse M.Lincoln (below).



POOR FEN

Overview: Poor fen is a sedge-dominated wetland found on very strongly to strongly acid, saturated peat that is moderately influenced by groundwater. The community occurs north of the climatic tension zone in kettle depressions and in flat areas or mild depressions on glacial outwash and glacial lakeplain (Cohen et al. 2015, Cohen et al. 2025).

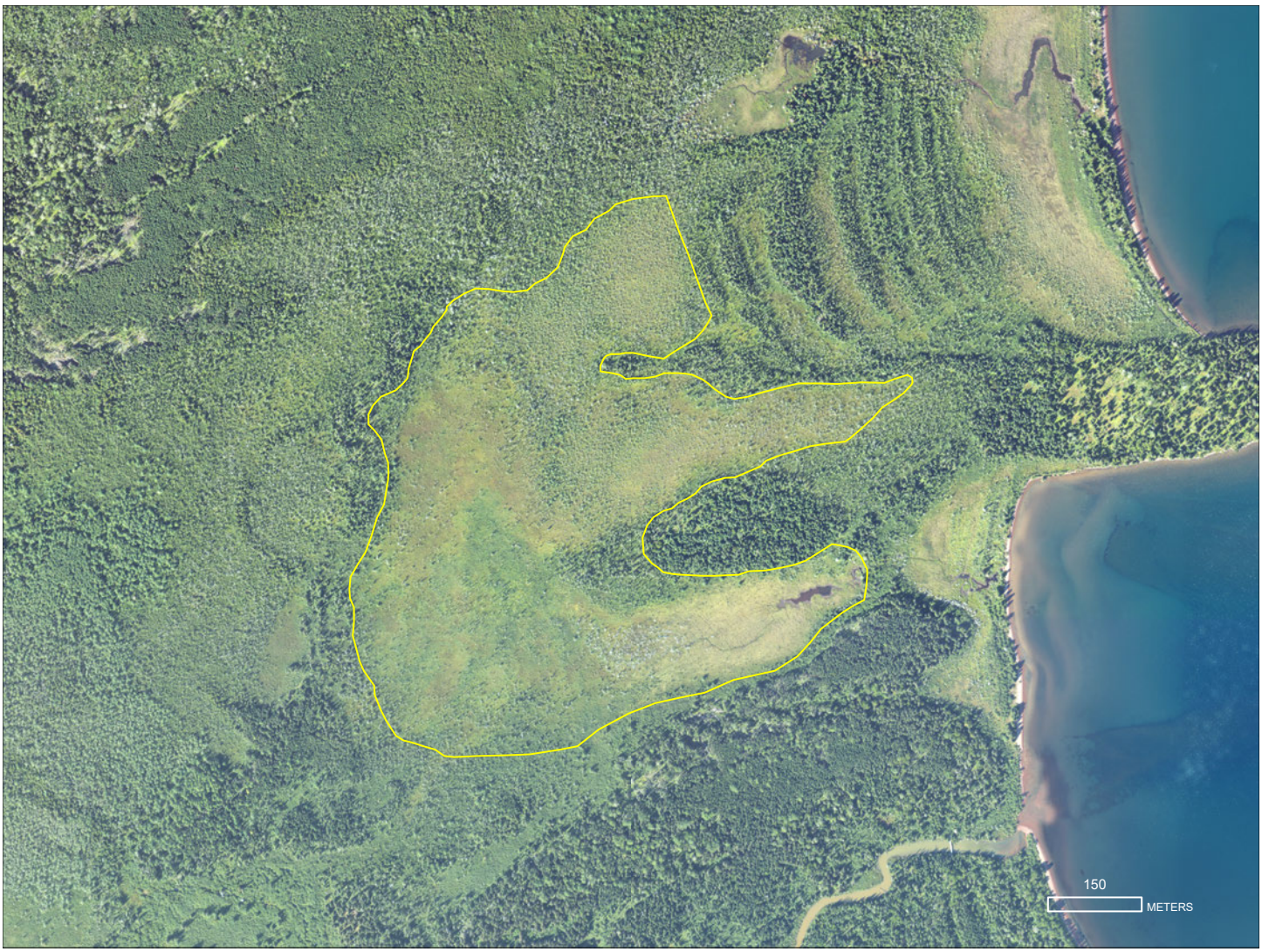


Map 7. Distribution of poor fen in Michigan (Albert et al. 2008).

11. Siskiwit Bay
Natural Community Type: Poor Fen
Rank: G3 S3, vulnerable globally and within the state
Element Occurrence Rank: B
Size: 110 acres (44 hectares)
Element Occurrence Identification Number: 27858

Site Description: The Siskiwit Bay Fen occurs on poorly drained lakeplain inland from Siskiwit Bay and the wooded dune and swale complex associated with the bay. The fen also occurs adjacent to boreal forest, poor conifer swamp, northern shrub thicket, and northern wet meadow. The poor fen is variable in composition with areas of younger fen being more graminoid-dominated and areas of older fen having greater coverage of shrubs and trees and more well-developed sphagnum hummocks. The density of shrub and tree cover is also influenced by depth of peats over the underlying sands. The poor fen is characterized by greater than a meter of saturated, acidic peats that range from fibric to hemic to sapric peats. The fibric peats on the top of the sphagnum hummock are more acidic (pH 4.5-5.0) than the underlying hemic and sapric peats (pH 6.5). Acidity decreases with increasing peat depth. Well-developed sphagnum hummocks and hollows contribute fine-scale structural diversity by providing small-scale gradients in soil moisture and soil chemistry and increase the overall species diversity. In portions of the fen, hummocks reach over a meter in height.

Numerous conifers were cored throughout the fen to gauge tree ages: a 14 cm black spruce (*Picea mariana*) was cored and estimated to be over 200 years old (193 growth rings counted); a 9.7 cm tamarack (*Larix laricina*) was cored and estimated to be over 56 years old (46 growth rings counted); and a 45.3 cm northern white-cedar (*Thuja occidentalis*) was cored and estimated to be over 120 years old. Moose browse was evident throughout the fen. Browsing of woody



Siskiwit Bay poor fen delineated in yellow on 2022 imagery.

species is likely an important disturbance factor contributing to the open physiognomy of the fen. Some areas of younger graminoid-dominated fen were characterized by standing dead northern white-cedar, suggesting that water level fluctuations from beaver impoundments have impacted portions of this peatland complex. Animal tracks were noted throughout the peatland.

The Siskiwit Bay poor fen is a diverse, graminoid-dominated fen with 80 to 90% herbaceous ground cover. Prevalent graminoids include wiregrass sedge (*Carex lasiocarpa*), yellow sedge (*C. flava*), tussock sedge (*C. stricta*), coastal sedge (*C. exilis*), three-way sedge (*Dulichium arundinaceum*), tufted bulrush (*Trichophorum cespitosum*), alpine bulrush (*T. alpinum*), cotton-grass (*Eriophorum vaginatum*), twig-rush (*Cladium mariscoides*), marsh wild-Timothy (*Muhlenbergia glomerata*), and blue-joint (*Calamagrostis canadensis*). Characteristic ground cover species include pitcher-plant (*Sarracenia purpurea*), buckbean (*Menyanthes trifoliata*), false mayflower (*Maianthemum trifolium*), flat-topped white aster (*Doellingeria umbellata*), bog goldenrod (*Solidago uliginosa*), small cranberry (*Vaccinium oxycoccos*), star-flower (*Trientalis borealis*), wild blue flag (*Iris versicolor*), variegated scouring rush (*Equisetum variegatum*), marsh horsetail (*E. palustre*), marsh bellflower (*Campanula aparinoides*), marsh cinquefoil (*Comarum palustre*), Joe-pye-weed (*Eutrochium maculatum*), star-flower (*Trientalis borealis*), naked miterwort (*Mitella nuda*), round-leaved sundew (*Drosera rotundifolia*), creeping-snowberry (*Gaultheria hispidula*), skunk cabbage (*Symplocarpus foetidus*), twinflower (*Linnaea borealis*), bunchberry (*Cornus canadensis*), and dwarf raspberry (*Rubus pubescens*).

Conifers and shrubs are concentrated on the sphagnum hummocks. The poor fen is characterized by a scattered and stunted canopy of conifers (2-5%) with northern white-cedar, tamarack, and black spruce. The tall shrub layer is sparse (5-10%) and is dominated by saplings of northern white-cedar, tamarack, and black spruce as well as tag alder (*Alnus incana*). The low shrub layer is diverse and patchy (10-25%) with leatherleaf (*Chamaedaphne calyculata*), sweet gale (*Myrica gale*), alder-leaved buckthorn (*Rhamnus alnifolia*), shrubby cinquefoil (*Dasiphora fruticosa*), bog rosemary (*Andromeda glaucophylla*), Labrador-tea (*Rhododendron groenlandicum*), mountain fly honeysuckle (*Lonicera villosa*), tag alder, red-osier dogwood (*Cornus sericea*), swamp rose (*Rosa palustris*), bog willow (*Salix pedicellaris*), and seedling northern white-cedar, tamarack, and black spruce. Closer to the margins of the poor fen and in areas of older fen, canopy cover increases to 5 to 15%, understory cover to 10 to 25%, and low shrub cover to 40 to 60%.



Siskiwit Bay poor fen. Photo by Joshua G. Cohen.

While conducting surveys of the poor fen, MNFI ecologists documented the first record of lingonberry (*Vaccinium vitis-idaea,* State Endangered) on mainland Isle Royale. The lingonberry occurs along the margin of the east-central portion of the fen and extends into the adjacent poor conifer margin and paludified boreal forest. This constitutes the third official record of this species in the state (first in 1868 on Smithwick Island and second in 1994 on Passage Island).

The Siskiwit Fen poor fen was surveyed on August 19, 2024. Seventy-five plant species were documented with no non-native species recorded. The total FQI was 56.3 and the total mean C value was 6.5.

Threats: Species composition and zonation are patterned by natural processes. No threats were observed during the course of the survey.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to retain an intact buffer of natural communities surrounding the poor fen to minimize the threat of hydrological alteration. Additional surveys to refine the mapped boundaries of the lingonberry population are merited.



Lingonberry (*Vaccinium vitis-idaea,* state endangered) was documented within the Siskiwit Bay poor fen and in adjacent poor conifer swamp and paludified boreal forest. The highest concentrations of lingonberries were found in an opening in the boreal forest to the south of the fen. The lingonberry documentation is the first record of this species on mainland Isle Royale. Photo by Joshua G. Cohen.

12. Sumner Lake and Newt Lake
Natural Community Type: Poor Fen
Rank: G3 S3, vulnerable globally and within the state
Element Occurrence Rank: B
Size: 44 acres (17 hectares)
Element Occurrence Identification Number: 27860

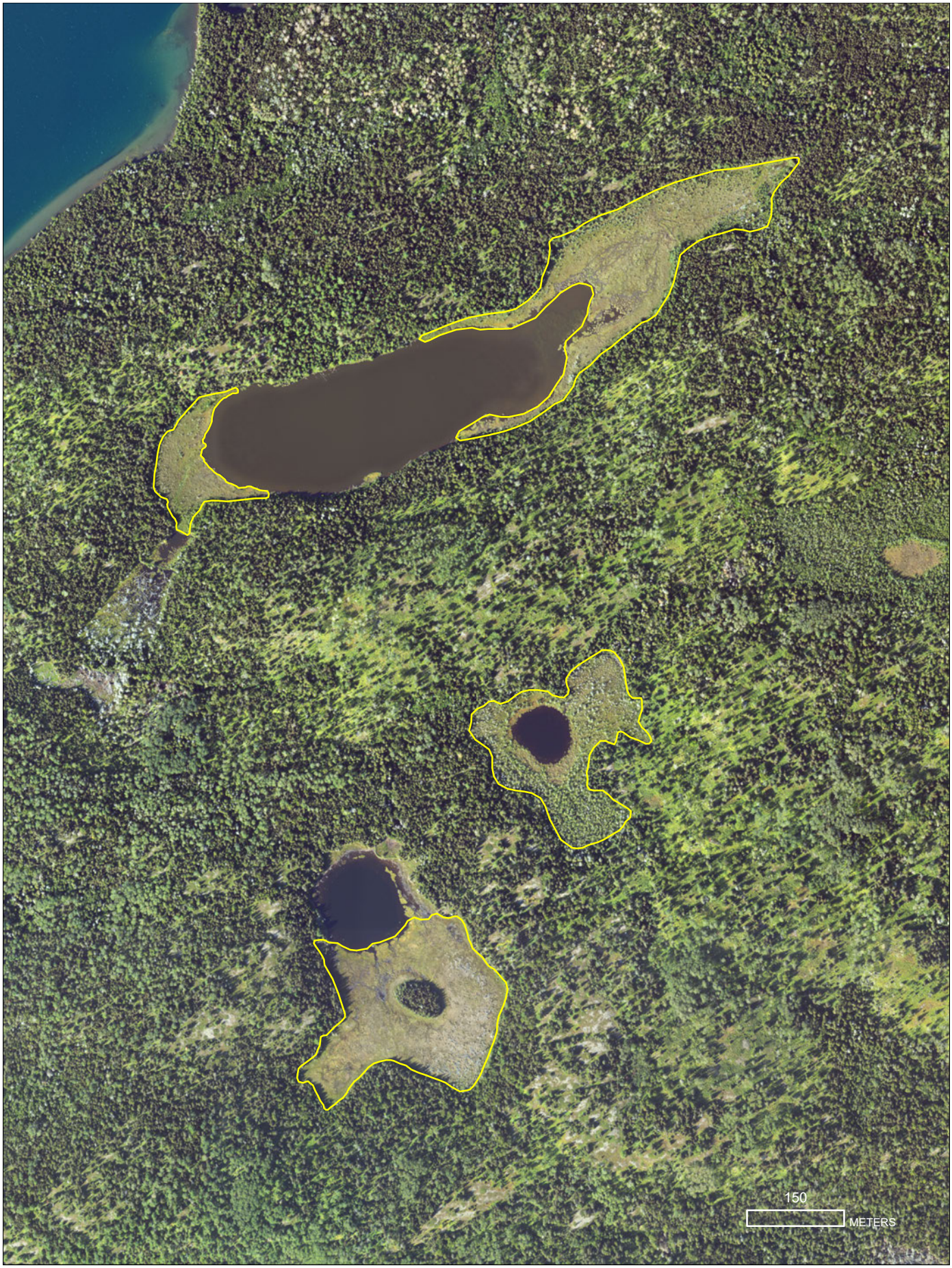
Site Description: Several small fens occur along the margins of Sumner and Newt Lake and surrounding an unnamed lake between Sumner and Newt Lakes. A total of four fen polygons were mapped within this site. The fens are of variable age and have been highly influenced by beaver flooding. The fen associated with Newt Lake was formerly a rich conifer swamp that was converted to open fen by beaver flooding. This fen occurs along the southern margin of Newt Lake in the wetland basin. Scattered northern white-cedar (*Thuja occidentalis*) snags occur throughout the wetland basin. Fen also occurs along the eastern and western margins of Sumner Lake. The fen surrounding the unnamed lake is the oldest peatland with denser conifer and shrub cover compared to the graminoid-dominated fens associated with the Sumner Lake and Newt Lake fens. These fens have formed through lake filling (terrestrialization).

The poor fen is characterized by greater than a meter of saturated, acidic peats that range from fibric to hemic to sapric peats. The fibric peats on the top of the sphagnum hummocks are more acidic (pH 4.5) than the underlying hemic and sapric peats (pH 6.0-6.8). Acidity decreases with increasing peat depth. Fine-scale gradients in soil composition and soil moisture associated within the well-developed sphagnum hummocks and hollows generate small-scale microhabitat within the fen and increase the overall species diversity. The Newt Lake fen is characterized by deep hemic to sapric peats that are slightly acidic (pH 6.5-6.8). The fen associated with the unnamed lake is characterized by acidic fibric peats on the hummocks (pH 5.0-5.5) and slightly acidic hemic to sapric peats in the hollows (pH 6.0).

The Sumner Lake poor fen is a diverse, graminoid-dominated fen with 70 to 90 % herbaceous ground cover. Prevalent graminoids include wiregrass sedge (*Carex lasiocarpa*), white beak-rush (*Rhynchospora alba*), livid sedge (*C. livida*), alpine bulrush (*Trichophorum alpinum*), three-way sedge (*Dulichium arundinaceum*), and blue-joint (*Calamagrostis canadensis*). Characteristic ground cover species include pitcher-plant (*Sarracenia purpurea*), marsh grass-of-Parnassus (*Parnassia palustris*, State Threatened), round-leaved sundew (*Drosera rotundifolia*), small cranberry (*Vaccinium oxycoccos*), bog goldenrod (*Solidago uliginosa*), Joe-pye-weed (*Eutrochium maculatum*), marsh bellflower (*Campanula aparinoides*), marsh St. John's-wort (*Triadenum fraseri*), buckbean (*Menyanthes trifoliata*), grass-pink (*Calopogon tuberosus*), hooded ladies'-tresses (*Spiranthes romanzoffiana*), wild blue flag (*Iris versicolor*), and royal fern (*Osmunda spectabilis*).



Poor fen along the western margin of Sumner Lake with volcanic cliff in the background. Photo by Joshua G. Cohen.



Sumner Lake and Newt Lake poor fen delineated in yellow on 2022 imagery.

The conifers and shrubs are concentrated on the low sphagnum hummocks. The poor fen is characterized by a scattered and stunted canopy of conifers (2-5%) with northern white-cedar (*Thuja occidentalis*), tamarack (*Larix laricina*), black spruce (*Picea mariana*), and white pine (*Pinus strobus*). The tall shrub layer (5-10%) is dominated by saplings of tamarack and northern white-cedar as well as tag alder (*Alnus incana*). The low shrub layer is patchy (10-30%) with leatherleaf (*Chamaedaphne calyculata*), bog rosemary (*Andromeda glaucophylla*), bog willow (*Salix pedicellaris*), sweet gale (*Myrica gale*), and seedling black spruce and northern white-cedar.

The Newt Lake poor fen is graminoid-dominated with wiregrass sedge, yellow sedge (*Carex flava*), white beak-rush, blue-joint, three-way sedge, and green-keeled cotton-grass (*Eriophorum viridicarinatum*). Common forbs and ferns include buckbean, Kalm's lobelia (*Lobelia kalmia*), marsh grass-of-Parnassus, pitcher-plant, flat-leaved bladderwort (*Utricularia intermedia*), marsh fern (*Thelypteris palustris*), and royal fern. In comparison, this fen is younger than the Sumner Lake fen and has fewer shrubs and trees. Scattered low shrubs include leatherleaf, sweet gale, and small cranberry. A floating fen mat occurs locally.

The poor fen surrounding the unnamed lake is characterized by denser tree and shrub cover. The overstory layer is 5 to 15% with northern white-cedar, tamarack, and black spruce. The tall shrub layer (10-25%) is dominated by saplings of tamarack and northern white-cedar as well as tag alder. The low shrub layer is dense (40-60%) with leatherleaf, bog rosemary, Labrador-tea, bog willow, Labrador-tea (*Rhododendron groenlandicum*), bog-laurel (*Kalmia polifolia*), and seedling northern white-cedar. Characteristic ground cover species include wiregrass sedge, white beak-rush, pitcher-plant, livid sedge, beak-rush (*Rhynchospora fusca*), small cranberry, round-leaved sundew, grass-pink, blue-joint, variegated scouring rush (*Equisetum variegatum*), arrow-grass (*Scheuchzeria palustris*), wild blue flag, and skunk cabbage (*Symplocarpus foetidus*).

The Sumner and Newt Lake poor fen was surveyed August 11, 2024. Sixty-one plant species were documented with no non-native species recorded. The total FQI was 50.0 and the total mean C value was 6.4.

Threats: Species composition and zonation are patterned by natural processes. No threats were observed during the course of the survey.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to retain an intact buffer of natural communities surrounding the poor fens to minimize the threat of hydrological alteration.



The view of the poor fen along the margin of Sumner Lake from atop the Sumner Lake volcanic cliff. Photo by Joshua G. Cohen.

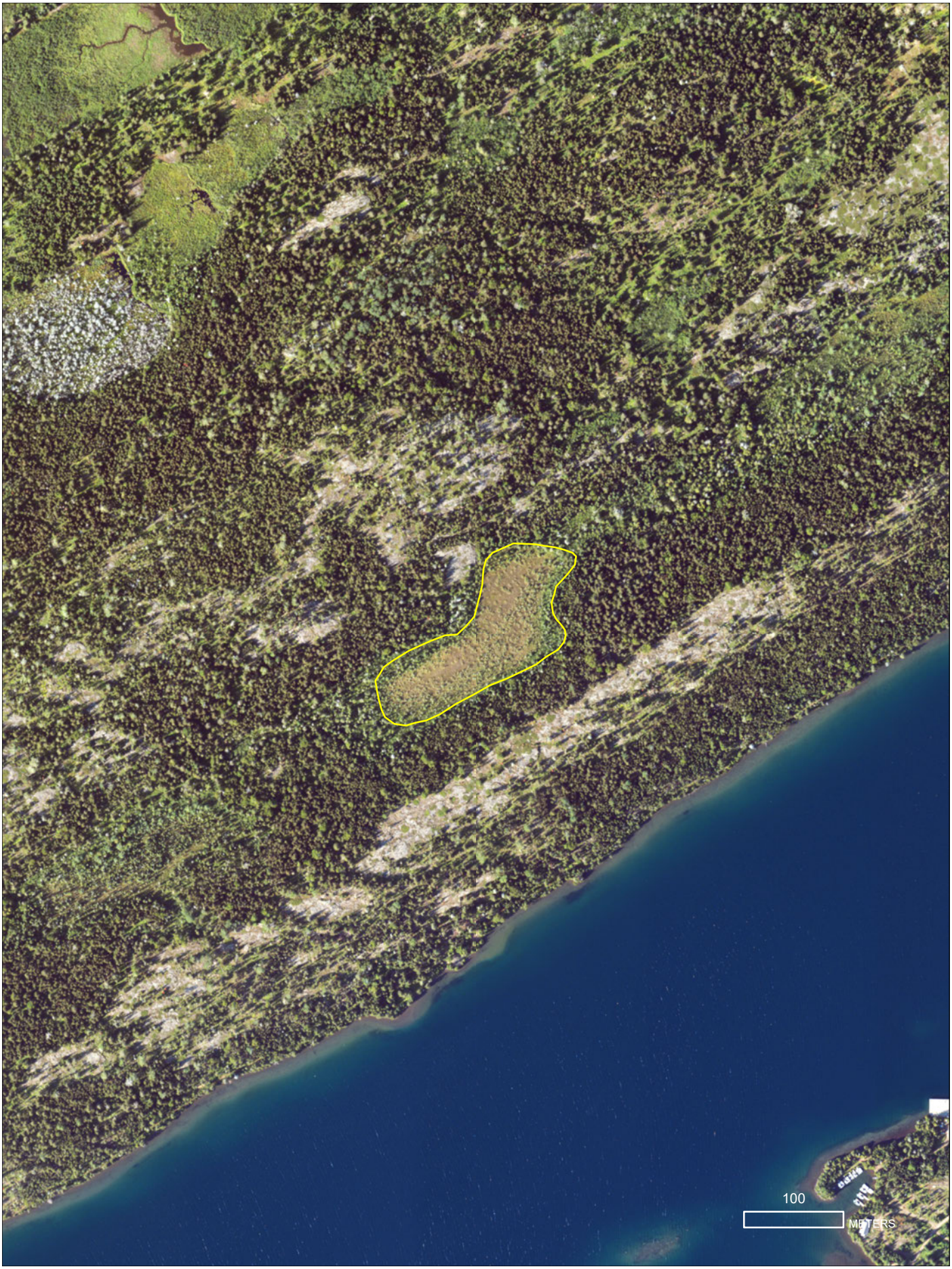
13. Tobin Creek
Natural Community Type: Poor Fen
Rank: G3 S3, vulnerable globally and within the state
Element Occurrence Rank: B
Size: 4.2 acres (1.7 hectares)
Element Occurrence Identification Number: 27861

Site Description: The Tobin Creek poor fen occurs in a depression between volcanic bedrock ridges with high-quality boreal forest to the south and volcanic bedrock glade to the north. The fen occurs north of Rock Harbor and south of the Tobin Creek drainage. The poor fen is characterized by greater than a meter of saturated, acidic peats that range from fibric to hemic to sapric peats. The fibric peats on the top of the sphagnum hummock are more acidic (pH 4.5-5.0) than the underlying hemic and sapric peats (pH 6.0-6.8). Acidity decreases with increasing peat depth. Fine-scale gradient in soil composition and soil moisture associated within the well-developed sphagnum hummocks and hollows generate small-scale microhabitats within the fen and increases the overall species diversity. A floating fen mat occurs locally within the fen and indicates that this fen formed through lake filling (terrestrialization). Conifers were cored to gauge tree ages: a 4.8 cm tamarack (*Larix laricina*) was cored and estimated to be over 60 years old (49 growth rings counted) and a 13.5 cm northern white-cedar (*Thuja occidentalis*) was cored and estimated to be over 145 years old (135 growth rings counted). Moose sign was evident throughout the fen and included evidence of browsing and bedding.

The Tobin Creek poor fen is a small but diverse graminoid-dominated fen with 80 to 95 % herbaceous ground cover. Prevalent graminoids include wiregrass sedge (*Carex lasiocarpa*), tufted bulrush (*Trichophorum cespitosum*), narrow-leaved cotton-grass (*Eriophorum angustifolium*), white beak-rush (*Rhynchospora alba*), beak-rush (*R. fusca*), alpine bulrush (*Trichophorum alpinum*), livid sedge (*Carex livida*), twig-rush (*Cladium mariscoides*), blue-joint (*Calamagrostis canadensis*), and sedge (*Carex michauxiana*).



The Tobin Creek poor fen occurs north of Rock Harbor and south of the Tobin Creek drainage.. Photo by Joshua G. Cohen.



Tobin Creek poor fen delineated in yellow on 2022 imagery.

Characteristic ground cover species include pitcher-plant (*Sarracenia purpurea*), buckbean (*Menyanthes trifoliata*), marsh fern (*Thelypteris palustris*), flat-topped white aster (*Doellingeria umbellata*), arrow-grass (*Scheuchzeria palustris*), bog goldenrod (*Solidago uliginosa*), round-leaved sundew (*Drosera rotundifolia*), small cranberry (*Vaccinium oxycoccos*), horned bladderwort (*Utricularia cornuta*), bunchberry (*Cornus canadensis*), and skunk-cabbage (*Symplocarpus foetidus*). The conifers and shrubs are concentrated on the low sphagnum hummocks. The poor fen is characterized by a scattered and stunted canopy of conifers (5-15%) with northern white-cedar, tamarack, and black spruce (*Picea mariana*). The tall shrub layer (10-25%) is dominated by saplings of northern white-cedar, tamarack, and black spruce, as well as tag alder (*Alnus incana*). The low shrub layer is patchy (10-40%) with leatherleaf (*Chamaedaphne calyculata*), bog rosemary (*Andromeda glaucophylla*), Labrador-tea (*Rhododendron groenlandicum*), bog willow (*Salix pedicellaris*), red-osier dogwood (*Cornus sericea*), alder-leaved buckthorn (*Rhamnus alnifolia*), and seedling northern white-cedar, black spruce, and tamarack.

The Tobin Creek poor fen was surveyed August 10, 2024. Fifty-one plant species were documented with no non-native species recorded. The total FQI was 49.3 and the total mean C value was 6.9.

Threats: Species composition and zonation are patterned by natural processes. No threats were observed during the course of the survey.

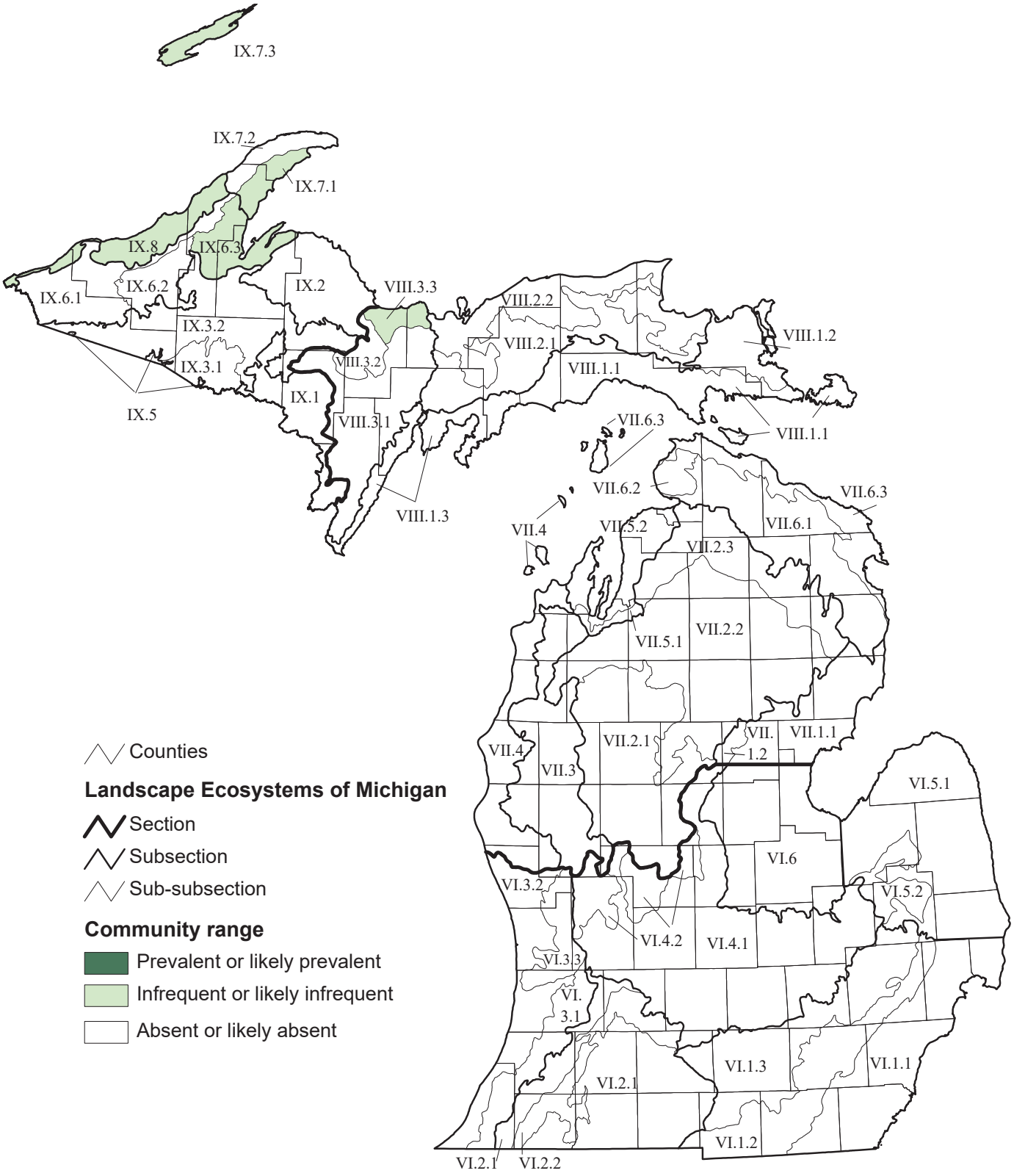
Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to retain an intact buffer of natural communities surrounding the poor fen to minimize the threat of hydrological alteration.



Matted-down vegetation is indicative of moose bedding in the Tobin Creek poor fen. Photo by Joshua G. Cohen.

SANDSTONE BEDROCK GLADE

Overview: Sandstone bedrock glade is a savanna or open woodland community domi¬nated by herbs, graminoids, scattered shrubs, and stunted trees that typically occurs on flat to sloping expanses of sandstone bedrock near the Lake Superior shoreline in the western Upper Peninsula. The sandstone bedrock is covered by a thin, acidic layer of organics and sands. Areas of exposed bedrock 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 (Cohen et al. 2025).



Map 8. Distribution of sandstone bedrock glade in Michigan (Cohen et al. 2025).

14. Houghton Point
Natural Community Type: Sandstone Bedrock Glade
Rank: GU S1, uncertain globally and critically imperiled within the state
Element Occurrence Rank: A
Size: 18 acres (7 hectares)
Element Occurrence Identification Number: 28351

Site Description: Three distinct polygons of sandstone bedrock glade occur along the gently to moderately sloping ridge above Houghton Point. The complex extends for just over half a mile and slopes down to sandstone bedrock lakeshore along the southern side of Houghton Point. The northern shore of Houghton Point is dominated by low-stature sandstone lakeshore cliff. The sandstone ecosystems are embedded within a forested matrix of boreal forest. Moose signs including trails, scat, and bedding were occasionally noted throughout the glade and adjacent boreal forest but were at much lower levels than the glade at the top of Houghton Ridge. Moose herbivory was prevalent on balsam fir. Herbivory, windthrow, and shallow soils over bedrock contribute to the open physiognomy of the sandstone bedrock glade. Soils are shallow (typically 2-4 cm) organics and sands overlying sandstone bedrock and range from acidic to circumneutral (pH 6.5-7.0) with soil chemistry depending on the content of the decomposing organic matter. Soil development is restricted to cracks, fissures, and low depressions with significant portions of the glade being characterized by exposed sandstone bedrock. Scattered ant mounds were noted throughout the glade. Canopy conifers were cored throughout the glade to gauge tree age: a 20.2 cm white spruce (*Picea glauca*) was cored and 37 growth rings were counted; a 47.5 cm white pine (*Pinus strobus*) was cored and 120 growth rings were counted; and a 24.4 cm jack pine (*Pinus banksiana*) was cored and 140 growth rings were counted.



Houghton Point sandstone bedrock glade delineated in yellow on 2022 imagery.

The glade is characterized by a scattered and stunted overstory (5-15%) with canopy composition including white spruce, quaking aspen (*Populus tremuloides*), jack pine, white pine, and occasional northern white-cedar (*Thuja occidentalis*). Canopy trees typically range in diameter from 10 to 30 cm. The understory is also sparse (5-15%) with characteristic species including white spruce, quaking aspen, paper birch (*Betula papyrifera*), red-osier dogwood (*Cornus sericea*), mountain alder (*Alnus viridis*), serviceberries (*Amelanchier bartramiana* and *A. sanguinea*), prairie willow (*Salix humilis*), and squashberry (*Viburnum edule*, State Threatened). The low shrub layer is diverse and patchy to dense (40-60%) with common shrubs including common juniper (*Juniperus communis*), bearberry (*Arctostaphylos uva-ursi*), bush-honeysuckle (*Diervilla lonicera*), wild rose (*Rosa acicularis*), pin cherry (*Prunus pensylvanica*), hairy honeysuckle (*Lonicera hirsuta*), thimbleberry (*Rubus parviflorus*), squashberry, wild red raspberry (*Rubus strigosus*), ninebark (*Physocarpus opulifolius*), snowberry (*Symphoricarpos albus var. albus*), Canada blueberry (*Vaccinium myrtilloides*), and creeping juniper (*Juniperus horizontalis*). Seedling quaking aspen and balsam fir (*Abies balsamea*) are also common in the low shrub layer.

The ground cover ranges from patchy to locally dense (50-70%). Herbaceous species are concentrated where soils have accumulated along cracks, crevices, and depressions in the sandstone bedrock. A diverse array of lichens and mosses cover the exposed bedrock. Characteristic non-vascular species observed within the glade include reindeer lichens (*Cladonia mitis* and *C. rangiferina*) and feather moss (*Pleurozium schreberi*). Prevalent ground cover species include poverty grass (*Danthonia spicata*), ticklegrass (*Agrostis scabra*), hair grass (*Avenella flexuosa*), wild strawberry (*Fragaria virginiana*), big-leaved aster (*Eurybia macrophylla*), harebell (*Campanula rotundifolia*), goldenrods (*Solidago hispida*, S. *juncea*, and *S. simplex*), northern heart-leaved aster (*Symphyotrichum ciliolatum*), fireweed (*Chamaenerion angustifolium*), yarrow (*Achillea millefolium*), cow-wheat (*Melampyrum lineare*), Kalm's hawkweed (*Hieracium kalmia*), Canada mayflower (*Maianthemum canadense*), pearly everlasting (*Anaphalis margaritacea*), small pussytoes (*Antennaria howellii*), common polypody (*Polypodium virginianum*), rusty woodsia (*Woodsia ilvensis*), prairie cinquefoil (*Drymocallis arguta*), wild columbine (*Aquilegia canadensis*), early saxifrage (*Micranthes virginiensis*), and geocaulon (*Geocaulon lividum*). Depressions and wet seams within the glade support blue-joint (*Calamagrostis canadensis*) and red-osier dogwood among other wetland species.



The Houghton Point sandstone bedrock glade is characterized by a scattered and stunted overstory with canopy composition including white spruce (*Picea glauca*), quaking aspen (*Populus tremuloides*), jack pine (*Pinus banksiana*), white pine (*P. strobus*), and occasional northern white-cedar (*Thuja occidentalis*). Photo by Joshua G. Cohen.

Rare species documented within the sandstone bedrock glade include squashberry, downy oatgrass (*Trisetum spicatum*, State Special Concern), bluegrass (*Poa interior*, State Special Concern), and northern paintbrush (*Castilleja septentrionalis*, State Threatened).

The Houghton Point sandstone bedrock glade was surveyed August 13, 2025. Seventy-three plant species were documented with 69 native species and 4 non-native species. The total FQI was 44.4 and the total mean C value was 5.2.

Threats: Species composition and structure are natural processes. Scattered non-native species occur locally and include orange hawkweed (*Hieracium aurantiacum*), yellow hawkweed (*Hieracium caespitosum*), Canada bluegrass (*Poa compressa*), and Kentucky bluegrass (*P. pratensis*).

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and to maintain a natural buffer surrounding the glades to prevent the increase of a weedy seed source. The glades should be periodically monitored for invasive species infestations.



Michigan's highest quality sandstone bedrock glade occurs on Isle Royale along Houghton Point. Data collected from these surveys have been incorporated into MNFI's natural community classification of sandstone bedrock glade and have contributed to the updating of natural community type overview, list of characteristic species, and distribution map. Photo by Joshua G. Cohen.



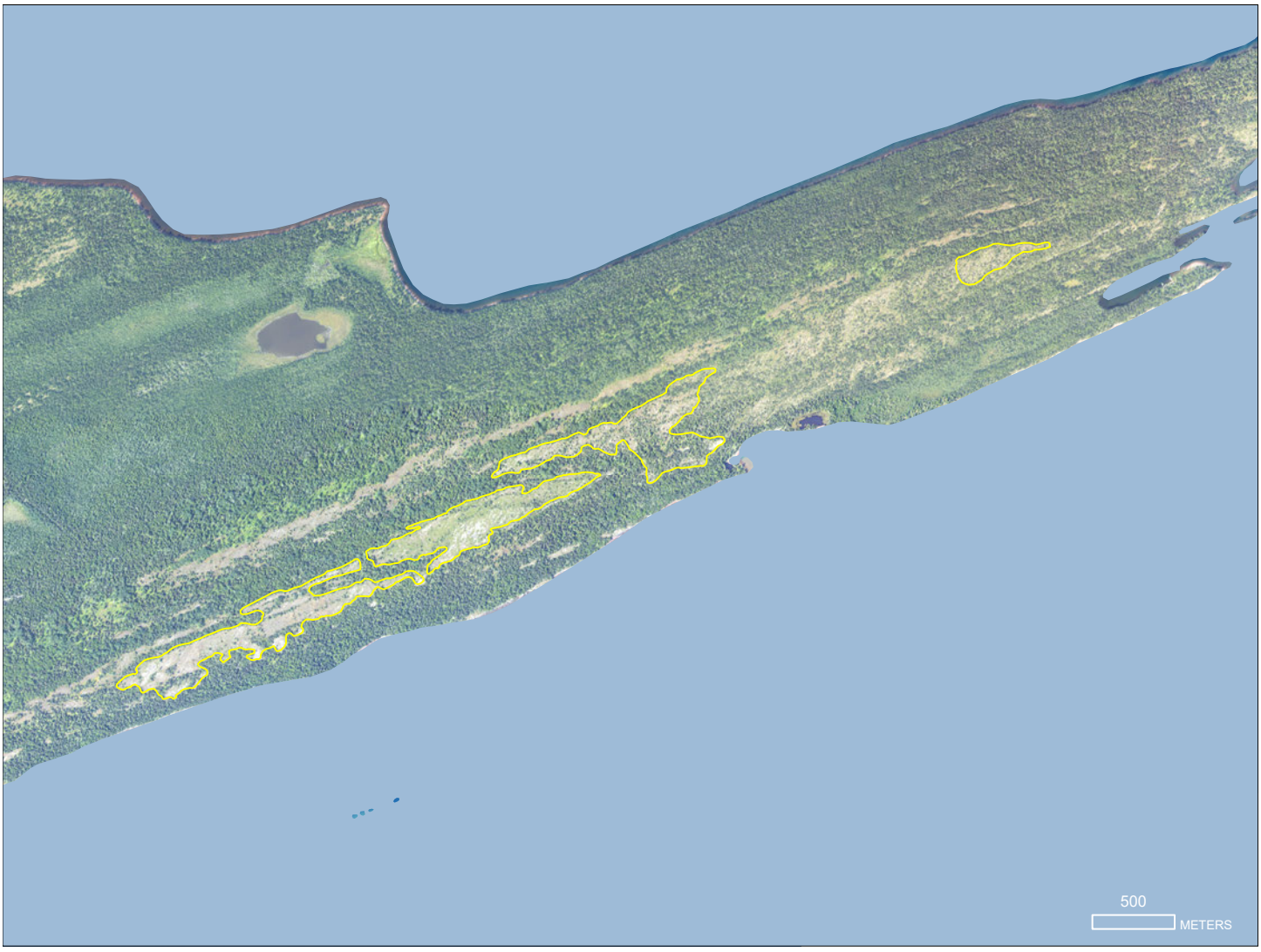
Sandstones comprising the upper part of the Copper Harbor Conglomerate formation are exposed along Houghton Point. Along the point, sandstone bedrock lakeshore transitions to sandstone bedrock glade (above). The dramatic red coloration of the sandstones is due to the iron content of the basalts from which they are derived. These Copper Harbor sandstones are estimated to be over a billion years old. Photos by Jesse M. Lincoln.



15. Houghton Ridge
Natural Community Type: Sandstone Bedrock Glade
Rank: GU S1, uncertain globally and critically imperiled within the state
Element Occurrence Rank: B
Size: 106 acres (43 hectares)
Element Occurrence Identification Number: 28355

Site Description: Four distinct polygons of sandstone bedrock glade occur along or below Houghton Ridge. The glades are gently to moderately sloping and range from 30 to 100 meters above Lake Superior. Pockets of conglomerate bedrock are found locally along the Houghton Ridge and are mapped within this complex. Sandstone cliff occurs locally along the southern margin of the glades. To the south, the shoreline supports high-quality sandstone bedrock lakeshore. The northern shore of Houghton Point is dominated by low-stature sandstone lakeshore cliff. The sandstone ecosystems are embedded within a forested matrix of boreal forest. This is the largest example of sandstone bedrock glade documented in Michigan. The glade contains areas with exposed slabs of bedrock that stair-step up to the next layer, often with 1 to 2 m of short, north facing cliff. South-facing slabs of rock are extremely drought-prone with thin soils with organics collecting in cracks or amongst cobble that has weathered from the bedrock. Zones with some shade at the margins or in the shade of short cliffs are often more diverse. The glade transitions to sandstone cliff along its southern edge.

Moose signs including trails, scat, and bedding were noted throughout the glades and adjacent boreal forest. Moose herbivory within the glade likely contributes to the open vegetative structure. Moose trails are especially prevalent along the glade fingers that run along the ridgeline and non-native plants are locally abundant along these travel corridors. It is likely that moose are contributing to the spread of non-native plant species.



Houghton Ridge sandstone bedrock glade delineated in yellow on 2022 imagery.

Shallow soils over bedrock, herbivory, and windthrow contribute to the open physiognomy of the sandstone bedrock glade. The soils of the sandstone bedrock glade are shallow (typically 2-4 cm) organics and sands overlying sandstone bedrock and range from acidic to alkaline (pH 5.5-6.0 in one sample and pH 7.5-7.8 in another sample). Soil chemistry depends on the content of the decomposing organic matter. Soil development is restricted to cracks, fissures, and low depressions with significant portions of the glade being characterized by exposed sandstone bedrock. Soils sampled from areas of conglomerate bedrock inclusions were acidic (pH 5.0-5.5). Conifers within the glade were cored to estimate tree age: a 48.5 cm white pine (*Pinus strobus*) was cored and 139 growth rings were counted and a 35 cm jack pine (*P. banksiana*) was cored and estimated to be over 200 years old (134 growth rings were counted on an 11.0 cm of core).

The glade is characterized by a scattered and typically stunted overstory (5-10%) with canopy composition including white pine, jack pine, white spruce (*Picea glauca*), quaking aspen (*Populus tremuloides*), and northern white-cedar (*Thuja occidentalis*). Canopy trees typically range in diameter from 10 to 30 cm with larger white pine reaching over 50 cm. Areas along the eastern end of the complex support greater canopy coverage with jack pine increasing in importance. Portions of the glade are characterized by widely spaced white pine. Other zones feature small inclusions of boreal forest with white spruce and quaking aspen.

The understory is sparse (5-10%) with characteristic species including quaking aspen, jack pine, prairie willow (*Salix humilis*), pin cherry (*Prunus pensylvanica*), and serviceberries (*Amelanchier interior, A. sanguinea,* and *A. spicata*). The low shrub layer is patchy to dense (60-70%) with common shrubs including common juniper (*Juniperus communis*), serviceberries, bearberry (*Arctostaphylos uva-ursi*), bush-honeysuckle (*Diervilla lonicera*), common juniper (*Juniperus communis*), creeping juniper (*J. horizontalis*), staghorn sumac (*Rhus typhina*), wild rose (*Rosa acicularis*), thimbleberry (*Rubus parviflorus*), wild red raspberry (*Rubus strigosus*), snowberry (*Symphoricarpos albus* var. *albus*), low sweet blueberry (*Vaccinium angustifolium*), Canada blueberry (*V. myrtilloides*), squashberry (*Viburnum edule,* State Threatened), and prairie willow. Seedling quaking aspen and jack pine are also common in the low shrub layer.

The ground cover ranges from patchy to locally dense (20-60%). Herbaceous species are concentrated where soils have accumulated along cracks, crevices, and depressions in the sandstone bedrock. A diverse array of lichens and mosses cover the exposed bedrock. Characteristic non-vascular species observed within the glade include reindeer lichens



Michigan's largest sandstone bedrock glade occurs on Isle Royale along Houghton Ridge. Photo by Jesse M. Lincoln.

(*Cladonia mitis* and *C. rangiferina*) and feather moss (*Pleurozium schreberi*). Prevalent graminoids include poverty grass (*Danthonia spicata*), rough-leaved rice-grass (*Oryzopsis asperifolia*), hair grass (*Avenella flexuosa*), ticklegrass (*Agrostis scabra*), false melic (*Schizachne purpurascens*), and slender wheatgrass (*Elymus trachycaulus*). Less frequently encountered graminoids include western fescue (*Festuca occidentalis*), fescue (*Festuca saximontana*), rice-grass (*Piptatherum pungens*), and bluegrass (*Poa glauca*). Forbs are diverse and highly variable and include cow-wheat (*Melampyrum lineare*), Kalm's hawkweed (*Hieracium kalmia*), Canada mayflower (*Maianthemum canadense*), harebell (*Campanula rotundifolia*), pale corydalis (*Capnoides sempervirens*), goldenrods (*Solidago hispida* and S. *juncea*), rock cress (*Boechera grahamii*), big-leaved aster (*Eurybia macrophylla*), yarrow (*Achillea millefolium*), wild strawberry (*Fragaria virginiana*), geocaulon (*Geocaulon lividum*), pearly everlasting (*Anaphalis margaritacea*), small pussytoes (*Antennaria howellii*), wild columbine (*Aquilegia canadensis*), prairie cinquefoil (*Drymocallis arguta*), and harebell (*Campanula rotundifolia*). Ferns grow on vertical rock faces and some portions of exposed bedrock. Common ferns include rusty woodsia (*Woodsia ilvensis*), common polypody (*Polypodium virginianum*), and fragile fern (*Cystopteris fragilis*).

Pockets of conglomerate bedrock occur locally along Houghton Ridge and are included within this complex. In addition to the species listed above, three-toothed cinquefoil (*Sibbaldiopsis tridentata*), early saxifrage (*Micranthes virginiensis*), and prairie buttercup (*Ranunculus rhomboideus,* State Threatened) become locally prevalent in these conglomerate inclusions. Additional rare plants recorded within the glade include northern paintbrush (*Castilleja septentrionalis,* State Threatened), ram's head lady-slipper (*Cypripedium arietinum*, State Special Concern), and northern gooseberry (*Ribes oxyacanthoides,* State Special Concern).

The Houghton Ridge sandstone bedrock glade was surveyed August 14, 2025. Ninety-five plant species were documented with 81 native species and 14 non-native species. The total FQI was 42.9 and the total mean C value was 4.4.

Threats: Species composition and structure are patterned by natural processes but have been impacted by moose herbivory and non-native species. Numerous non-native species occur within the sandstone bedrock glade, and are locally abundant, especially closer to the ridgeline where there is more moose traffic. Locally common non-natives include Timothy (*Phleum pratense*), Canada bluegrass (*Poa compressa*), Kentucky bluegrass (*P. pratensis*), mouse-ear chickweed (*Cerastium fontanum*), hawkweeds (*Hieracium aurantiacum, H. caespitosum,* and *H. piloselloides*), rough-fruited



A diverse assemblage of graminoids, forbs, and low shrubs characterize the ground cover of the Houghton Ridge sandstone bedrock glade. Photo by Jesse M. Lincoln.

cinquefoil (*Potentilla recta*), common buttercup (*Ranunculus acris*), curly dock (*Rumex crispus*), common goat's beard (*Tragopogon pratensis*), red clover (*Trifolium pratense*), and common mullein (*Verbascum thapsus*). Areas with heavy moose traffic feature the greatest concentrations of invasive species, especially bluegrasses and Timothy.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and to maintain a natural buffer surrounding the glades to prevent the increase of a weedy seed source. The glades should be periodically monitored for invasive species infestations. Trail development should be avoided along Houghton Ridge.

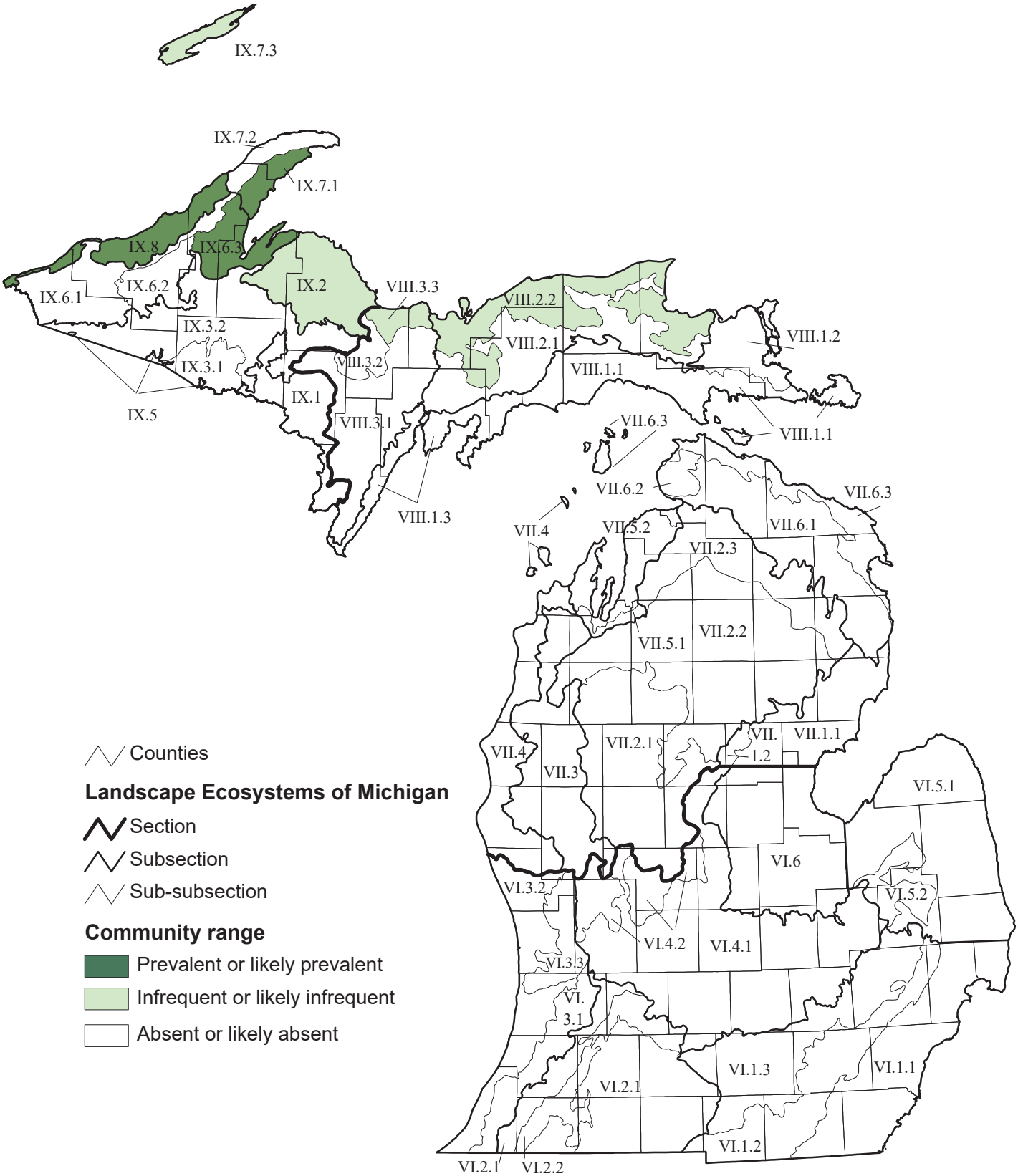


Houghton Ridge sandstone bedrock glade. Photos by Joshua G. Cohen.



SANDSTONE BEDROCK LAKESHORE

Overview: Sandstone bedrock lakeshore is a sparsely vegetated community that occurs along the Lake Superior shoreline in the central and western Upper Peninsula. Exposed sandstone bedrock is prominent, with lichens and mosses locally dominant, and scattered sedges, grasses, forbs, shrubs, and occasionally trees restricted to cracks, joints, and depressions in the bedrock (Cohen et al. 2025, Cohen et al. 2025).



Map 9. Distribution of sandstone bedrock lakeshore in Michigan (Cohen et al. 2025).

16. Houghton Point
Natural Community Type: Sandstone Bedrock Lakeshore
Rank: G4G5 S2, apparently secure to secure globally and imperiled within the state
Element Occurrence Rank: A
Size: 2.9 acres (1.1 hectares)
Element Occurrence Identification Number: 28352

Site Description: Gently sloping sandstone bedrock lakeshore occurs along the southern side of the tip of Houghton Point and extends for just over half a mile. The sandstone bedrock lakeshore intergrades with sandstone cobble shore along the shore and transitions to sandstone bedrock glade inland. The northern shore of Houghton Point is dominated by low stature sandstone lakeshore cliff. The sandstone ecosystems are embedded within a forested matrix of boreal forest. The bedrock lakeshore ranges in width from 3 to 7 meters and increases in extent during low water years. The wave-splashed zone was observed to be 3 meters in width.

Due to the frequent wave activity, ice scour, the resistance of the bedrock, and the lack of suitable sites for soil retention, vegetation is sparse along the sloping sandstone bedrock lakeshore. Wave action, freeze thaw dynamics, and weathering cause erosion of the sandstone bedrock. Sandstone 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 sandstone bedrock lakeshore, removing fine mineral sediments and organic soils. Winter storms scour vegetation from sandstone bedrock lakeshore. Long-term cyclic fluctuations of Great Lakes water levels significantly influence vegetation patterns of sandstone bedrock lakeshore, with vegetation and organic soils becoming established during low-water periods and reduced or eliminated during high-water periods. This site was surveyed in 2025, five years after five consecutive years of high Great Lakes water levels (from 2016 to 2020) resulting in the decrease



Houghton Point sandstone bedrock lakeshore delineated in yellow on 2022 imagery.

in the extent of the sandstone bedrock lakeshore. High water levels and increased wave activity have likely reduced the overall cover of herbaceous species in the sandstone bedrock lakeshore. Horizontal bedrock coastal systems are more impacted by Great Lakes water level fluctuations compared to vertical bedrock systems such as sandstone lakeshore cliff. The soils of the sandstone bedrock lakeshore are characterized by shallow (0-2 cm) organics accumulating in cracks, crevices, and small depressions. Soil chemistry of the soils within the bedrock lakeshore is likely linked to the decomposition of the local organic material. Samples of sandy organics collected from this stretch of sandstone bedrock lakeshore ranged from slightly acidic to circumneutral (pH 6.8-7.0).

The Houghton Point sandstone bedrock lakeshore is sparsely vegetated with herbaceous plants and scattered tree and shrub cover restricted to the inland edge and cracks and crevices within the bedrock. Characteristic herbaceous species (4-8%) include three-toothed cinquefoil (*Sibbaldiopsis tridentata*), yarrow (*Achillea millefolium*), harebell (*Campanula rotundifolia*), poverty grass (*Danthonia spicata*), grass-leaved goldenrod (*Euthamia graminifolia*), Kalm's lobelia (*Lobelia kalmii*), hair grass (*Deschampsia cespitosa*), glaucous white lettuce (*Prenanthes racemosa*), Gillman's goldenrod (*Solidago simplex*), bird's-eye primrose (*Primula mistassinica*), fireweed (*Chamaenerion angustifolium*), prairie cinquefoil (*Drymocallis arguta*), beach pea (*Lathyrus japonicus*), ticklegrass (*Agrostis scabra*), small pussytoes (*Antennaria howellii*), northern bog violet (*Viola nephrophylla*), and blue-joint (*Calamagrostis canadensis*). Rare plants that occur locally within the sandstone bedrock lakeshore include northern paintbrush (*Castilleja septentrionalis*, State Threatened), eyebright (*Euphrasia hudsoniana*, State Threatened), downy oatgrass (*Trisetum spicatum*, State Special Concern), and squashberry (*Viburnum edule*, State Threatened).

Characteristic species of the low shrub layer (2-4%) include ninebark (*Physocarpus opulifolius*), round-leaved serviceberry (*Amelanchier sanguinea*), bush-honeysuckle (*Diervilla lonicera*), bearberry (*Arctostaphylos uva-ursi*), wild red raspberry (*Rubus strigosus*), wild rose (*Rosa acicularis*), squashberry, creeping juniper (*Juniperus horizontalis*), and shrubby cinquefoil (*Dasiphora fruticosa*) along with seedling white spruce (*Picea glauca*), northern white-cedar (*Thuja occidentalis*), paper birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*), and balsam poplar (*P. balsamifera*).



Houghton Point sandstone bedrock lakeshore. Photo by Joshua G. Cohen.

Scattered tall shrubs and saplings (1-2%) are typically restricted to the upper margin and include mountain alder (*Alnus viridis*), Bebb's willow (*Salix bebbiana*), mountain maple (*Acer spicatum*), red-osier dogwood (*Cornus sericea*), mountain-ash (*Sorbus decora*), white spruce, and paper birch. Scattered and stunted trees (<1%) include northern white-cedar and white spruce.

The Houghton Point sandstone bedrock Lakeshore was surveyed August 13, 2025. Fifty-nine plant species were documented with 57 native species and 2 non-native species. The total FQI was 38.4 and the total mean C value was 5.



The Houghton Point sandstone bedrock lakeshore supports numerous rare plant populations including eyebright (*Euphrasia hudsoniana*, State Threatened). Photos by Joshua G. Cohen (above) and Jesse M. Lincoln (below).



Threats: Species composition and structure are patterned by natural processes. Non-native species recorded occasionally along the sandstone bedrock lakeshore include yellow hawkweed (*Hieracium caespitosum*) and Canada bluegrass (*Poa compressa*).

Management Recommendations: The main management recommendation is to maintain a natural buffer surrounding the shoreline to prevent the increase of a weedy seed source. The shoreline should be periodically monitored for invasive species infestations.



Houghton Point sandstone bedrock lakeshore. Photos by Jesse M. Lincoln (above) and Joshua G. Cohen (below).



17. Houghton Ridge
Natural Community Type: Sandstone Bedrock Lakeshore
Rank: G4G5 S2, apparently secure to secure globally and imperiled within the state
Element Occurrence Rank: AB
Size: 5.5 acres (2.2 hectares)
Element Occurrence Identification Number: 28357

Site Description: Gently sloping sandstone bedrock lakeshore occurs south of Houghton Ridge and extends for just over half a mile. The sandstone bedrock lakeshore intergrades with sandstone cobble shore along the shore and transitions to sandstone bedrock glade inland. The sandstone ecosystems are embedded within a forested matrix of boreal forest. The bedrock lakeshore ranges in width from 3 to 7 meters and increases in extent during low water years. The wave splash zone was observed to be 3 meters in width.

Due to the frequent wave activity, ice scour, the resistance of the bedrock, and the lack of suitable sites for soil retention, vegetation is sparse along the sloping sandstone bedrock lakeshore. Wave action, freeze thaw dynamics, and weathering cause erosion of the sandstone bedrock. Sandstone 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 sandstone bedrock lakeshore, removing fine mineral sediments and organic soils. Winter storms scour vegetation from sandstone bedrock lakeshore. Long-term cyclic fluctuations of Great Lakes water levels significantly influence vegetation patterns of sandstone bedrock lakeshore, with vegetation and organic soils becoming established during low-water periods and reduced or eliminated during high-water periods. This site was surveyed in 2025, five years after five consecutive years of high Great Lakes water levels (from 2016 to 2020) resulting in the decrease in the extent of the sandstone bedrock lakeshore. High water levels and increased wave activity have likely reduced the overall cover of



Houghton Ridge sandstone bedrock lakeshore delineated in yellow on 2022 imagery.

herbaceous species in the sandstone bedrock lakeshore. Horizontal bedrock coastal systems are more impacted by Great Lakes water level fluctuations compared to vertical bedrock systems such as sandstone lakeshore cliff.

The soils of the sandstone bedrock lakeshore are characterized by shallow (0-2 cm) organics accumulating in cracks, crevices, and small depressions. Soil chemistry of the soils within the bedrock lakeshore is likely linked to the decomposition of the local organic material. Samples of sandy organics collected from this stretch of sandstone bedrock lakeshore ranged from slightly acidic to circumneutral (pH 6.8-7.0).

The Houghton Ridge sandstone bedrock lakeshore is sparsely vegetated with herbaceous plants and scattered tree and shrub cover restricted to the inland edge and cracks and crevices within the bedrock. Characteristic herbaceous species (2-4%) include hair grass (*Deschampsia cespitosa*), Gillman's goldenrod (*Solidago simplex*), harebell (*Campanula rotundifolia*), yarrow (*Achillea millefolium*), bird's-eye primrose (*Primula mistassinica*), Kalm's lobelia (*Lobelia kalmii*), dwarf raspberry (*Rubus pubescens*), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), yarrow (*Achillea millefolium*), prairie cinquefoil (*Drymocallis arguta*), glaucous white lettuce (*Prenanthes racemosa*), beach pea (*Lathyrus japonicus*), northern bog violet (*Viola nephrophylla*), and blue-joint (*Calamagrostis canadensis*). Rare plants that occur locally within the sandstone bedrock lakeshore include eyebright (*Euphrasia hudsoniana*, State Threatened), downy oatgrass (*Trisetum spicatum*, State Special Concern), and squashberry (*Viburnum edule*, State Threatened).

Characteristic species of the low shrub layer (1-2%) include mountain alder (*Alnus viridis*), ninebark (*Physocarpus opulifolius*), round-leaved serviceberry (*Amelanchier sanguinea*), bush-honeysuckle (*Diervilla lonicera*), bearberry (*Arctostaphylos uva-ursi*), wild rose (*Rosa acicularis*), squashberry, creeping juniper (*Juniperus horizontalis*), common juniper (*J. communis*), shrubby cinquefoil (*Dasiphora fruticosa*), and red-osier dogwood (*Cornus sericea*) along with seedling white spruce (*Picea glauca*) and balsam poplar (*P. balsamifera*). Scattered tall shrubs and saplings (1-4%) are typically restricted to the upper margin and include mountain alder, ninebark, round-leaved serviceberry, Bebb's willow (*Salix bebbiana*), white spruce, and northern white-cedar (*Thuja occidentalis*). Scattered and stunted trees (<1%) include northern white-cedar and white spruce.

The Houghton Ridge sandstone bedrock Lakeshore was surveyed August 14, 2025. Fifty-eight plant species were documented with 56 native species and 2 non-native species. The total FQI was 38.8 and the total mean C value was 5.1.

Threats: Species composition and structure are patterned by natural processes. Non-native species recorded locally within the sandstone bedrock lakeshore include yellow hawkweed (*Hieracium caespitosum*) and Canada bluegrass (*Poa compressa*).



Houghton Ridge sandstone bedrock lakeshore. Photo by Jesse M. Lincoln.

Management Recommendations: The main management recommendation is to maintain a natural buffer surrounding the shoreline to prevent the increase of a weedy seed source. The shoreline should be periodically monitored for invasive species infestations.



Comparison of recently eroded sandstone (left) with no lichens and lichen-diverse sandstone (right) along the Houghton Ridge sandstone bedrock lakeshore. Photo by Joshua G. Cohen.



Houghton Ridge sandstone bedrock lakeshore. Photo by Joshua G. Cohen.

18. Malone Bay
Natural Community Type: Sandstone Bedrock Lakeshore
Rank: G4G5 S2, apparently secure to secure globally and imperiled within the state
Element Occurrence Rank: AB
Size: 9.3 acres (3.7 hectares)
Element Occurrence Identification Number: 28338

Site Description: Sandstone bedrock lakeshore, sandstone lakeshore cliff, and sandstone cobble shore occur along the shore of Malone Bay and also along the shores of Schooner, Hat, Fat, and Bass Islands within Malone Bay. Approximately a mile of sandstone bedrock lakeshore occurs in nine discrete segments. The bedrock lakeshore ranges in width from 3 to 7 meters and increases in extent during low water years. The wave splash zone was observed to be 5 meters in width. Due to the frequent wave activity, ice scour, the resistance of the bedrock, and the lack of suitable sites for soil retention, vegetation is sparse along the sloping sandstone bedrock lakeshore. Wave action, freeze thaw dynamics, and weathering cause erosion of the sandstone bedrock. Sandstone 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 sandstone bedrock lakeshore, removing fine mineral sediments and organic soils. Winter storms scour vegetation from sandstone bedrock lakeshore. Long-term cyclic fluctuations of Great Lakes water levels significantly influence vegetation patterns of sandstone bedrock lakeshore, with vegetation and organic soils becoming established during low-water periods and reduced or eliminated during high-water periods. This site was surveyed in 2025, five years after five consecutive years of high Great Lakes water levels (from 2016 to 2020) resulting in the decrease in the extent of the sandstone bedrock lakeshore. High water levels and increased wave activity have likely reduced the overall cover of herbaceous species in the sandstone bedrock lakeshore. Horizontal bedrock coastal systems are more



Malone Bay sandstone bedrock lakeshore delineated in yellow on 2022 imagery.

impacted by Great Lakes water level fluctuations compared to vertical bedrock systems such as sandstone lakeshore cliff. The soils of the sandstone bedrock lakeshore are characterized by shallow (0-2 cm) organics accumulating in cracks, crevices, and small depressions. Soil chemistry of the soils within the bedrock lakeshore is likely linked to the decomposition of the local organic material. Samples of sandy organics collected from this stretch of sandstone bedrock lakeshore ranged from slightly acidic to circumneutral (pH 6.8-7.0). Along the upper margin of the sandstone bedrock lakeshore and sandstone lakeshore cliff, a 27.9 cm northern white-cedar (*Thuja occidentalis*) was cored, and 223 growth rings were counted.

This particular stretch of sandstone bedrock lakeshore constitutes the northernmost extent of sandstone bedrock lakeshore in Michigan. To the north of Schooner Island, the bedrock transitions to basalt of the Portage Lake Volcanics. The northern mainland portion of this site occurs adjacent to a tombolo with the nearshore landmass having sandstone bedrocks and the inland landmass having Keweenawan basalts. This is the first documentation of this specific geological formation in the Great Lakes. This stretch of sandstone bedrock lakeshore is also notable for the presence of multiple arctic-alpine disjuncts, including downy oatgrass (*Trisetum spicatum*, State Special Concern) and lime-encrusted saxifrage (*Saxifraga paniculata*, State Threatened). In Michigan, these species are more typically found along volcanic shoreline.

The Malone Bay sandstone bedrock lakeshore is sparsely vegetated with herbaceous plants (4-8%) and scattered tree and shrub cover (2-4%) restricted to the inland edge and cracks and crevices within the bedrock. Characteristic herbaceous species include goldenrods (*Solidago hispida*, *S. ptarmicoides*, and *S. simplex*), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), yarrow (*Achillea millefolium*), wild strawberry (*Fragaria virginiana*), harebell (*Campanula rotundifolia*), poverty grass (*Danthonia spicata*), hair grass (*Deschampsia cespitosa*), prairie cinquefoil (*Drymocallis arguta*), Kalm's lobelia (*Lobelia kalmii*), balsam ragwort (*Packera paupercula*), fireweed (*Chamaenerion angustifolium*), fescue (*Festuca*



Malone Bay sandstone bedrock lakeshore. Photo by Joshua G. Cohen.

saximontana), rough cinquefoil (*Potentilla norvegica*), sand violet (*Viola adunca*), pearly everlasting (*Anaphalis margaritacea*), bird's-eye primrose (*Primula mistassinica*), dwarf raspberry (*Rubus pubescens*), and grass-leaved goldenrod (*Euthamia graminifolia*). Butterwort (*Pinguicula vulgaris,* State Special Concern), downy oatgrass, prairie cinquefoil (*Potentilla litoralis*, State Threatened), and lime-encrusted saxifrage occur locally within the sandstone bedrock lakeshore.

Characteristic species of the low shrub layer (2-4%) include wild rose (*Rosa acicularis*), pussy willow (*Salix discolor*), squashberry (*Viburnum edule*, State Threatened), mountain alder (*Alnus viridis*), bearberry (*Arctostaphylos uva-ursi*), shrubby cinquefoil (*Dasiphora fruticosa*), round-leaved serviceberry (*Amelanchier sanguinea*), common juniper (*Juniperus communis*), creeping juniper (*J. horizontalis*), low sweet blueberry (*Vaccinium angustifolium*), red-osier dogwood (*Cornus sericea*), ninebark (*Physocarpus opulifolius*), soapberry (*Shepherdia canadensis*), wild red raspberry (*Rubus strigosus*), and thimbleberry (*Rubus parviflorus*), along with seedling white spruce (*Picea glauca*), northern white-cedar (*Thuja occidentalis*), balsam fir (*Abies balsamea*), paper birch (*Betula papyrifera*), mountain-ash (*Sorbus decora*), and balsam poplar (*Populus balsamifera*). Scattered tall shrubs and saplings (2-4%) are typically restricted to the upper margin and include mountain alder, northern white-cedar, white spruce, paper birch, mountain-ash, and quaking aspen (*Populus tremuloides*). Scattered and stunted trees (1-2%) include northern white-cedar and white spruce.

The Malone Bay sandstone bedrock Lakeshore was surveyed August 4, 2025. Seventy plant species were documented with 65 native species and 5 non-native species. The total FQI was 42.7 and the total mean C value was 5.1.

Threats: Species composition and structure are patterned by natural processes. Non-native species recorded within the sandstone bedrock lakeshore include hemp-nettle (*Galeopsis tetrahit*), yellow hawkweed (*Hieracium caespitosum*), Timothy (*Phleum pratense*), mouse-ear chickweed (*Cerastium fontanum*), and Canada bluegrass (*Poa compressa*).

Management Recommendations: The main management recommendation is to maintain a natural buffer surrounding the shoreline to prevent the increase of a weedy seed source. The shoreline should be periodically monitored for invasive species infestations.



Sandstones comprising the upper part of the Copper Harbor Conglomerate formation are exposed along the shoreline north of Malone Bay. This constitutes the northernmost expression of this formation on Isle Royale. Photo by Jesse M. Lincoln.

19. Wright Island
Natural Community Type: Sandstone Bedrock Lakeshore
Rank: G4G5 S2, apparently secure to secure globally and imperiled within the state
Element Occurrence Rank: C
Size: 3.4 acres (1.4 hectares)
Element Occurrence Identification Number: 28334

Site Description: Sandstone bedrock lakeshore and sandstone cobble shore occur along the southern shore of Wright Island in Malone Bay off of Isle Royale. Approximately a half mile of sandstone bedrock lakeshore occurs in three discrete segments. The bedrock lakeshore ranges in width from 3 to 7 meters and increases in extent during low water years. Due to the frequent wave activity, ice scour, the resistance of the bedrock, and the lack of suitable sites for soil retention, vegetation is sparse along the sandstone bedrock lakeshore. Wave action, freeze thaw dynamics, and weathering cause erosion of the sandstone bedrock. Sandstone 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 sandstone bedrock lakeshore, removing fine mineral sediments and organic soils. Winter storms scour vegetation from sandstone bedrock lakeshore. Long-term cyclic fluctuations of Great Lakes water levels significantly influence vegetation patterns of sandstone bedrock lakeshore, with vegetation and organic soils becoming established during low-water periods and reduced or eliminated during high-water periods. This site was surveyed in 2025, five years after five consecutive years of high Great Lakes water levels (from 2016 to 2020) resulting in the decrease in the extent of the sandstone bedrock lakeshore. High water levels and increased wave activity have likely reduced the overall cover of herbaceous species in the sandstone bedrock lakeshore. Horizontal bedrock coastal systems are more impacted by Great Lakes water level fluctuations compared to vertical bedrock systems such as sandstone lakeshore cliff. The soils of the sandstone bedrock lakeshore are characterized by shallow (1-2 cm) organics accumulating in cracks,



Wright Island sandstone bedrock lakeshore delineated in yellow on 2022 imagery.

crevices, and small depressions. Soil chemistry of the soils within the bedrock lakeshore is likely linked to the decomposition of the local organic material. Samples of sandy organics collected from this stretch of sandstone bedrock lakeshore ranged from acidic to circumneutral (pH 5.5-7.0).

The Wright Island sandstone bedrock lakeshore is sparsely vegetated with herbaceous plants (5-8%) and scattered tree and shrub cover (1-2%) restricted to the inland edge and cracks and crevices within the bedrock. Characteristic herbaceous species include harebell (*Campanula rotundifolia*), yarrow (*Achillea millefolium*), goldenrods (*Solidago hispida* and *S. ptarmicoides*), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), hair grass (*Deschampsia cespitosa*), Kalm's lobelia (*Lobelia kalmii*), bluegrass (*Poa glauca*), wild strawberry (*Fragaria virginiana*), bird's-eye primrose (*Primula mistassinica*), and grass-leaved goldenrod (*Euthamia graminifolia*). Butterwort (*Pinguicula vulgaris*, State Special Concern) occurs locally within the sandstone bedrock lakeshore.

Characteristic species of the low shrub layer (2-5%) include ninebark (*Physocarpus opulifolius*), thimbleberry (*Rubus parviflorus*), wild rose (*Rosa acicularis*), serviceberries (*Amelanchier interior* and *A. sanguinea*), willows (*Salix* spp.), and red-osier dogwood (*Cornus sericea*) along with seedling balsam fir (*Abies balsamea*), quaking aspen (*Populus tremuloides*), and paper birch (*Betula papyrifera*). Scattered tall shrubs and saplings (1-2%) are typically restricted to the upper margin and include mountain alder (*Alnus viridis*), mountain-ash (*Sorbus decora*), squashberry (*Viburnum edule*, State Threatened), white pine (*Pinus strobus*), and serviceberries. Scattered and stunted tress (1-2%) trees include northern white-cedar (*Thuja occidentalis*), white spruce (*Picea glauca*), paper birch, quaking aspen, and mountain-ash.

The Wright Island sandstone bedrock Lakeshore was surveyed August 2, 2025. Forty-two plant species were documented with 39 native species and 3 non-native species. The total FQI was 27.9 and the total mean C value was 4.3.

Threats: Species composition and structure are patterned by natural processes. Non-native species recorded within the sandstone bedrock lakeshore include hemp-nettle (*Galeopsis tetrahit*), yellow hawkweed (*Hieracium caespitosum*), and Canada bluegrass (*Poa compressa*). An old dock occurs on Wright Island, which was used historically as a fishing encampment. The interior of the island is characterized by early-successional boreal forest and openings with weedy vegetation that is the likely seed source for opportunistic native and non-native species along the shoreline.

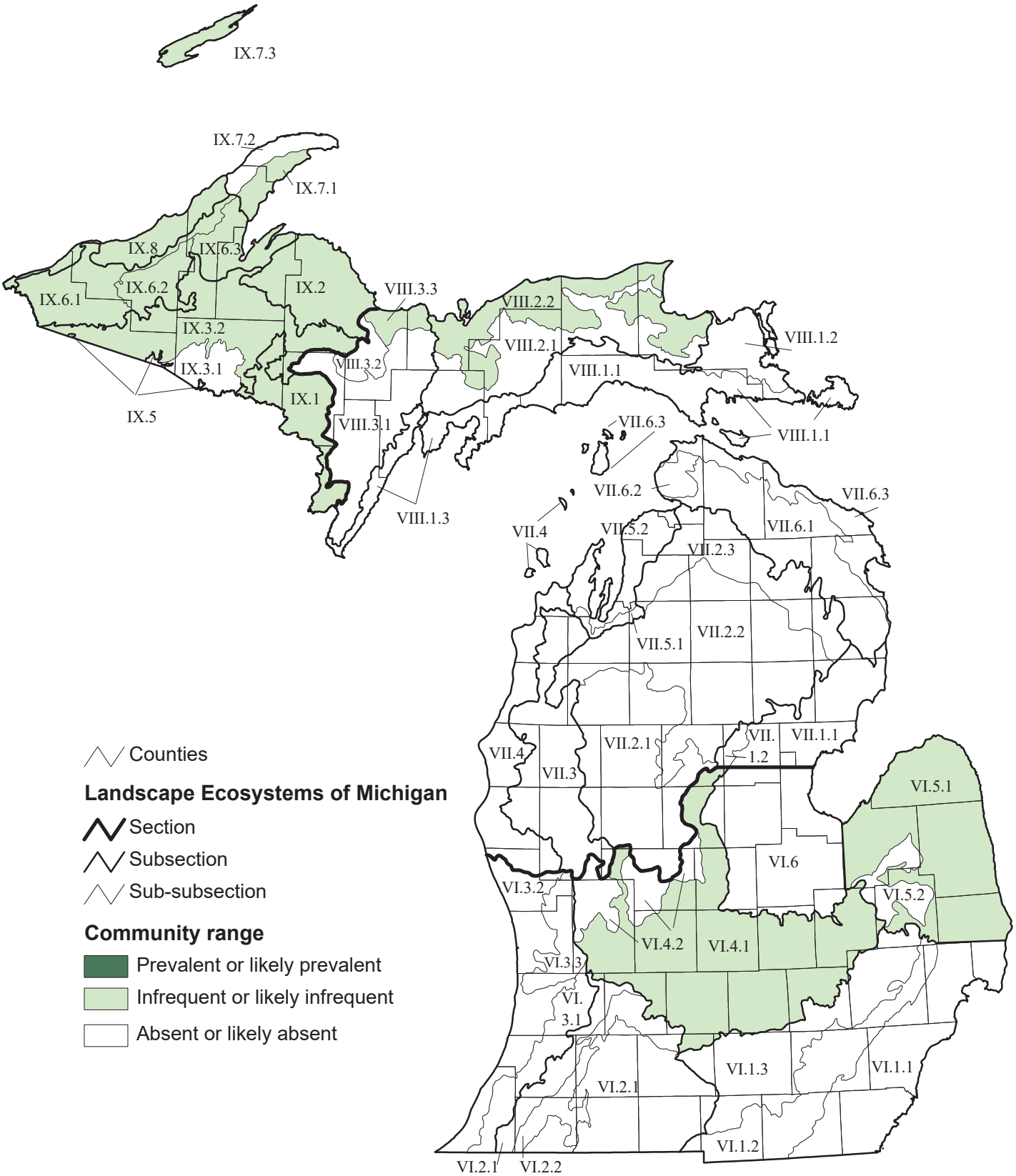
Management Recommendations: The main management recommendation is to maintain a natural buffer surrounding the shoreline to prevent the increase of a weedy seed source. The shoreline should be periodically monitored for invasive species infestations.



Wright Island sandstone bedrock lakeshore. Photo by Jesse M. Lincoln.

SANDSTONE CLIFF

Overview: Sandstone cliff consists of vertical or near-vertical exposures of bedrock with sparse coverage of vascular plants, lichens, mosses, and liverworts. The community occurs in the central and western Upper Peninsula, and locally in Eaton County in the southern Lower Peninsula (Cohen et al. 2015, Cohen et al. 2025).



Map 10. Distribution of sandstone cliff in Michigan (Albert et al. 2008).

20. Houghton Ridge
Natural Community Type: Sandstone Cliff
Rank: G4G5 S2, apparently secure to secure globally and imperiled within the state
Element Occurrence Rank: AB
Size: 5.6 acres (2.2 hectares)
Element Occurrence Identification Number: 28356

Site Description: These cliffs are composed of two polygons of south-facing escarpment that occur along the margin of sandstone bedrock glade embedded in a matrix of boreal forest along the Houghton Ridge. The cliffs run for approximately three-quarters of a mile and range from 3 to 30 meters tall. Talus slope occurs along the base of the cliffs. A 42 cm jack pine (*Pinus banksiana*) along the top of the cliff was cored and 136 growth rings were counted. There is little soil development on the steep rock face of the cliffs. Some organic soil development occurs in crevices in the rock face and on the upper lip of the cliffs. The soils are characterized by shallow (0-2 cm), acidic (pH 5.0-5.5) organics. Soils along the sandstone cliff have variable soil chemistry depending on the local composition of decomposing plants and organic material.

The Houghton Ridge sandstone cliff is characterized by sparse vegetation that is generally restricted to the flat, exposed bedrock at the upper edge of the cliff (i.e., lip), cracks and joints in the cliff face, ledges along the cliff face, and along the talus field at the cliff base. Sparse herbaceous cover (2-4%) includes common polypody (*Polypodium virginianum*), bunchberry (*Cornus canadensis*), twinflower (*Linnaea borealis*), wild sarsaparilla (*Aralia nudicaulis*), bluebead lily (*Clintonia borealis*), wild columbine (*Aquilegia canadensis*), fragile fern (*Cystopteris fragilis*), rusty woodsia (*Woodsia ilvensis*), hairy goldenrod (*Solidago hispida*), hair grass (*Avenella flexuosa*), fescue (*Festuca saximontana*), rough-leaved rice-grass (*Oryzopsis asperifolia*), bluegrass (*Poa glauca*), and fireweed (*Chamaenerion angustifolium*).



Houghton Ridge sandstone cliff delineated in yellow on 2022 imagery.

Sparse low shrub cover (1-2%) includes wild red raspberry (*Rubus strigosus*), bush-honeysuckle (*Diervilla lonicera*), bearberry (*Arctostaphylos uva-ursi*), common juniper (*Juniperus communis*), thimbleberry (*Rubus parviflora*), and snowberry (*Symphoricarpos albus var. albus*). Scattered trees and tall shrubs (1-2%) occur along the lip and on ledges and crevices of the cliff and include northern white-cedar (*Thuja occidentalis*), white spruce (*Picea glauca*), jack pine, paper birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*), serviceberry (*Amelanchier interior*), pin cherry (*Prunus pensylvanica*), and mountain maple (*Acer spicatum*).

The Houghton Ridge sandstone cliff was surveyed August 14, 2025. Twenty-nine plant species were documented with 28 native species and 1 non-native species. The total FQI was 25.8 and the total mean C value was 4.8.

Threats: Species composition and structure are patterned by natural processes. The non-native white sweet-clover (*Melilotus albus*) was documented along the cliff.

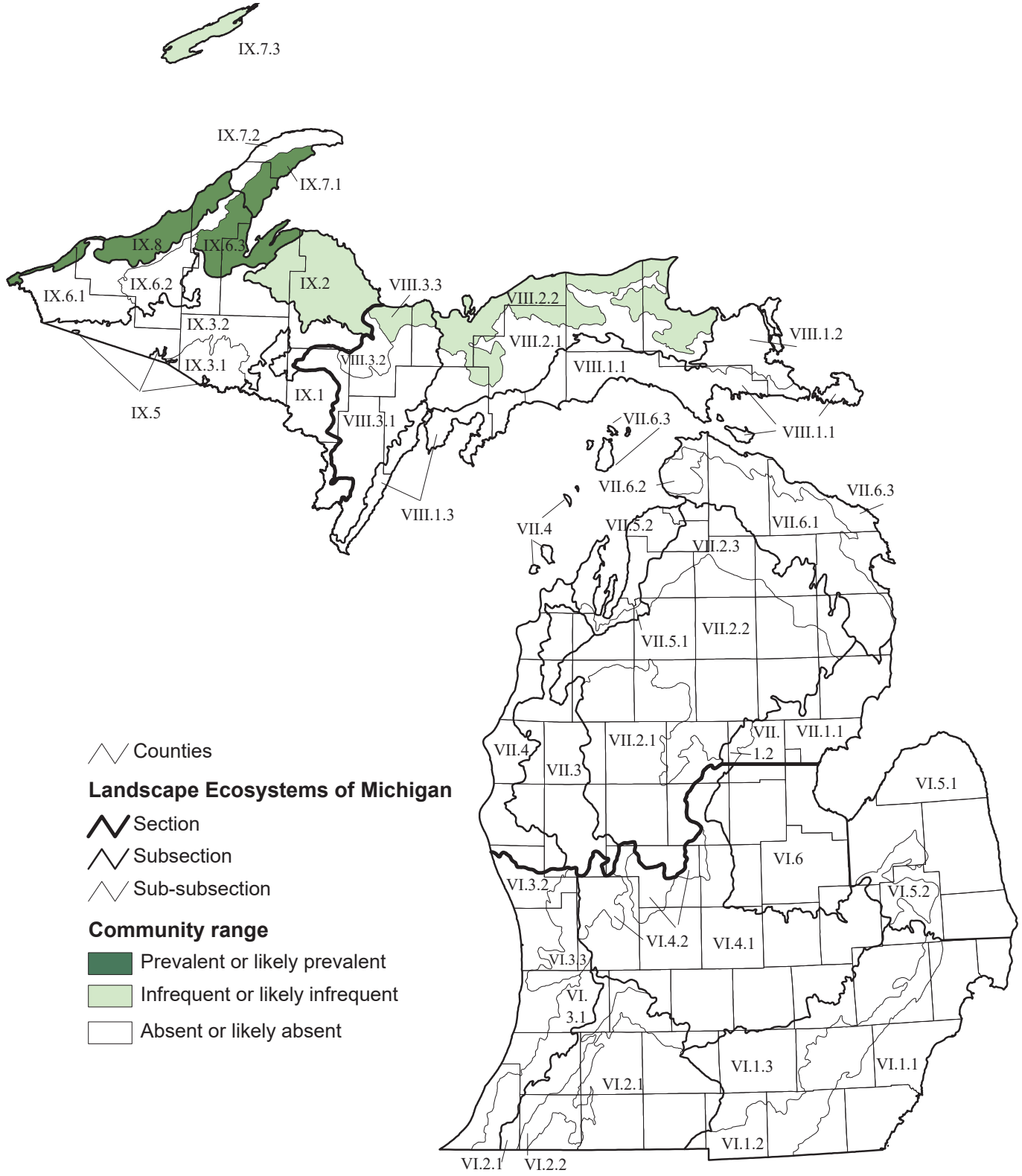
Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to maintain a buffer of natural communities surrounding the sandstone cliff to prevent the increase of a weedy seed source and desiccation.



Houghton Ridge sandstone cliff. Photo by Joshua G. Cohen.

SANDSTONE COBBLE SHORE

Overview: Sandstone cobble shore is a sparsely vegetated community that occupies the edges of Lake Superior, predominantly occurring in coves and gently curving bays in association with bedrock cliff, bedrock outcrop, sandstone bedrock lakeshore, and sand and gravel beach. These cobble shores may be nearly level and support a diversity of herbaceous plants where they border sand and gravel beach or relatively steep and terraced in coves between bedrock outcrops, with vegetation mostly limited to the highest cobble beach ridge, where scattered trees and shrubs are dominant. Sandstone cobble shore is dominated by flat, round-sided sandstones that move readily when subject to intense wave action, limiting soil development and vegetation establishment. (Cohen et al. 2025, Cohen et al. 2025).



Map 11. Distribution of sandstone cobble shore in Michigan (Cohen et al. 2025).

21. Wright Island
Natural Community Type: Sandstone Cobble Shore
Rank: G2G3 S2, imperiled to rare globally and imperiled within the state
Element Occurrence Rank: B
Size: 1.2 acres (2.2 hectares)
Element Occurrence Identification Number: 28335

Site Description: Sandstone cobble shore and sandstone bedrock lakeshore occur along the southern shore of Wright Island in Malone Bay off of Isle Royale. Approximately a quarter mile of sandstone cobble shore occurs in three discrete segments. The areas of cobble shore are typically narrow (1-3 meters wide) and increase in extent during low water years. The cobble shores are composed of cobbles made from weathering, glacial erosion, and wave action breaking down the island's Copper Harbor Conglomerate sandstones. Cobbles are variable in size and include occasional large slabs and boulders. Soil development is minimal and is limited to the narrow spaces between the cobbles. The soils of the sandstone cobble shore are characterized by shallow (1-2 cm) organics accumulating in cracks, crevices, and small depressions. Soil chemistry of the soils within the cobble shore is likely linked to the decomposition of the local organic material. Samples of sandy organics collected from this stretch of sandstone shore ranged from acidic to circumneutral (pH 5.5-7.0). Near the water's edge, storm waves regularly reorganize the cobble and erode the soil. During the winter, ice scours and abrades the rock. Freezing rain and mist coat both the rock and vegetation, and in combination with high winds, result in dwarf shrubs and stunted trees along the shore. This sandstone cobble shore is bordered by open-canopied boreal forest along its upland margin. This boreal forest is subject to frequent turnover of canopy trees from windthrow. Along the shoreline, the sandstone cobble shore intergrades with sandstone bedrock lakeshore.



Wright Island sandstone cobble shore delineated in yellow on 2022 imagery.

The sandstone cobble shore is sparsely vegetated with herbaceous plants (4-8%) and scattered tree and shrub cover (1-2%) restricted to the inland edge and cracks and crevices within the bedrock. Characteristic herbaceous species include fireweed (*Chamaenerion angustifolium*) and wild sarsaparilla (*Aralia nudicaulis*). Characteristic species of the low shrub layer (2-4%) include bush-honeysuckle (*Diervilla lonicera*), ninebark (*Physocarpus opulifolius*), wild rose (*Rosa acicularis*), and squashberry (*Viburnum edule*, State Threatened). Scattered tall shrubs (1-2%) are typically restricted to the upper margin and include mountain alder (*Alnus viridis*) and mountain-ash (*Sorbus decora*). Scattered and stunted tress (1-2%) trees include northern white-cedar (*Thuja occidentalis*) and white spruce (*Picea glauca*).

The Wright Island sandstone cobble shore was surveyed August 2, 2025. Ten plant species were documented with 10 native species and no non-native species. The total FQI was 15.5 and the total mean C value was 4.9.

Threats: Species composition and structure are patterned by natural processes. Non-native species recorded within the adjacent sandstone bedrock lakeshore include hemp-nettle (*Galeopsis tetrahit*), yellow hawkweed (*Hieracium caespitosum*), and Canada bluegrass (*Poa compressa*). An old dock occurs on Wright Island, which was used historically as a fishing encampment. The interior of the island is characterized by early-successional boreal forest and openings with weedy vegetation that are the likely seed source for opportunistic native and non-native species along the shoreline.

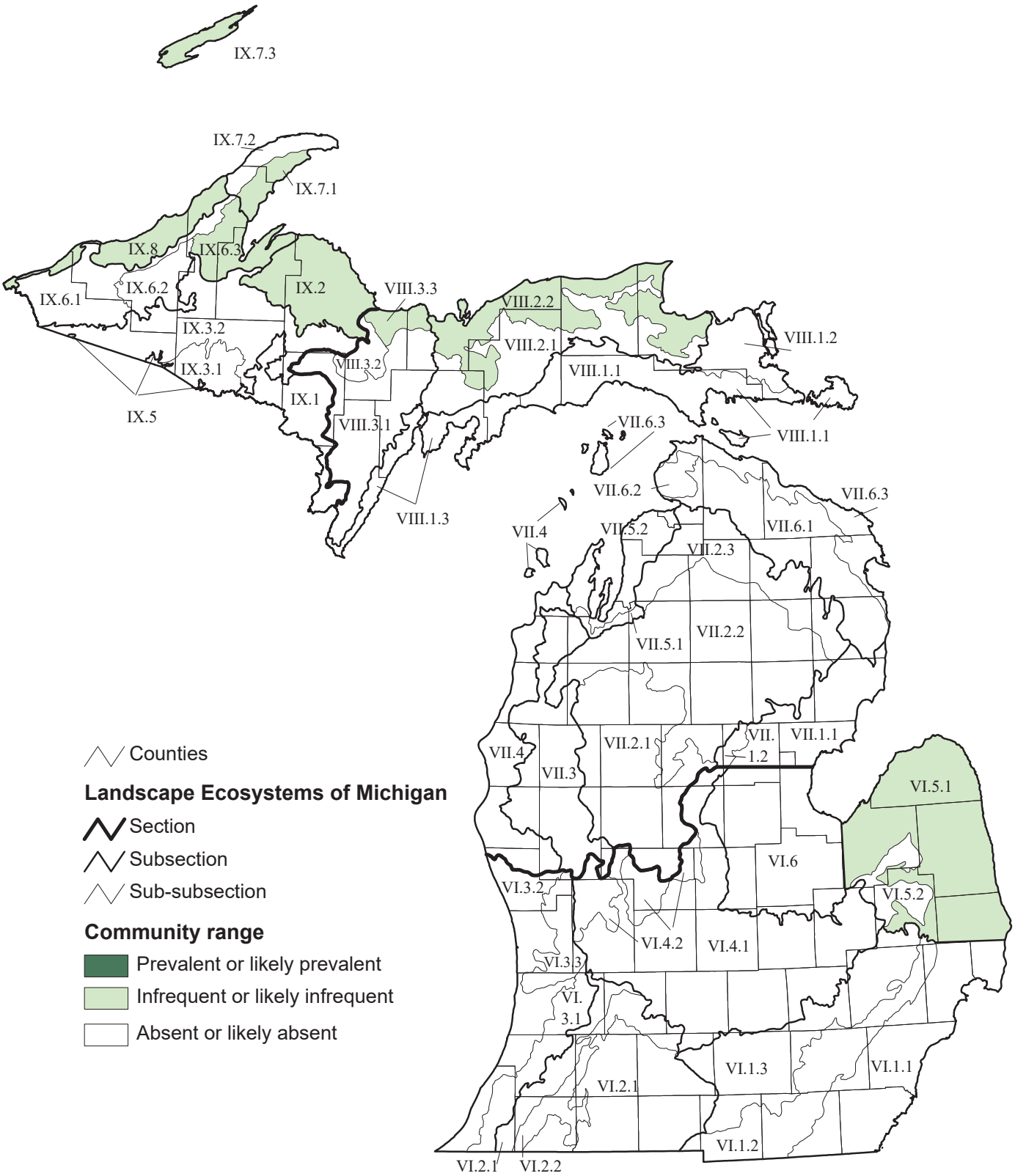
Management Recommendations: The main management recommendation is to maintain a natural buffer surrounding the shoreline to prevent the increase of a weedy seed source. The shoreline should be periodically monitored for invasive species infestations.



Wright Island sandstone cobble shore. Photo by Joshua G. Cohen.

SANDSTONE LAKESHORE CLIFF

Overview: Sandstone lakeshore cliff consists of vertical or near-vertical exposures of bedrock with sparse coverage of vascular plants, lichens, mosses, and liverworts. The community occurs primarily in the central and western Upper Peninsula along Lake Superior but also is found along a short stretch of shore along Lake Huron in the thumb region. Sandstone lakeshore cliff ranges from 2 to 65 m (6 to 200 ft) high and is characterized by high site moisture due to the proximity to the Great Lakes and a stressed and unstable environment because of severe waves, wind, and winter ice (Cohen et al. 2015, Cohen et al. 2025).



Map 12. Distribution of sandstone lakeshore cliff in Michigan (Cohen et al. 2025).

22. Houghton Point
Natural Community Type: Sandstone Lakeshore Cliff
Rank: G3 S2, vulnerable globally and imperiled within the state
Element Occurrence Rank: A
Size: 4.5 acres (1.8 hectares)
Element Occurrence Identification Number: 28353

Site Descriptions: Approximately a mile of north-facing sandstone lakeshore cliff occurs along the north side of Houghton Point and Houghton Ridge. Along the shoreline, the sandstone lakeshore cliff intergrades with sandstone cobble shore, and the shoreline is backed by boreal forest. The sandstone lakeshore cliff ranges in height from 2 to 10 meters tall. The vertical structure of the cliffs and erosive nature of sandstone cause periodic erosion and restrict soil development to the cliff edge, ledges, crevices, and the base of the cliff where sand particles, decaying roots, and plant debris accumulate. Soils sampled from the ledge of the sandstone lakeshore cliff are characterized by shallow (1-2 cm), alkaline (pH 7.5-7.8) organics and sands. Soil chemistry within the sandstone lakeshore cliff is likely linked to the decomposition of the local organic material. The thin soils and direct exposure to wind, ice, and sun produce desiccating conditions that limit plant growth and result in sparse vegetation.

Summer fog occurs regularly on the coast, fostering the growth of moss and lichen along the vertical cliff face. Trees and shrubs growing along the cliffs are stunted by ice and wind and are limited in extent because of the lack of substrate for root establishment and growth. Cliff faces and accompanying plant debris are scoured by ice and waves, further increasing rates of erosion. Wave action, freeze thaw dynamics, and weathering cause erosion of the cliff face and generation of talus and cobble at the cliff base. Much of the talus is sloughing off directly into the lake. Overhangs occur locally along the



Houghton Point sandstone lakeshore cliff delineated in yellow on 2022 imagery.

cliffs. Along the upper margin of the sandstone lakeshore cliff, a 39.1 cm northern white-cedar (*Thuja occidentalis*) was cored, and 123 growth rings were counted.

Vegetation is sparse, being generally restricted to the flat, exposed bedrock at the upper edge of the cliff (i.e., lip), cracks and joints in the cliff face, ledges along the cliff face, and talus blocks along the bottom of the cliff. The majority of the vertical cliff face is bare of all vascular vegetation, but lichens, mosses, and liverworts are common. Sparse herbaceous cover (2-4%) includes hair grass (*Deschampsia cespitosa*), harebell (*Campanula rotundifolia*), dwarf raspberry (*Rubus pubescens*), Gillman's goldenrod (*Solidago simplex*), downy oatgrass (*Trisetum spicatum*, State Special Concern), bluebead-lily (*Clintonia borealis*), rough cinquefoil (*Potentilla norvegica*), rose twisted-stalk (*Streptopus lanceolatus*), rusty woodsia (*Woodsia ilvensis*), common polypody (*Polypodium virginianum*), and wild sarsaparilla (*Aralia nudicaulis*). Characteristic species of the shrub layer (2-4%) include mountain alder (*Alnus viridis*), shrubby cinquefoil (*Dasiphora fruticosa*), thimbleberry (*Rubus parviflorus*), wild red raspberry (*Rubus strigosus*), ninebark (*Physocarpus opulifolius*), and Canadian fly honeysuckle (*Lonicera canadensis*). Scattered and often stunted trees (<1%) occur on the lip, ledges, and crevices and include northern white-cedar, white spruce (*Picea glauca*), paper birch (*Papyrifera betula*), white pine (*Pinus strobus*), and mountain-ash (*Sorbus decora*).

The Houghton Point sandstone lakeshore cliff was surveyed August 13, 2025. Eighteen plant species were documented with no non-native species recorded. The total FQI was 25.5 and the total mean C value was 6.

Threats: Species composition and structure are patterned by natural processes. No invasive plants were recorded along the cliff. Non-native species recorded locally along the adjacent sandstone bedrock lakeshore include yellow hawkweed (*Hieracium caespitosum*) and Canada bluegrass (*Poa compressa*).

Management Recommendations: The main management recommendation is to maintain a natural buffer surrounding the shoreline to prevent the increase of a weedy seed source. The shoreline should be periodically monitored for invasive species infestations.



Houghton Point sandstone lakeshore cliff. Photo by Joshua G. Cohen.



Houghton Point sandstone lakeshore cliff. Photos by Joshua G. Cohen (above) and Jesse M. Lincoln (below).



23. Malone Bay
Natural Community Type: Sandstone Lakeshore Cliff
Rank: G3 S2, vulnerable globally and imperiled within the state
Element Occurrence Rank: B
Size: 1.9 acres (0.8 hectares)
Element Occurrence Identification Number: 28337

Site Description: Sandstone lakeshore cliff, sandstone bedrock lakeshore, and sandstone cobble shore occur along the shore of Malone Bay and also along the shores of Schooner, Hat, Fat, and Bass Islands within Malone Bay. Approximately a third of a mile of sandstone lakeshore cliff occurs along this stretch of shoreline. Boreal forest occurs immediately adjacent to the sandstone lakeshore cliff along the islands as well as along the mainland shoreline. The sandstone lakeshore cliff ranges in height from 3 to 7 meters tall. The vertical structure of the cliffs and erosive nature of sandstone causes periodic erosion and restricts soil development to the cliff edge, ledges, crevices, and the base of the cliff where sand particles, decaying roots, and plant debris accumulate, and along the upper margin of the escarpment. Soils sampled from the ledge of the sandstone lakeshore cliff are characterized by shallow (1-2 cm) organics and sands ranging from acidic to circumneutral (pH 6.0-7.5). Soil chemistry of the soils within the sandstone lakeshore cliff is likely linked to the decomposition of the local organic material. The thin soils and direct exposure to wind, ice, and sun produce desiccating conditions that limit plant growth and result in sparse vegetation. Summer fog occurs frequently on the coast, fostering the growth of moss and lichen along the vertical cliff face. Trees and shrubs growing along the cliffs are stunted by ice and wind and are limited in extent because of the lack of substrate for root establishment and growth. Cliff faces and accompanying plant debris are scoured by ice and waves, further increasing rates of erosion. Wave action, freeze thaw dynamics, and weathering cause erosion of the cliff face and generation of talus and cobble at the cliff base. Much of the talus is sloughing off directly into the lake. Overhangs occur locally along the cliffs. Two of the cliff polygons are south



Malone Bay sandstone lakeshore cliff delineated in yellow on 2022 imagery.

facing, one is north facing, and one is east facing. Along the upper margin of the sandstone lakeshore cliff and sandstone bedrock lakeshore, a 27.9 cm northern white-cedar (*Thuja occidentalis*) was cored and 223 growth rings were counted.

This particular stretch of sandstone lakeshore cliff constitutes the northernmost extent of sandstone lakeshore cliff in Michigan. To the north of Schooner Island, the bedrock transitions to basalt of the Portage Lake Volcanics. This stretch of sandstone lakeshore cliff is notable for the presence of multiple arctic-alpine disjuncts, including downy oatgrass (*Trisetum spicatum*, State Special Concern) and lime-encrusted saxifrage (*Saxifraga paniculata,* State Threatened). In Michigan, these species are more typically found along volcanic shoreline.

Vegetation along the sandstone lakeshore cliff is sparse, being generally restricted to the flat, exposed bedrock at the upper edge of the cliff (i.e., lip), cracks and joints in the cliff face, ledges along the cliff face, and talus blocks along the bottom of the cliff. The majority of the vertical cliff face is bare of all vascular vegetation, but lichens, mosses, and liverworts are common. Sparse herbaceous cover (2-4%) includes hair grass (*Deschampsia cespitosa*), harebell (*Campanula rotundifolia*), yarrow (*Achillea millefolium*), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), sand violet (*Viola adunca*), wild strawberry (*Fragaria virginiana*), goldenrods (*Solidago hispida* and *S. ptarmicoides*), common polypody (*Polypodium virginianum*), cow-wheat (*Melampyrum lineare*), fireweed (*Chamaenerion angustifolium*), bluegrass (*Poa glauca*), geocaulon (*Geocaulon lividum*), and lime-encrusted saxifrage. Characteristic species of the low shrub layer (1-2%) include shrubby cinquefoil (*Dasiphora fruticosa*), ninebark (*Physocarpus opulifolius*), serviceberry (*Amelanchier interior*), bearberry (*Arctostaphylos uva-ursi*), wild red raspberry (*Rubus strigosus*), and paper birch (*Betula papyrifera*). Scattered and often stunted trees (1-2%) occur on the lip, ledges, and crevices and include northern white-cedar (*Thuja occidentalis*), white spruce (*Picea glauca*), and mountain-ash (*Sorbus decora*).

The Malone Bay sandstone lakeshore cliff was surveyed August 4, 2025. Twenty-three plant species were documented with 22 native species and 1 non-native species. The total FQI was 25.9 and the total mean C value was 5.4.



Lime-encrusted saxifrage (*Saxifraga paniculata,* State Threatened) occurs locally along the lip of the Malone Bay sandstone lakeshore cliff. Photo by Joshua G. Cohen.

Threats: Species composition and structure are patterned by natural processes. The non-native Canada bluegrass (*Poa compressa*) occurs infrequently along the cliff. Non-native species recorded locally along the adjacent sandstone bedrock lakeshore include hemp-nettle (*Galeopsis tetrahit*), yellow hawkweed (*Hieracium caespitosum*), and Canada bluegrass.

Management Recommendations: The main management recommendation is to maintain a natural buffer surrounding the shoreline to prevent the increase of a weedy seed source. The shoreline should be periodically monitored for invasive species infestations.

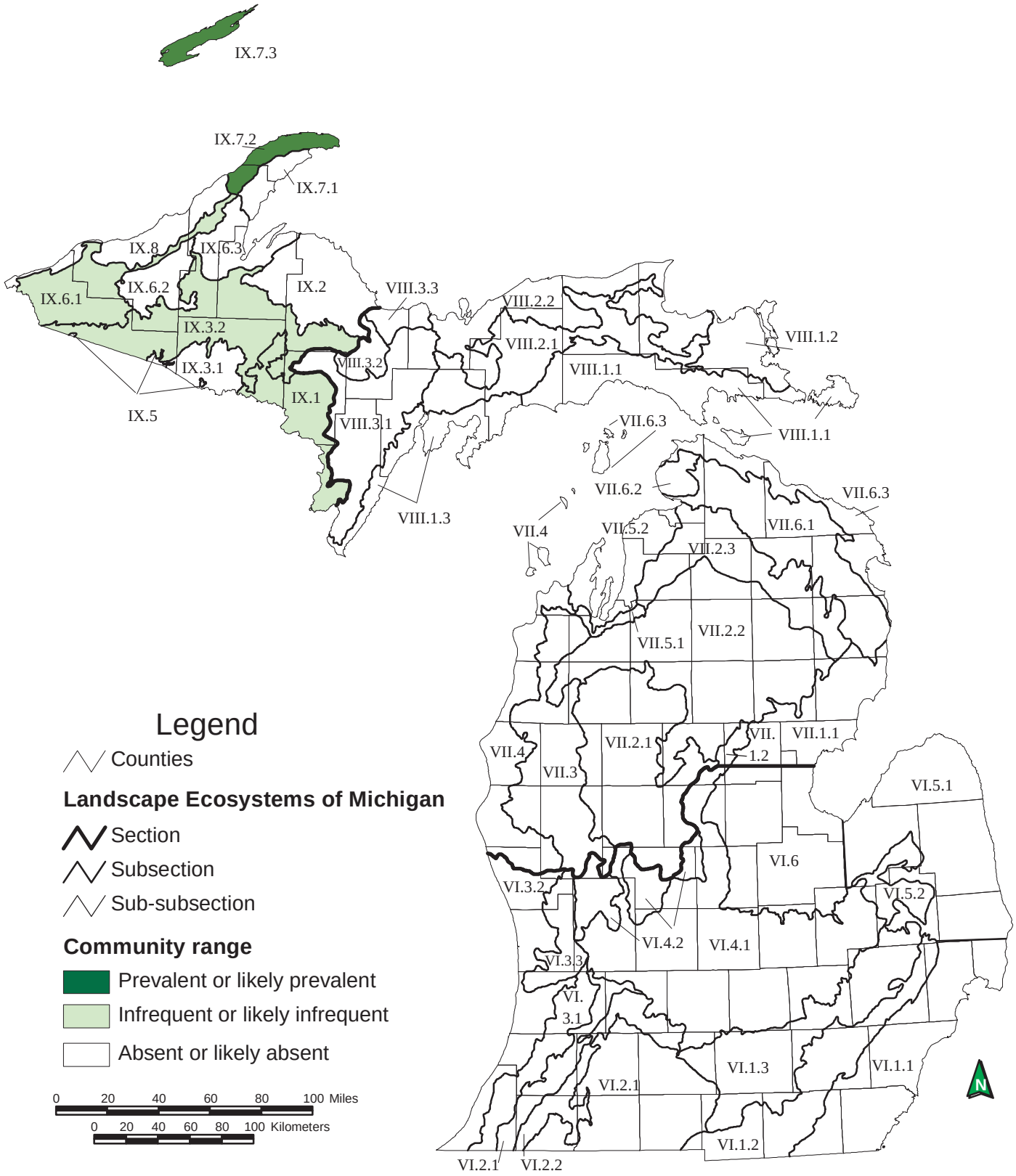


Malone Bay sandstone lakeshore cliff. Photos by Joshua G. Cohen.



VOLCANIC BEDROCK GLADE

Overview: Volcanic bedrock glade consists of an open forested or savanna community found where basaltic bedrock and conglomerates are exposed. The sparse vegetation consists of scattered open-grown trees, scattered shrubs or shrub thickets, and a partial turf of herbs, grasses, sedges, mosses, and lichens. The community occurs in the western Upper Peninsula on Isle Royale and the Keweenaw Peninsula, extending southwest into Houghton, Ontonagon, and Gogebic Counties (Cohen et al. 2015, Cohen et al. 2025).

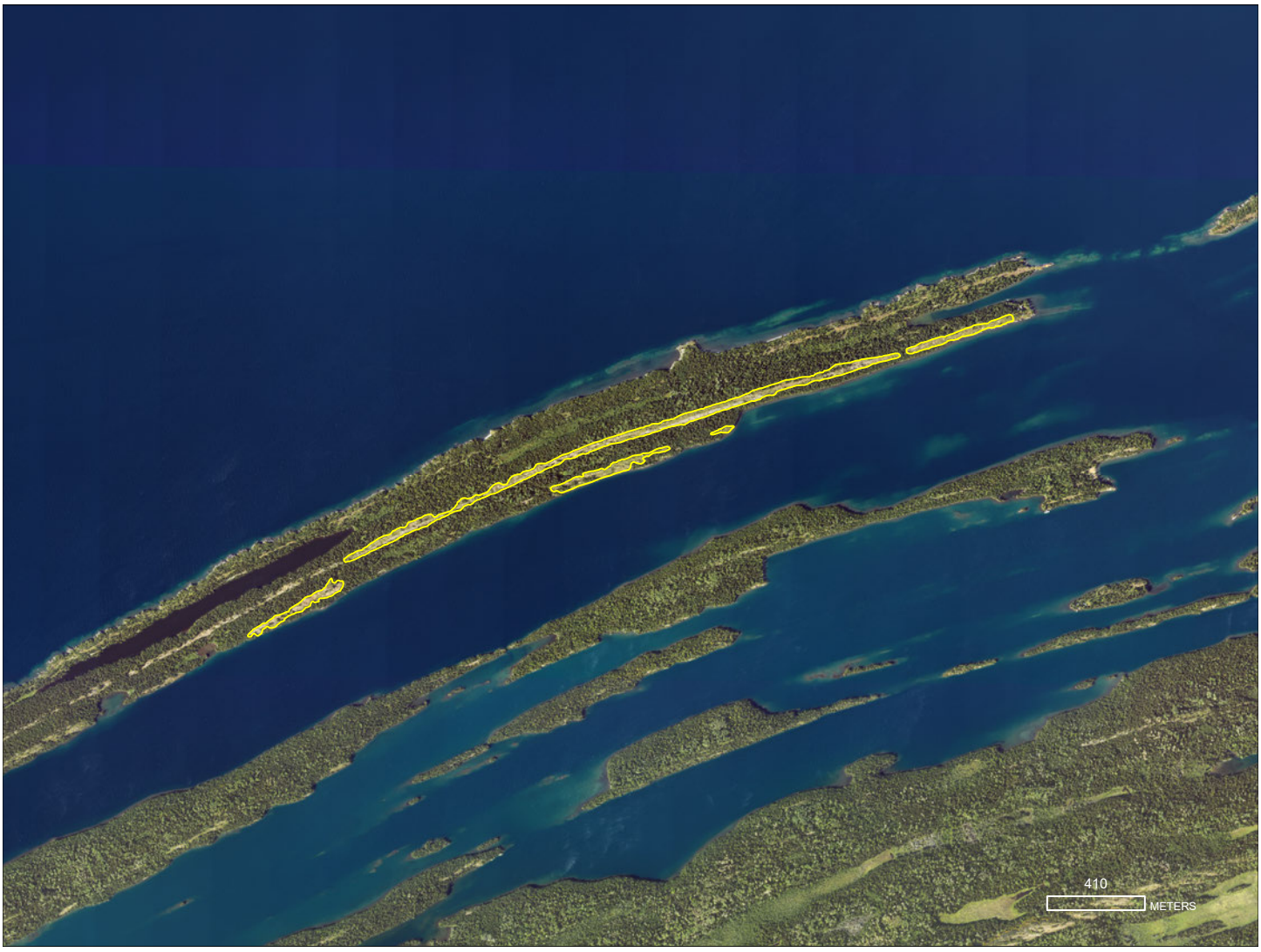


Map 13. Distribution of volcanic bedrock glade in Michigan (Albert et al. 2008).

24. Amygdaloid Island
Natural Community Type: Volcanic Bedrock Glade
Rank: GU S2, uncertain globally and imperiled within the state
Element Occurrence Rank: B
Size: 30 acres (12 hectares)
Element Occurrence Identification Number: 28371

Site Description: Volcanic bedrock glade occurs along the interior volcanic spine of Amygdaloid Island and runs for over 2 miles of the island's southern half. The topography is extreme, with the tilt of the bedrock nearly vertical in several place forming zones of cliff, sometimes 20 m above the boreal forest below. These tilted slabs of bedrock form small zones of north-facing cliff on the backside of the glade, and the tilt occasionally forms ridges barely wide enough for one person to walk along. Five polygons of volcanic bedrock glade are nested within boreal forest with localized volcanic cliff escarpments included in the mapped glade. The northeastern shore of Amygdaloid Island is characterized by volcanic lakeshore cliff.

The soils of the volcanic bedrock glade are shallow (typically 0-5 cm), acidic (pH 6.0-6.5) organics and loams overlying volcanic bedrock. Soil chemistry is variable and depends on the local composition of decomposing plant and organic material (e.g., needle cast from pine locally increases the soil acidity). Soil development is restricted to cracks, fissures, and depressions with scattered portions of the glade being characterized by exposed basalt. Scattered ant mounds were noted within the glade. Shallow soils over bedrock, herbivory, wildfire, and windthrow have contributed to the open physiognomy of the volcanic bedrock glade. Char was noted on an old stump within the glade. Several conifers within the glade were cored to gauge tree age: a 29 cm white spruce (*Picea glauca*) was cored and estimated to be over 160 years



Amygdaloid Island volcanic bedrock glade delineated in yellow on 2022 imagery.

old (154 growth rings); a 42 cm red pine (*Pinus resinosa*) was cored and estimated to be over 300 years old (110 growth rings counted on partial core); and a 31 cm red pine was cored and estimated to be over 300 years old (149 growth rings counted on partial core).

The volcanic bedrock glade is characterized by a scattered and stunted overstory (4-8%) with white spruce, jack pine (*Pinus banksiana*), paper birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*), northern white-cedar (*Thuja occidentalis*), balsam fir (*Abies balsamea*), and red pine, which occurs in a small cluster. Canopy trees typically range in diameter from 10 to 30 cm and some larger red pine and quaking aspen reach 40 to 50 cm. The understory is sparse (1-2%) with characteristic species including white spruce, balsam fir, mountain-ash (*Sorbus decora*), serviceberries (*Amelanchier bartramiana, A. sanguinea,* and *A. spicata*), pin cherry (*Prunus pensylvanica*), prairie willow (*Salix humilis*), and red-berried elder (*Sambucus racemosa*). The low shrub layer is diverse and dense (50-70%) with common species including common juniper (*Juniperus communis*), bearberry (*Arctostaphylos uva-ursi*), low sweet blueberry (*Vaccinium angustifolium*), Canada blueberry (*V. myrtilloides*), bush-honeysuckle (*Diervilla lonicera),* serviceberries, creeping juniper (*J. horizontalis*), wild rose (*Rosa acicularis*), swamp black currant (*Ribes lacustre*), thimbleberry (*Rubus parviflorus*), wild red raspberry (*Rubus strigosus*), squashberry (*Viburnum edule,* State Threatened), red-osier dogwood (*Cornus sericea*), snowberry (*Symphoricarpos albus* var. *albus*), pin cherry, and quaking aspen.

The ground cover ranges from patchy to locally dense (30-40%). A diverse array of lichens and mosses cover the exposed Portage Lake Volcanics within the volcanic bedrock glade. Characteristic non-vascular species observed within the glade include reindeer lichens (*Cladonia mitis* and *C. rangiferina*), feather moss (*Pleurozium schreberi*), and Umbilicaria lichens on vertical rock faces. Prevalent ground cover species include poverty grass (*Danthonia spicata*), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), rusty woodsia (*Woodsia ilvensis*), geocaulon (*Geocaulon lividum*), yarrow (*Achillea millefolium*), rock cress (*Boechera grahamii*), fescue (*Festuca saximontana*), harebell (*Campanula rotundifolia*), ticklegrass (*Agrostis scabra*), hair grass (*Avenella flexuosa*), small pussytoes (*Antennaria howellii*), wild columbine (*Aquilegia canadensis*), wormwood (*Artemisia campestris*), common polypody (*Polypodium virginianum*), bluegrasses (*Poa glauca* and *P. interior*), wild strawberry (*Fragaria virginiana*), goldenrods (*Solidago hispida* and *S. juncea*), pale corydalis (*Capnoides sempervirens*), prairie cinquefoil (*Drymocallis arguta*), American rock-brake (*Cryptogramma acrostichoides*, State Threatened), pearly everlasting (*Anaphalis margaritacea*), downy oatgrass (*Trisetum spicatum,* State Special Concern), fireweed (*Chamaenerion angustifolium*), rough-leaved rice-grass (*Oryzopsis asperifolia*), slender



Amygdaloid Island volcanic bedrock glade. Photo by Joshua G. Cohen.

wheatgrass (*Elymus trachycaulus*), hairy honeysuckle (*Lonicera hirsuta*), and early saxifrage (*Micranthes virginiensis*). Herbaceous species typical of boreal forests are common within the glade in areas of partial canopy and include Canada mayflower (*Maianthemum canadense*), cow-wheat (*Melampyrum lineare*), bunchberry (*Cornus canadensis*), twinflower (*Linnaea borealis*), wild sarsaparilla (*Aralia nudicaulis*), pipsissewa (*Chimaphila umbellata*), and big-leaved aster (*Eurybia macrophylla*). Fragrant woodfern (*Dryopteris fragrans*, State Special Concern) and bluegrass (*Poa interior*, State Special Concern) occur locally.

The Amygdaloid Island volcanic bedrock glade was surveyed August 21, 2025. Ninety-seven plant species were documented with 90 native species and 7 non-native species. The total FQI was 47.3 and the total mean C value was 4.8. Merlin (*Falco columbarius*, State Special Concern) and peregrine falcon (*Falco peregrinus*, State Threatened) were documented chasing each other above the glade.

Threats: Species composition and structure are patterned by natural processes. Numerous non-native species occur locally within the volcanic bedrock glade, especially closer to the ridgeline where there is more moose and human traffic. A social trail emanates from the fishing village at Crystal Cove and heads along the ridgeline. Non-native plants are locally abundant along this travel corridor and it is likely that moose are contributing to the spread of non-native plant species. Weedy non-native species are common within this glade. Non-natives observed within the glade include hemp nettle (*Galeopsis tetrahit*), orange hawkweed (*Hieracium aurantiacum*), yellow hawkweed (*Hieracium caespitosum*), Timothy (*Phleum pratense*), Canada bluegrass (*Poa compressa*), Kentucky bluegrass (*Poa pratensis*), and commons goat's beard (*Tragopogon pratensis*).

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and to maintain a natural buffer surrounding the glades to prevent the increase of a weedy seed source. The glades should be periodically monitored for invasive species infestations.



Amygdaloid Island volcanic bedrock glade. Photo by Jesse M. Lincoln.



Red pine (*Pinus resinosa*) occurs in one small area along Amygdaloid Island volcanic bedrock glade. These were cored and estimated to be over 300 years old and represent the oldest red pine documented on Isle Royale. Photos by Joshua G. Cohen (above) and Jesse M. Lincoln (below).



25. Banksi Glade
Natural Community Type: Volcanic Bedrock Glade
Rank: GU S2, uncertain globally and imperiled within the state
Element Occurrence Rank: AB
Size: 74 acres (12 hectares)
Element Occurrence Identification Number: 27864

Site Description: This volcanic bedrock glade spans over a mile south of the Tobin Creek drainage and north of the Siskiwit Mine and the Rock Harbor Trail. The glade occurs intermixed with boreal forest on moderate to rugged topography and includes stair-stepped topography. The glade occurs adjacent to high-quality poor fen and boreal forest. The soils of the volcanic bedrock glade are shallow (typically 2-5 cm) acidic (pH 4.5) organics and loams overlying volcanic bedrock. Soil chemistry is linked to the decomposition of the local organic material. Soil development is restricted to cracks, fissures, and low depressions with significant portions of the glade being characterized by exposed basalt. Shallow soils over bedrock, intense herbivory, periodic fire, and windthrow contribute to the open physiognomy of the volcanic bedrock glade. Moose trails and pellets occurred throughout the glade and boreal forest and several moose sheds were observed within the glade. The prevalence of jack pine (*Pinus banksiana*) within the canopy of this glade suggests that wildfire occurred here within the last 140 years. A 30.5 cm jack pine was cored and estimated to be over 135 years old (125 ring count) and a 44 cm jack pine was cored and estimated to be over 126 years old (116 ring count). The scattered and stunted trees and shrubs are persistently subject to drought, wind, and freezing. Extreme cold and heat generate challenging growing conditions for the plants within the glade. Many trees within the volcanic bedrock glade are stressed, and canopy mortality is prevalent. Snags and coarse woody debris are common.



Banksi glade volcanic bedrock glade delineated in yellow on 2022 imagery.

The glade is characterized by a scattered and stunted overstory (10-25%) with diverse composition. The canopy is dominated by jack pine and other canopy associates including white spruce (*Picea glauca*), white pine (*Pinus strobus*), northern white-cedar (*Thuja occidentalis*), paper birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*), and balsam fir (*Abies balsamea*). Infrequent red pines (*Pinus resinosa*) occur in the western portion of the glade. Canopy trees typically range in diameter from 20 to 50 cm. The understory is sparse (2-5%) with characteristic species including serviceberries (*Amelanchier sanguinea* and *A. interior*), balsam fir, quaking aspen, prairie willow (*Salix humilis*), choke cherry (*Prunus virginiana*), and jack pine. The low shrub layer is diverse and patchy to dense (40-60%) with common species including common juniper (*Juniperus communis*), creeping juniper (*J. horizontalis*), bearberry (*Arctostaphylos uva-ursi*), low sweet blueberry (*Vaccinium angustifolium*), prairie willow, bush-honeysuckle (*Diervilla lonicera*), choke cherry, soapberry (*Shepherdia canadensis*), thimbleberry (*Rubus parviflorus*), and mountain-ash (*Sorbus decora*).

The ground cover ranges from patchy to locally dense (20-40%). Herbaceous species are concentrated where soils have accumulated along cracks, crevices, and depressions in the volcanic bedrock. A diverse array of lichens and mosses cover the exposed Portage Lake Volcanics within the volcanic bedrock glade. Characteristic non-vascular species observed within the glade include reindeer lichens (*Cladonia mitis* and *C. rangiferina*) and feather moss (*Pleurozium schreberi*). Lichen cover is locally deep (over 15 cm deep in places). Prevalent ground cover species include poverty grass (*Danthonia spicata*), American rock-brake (*Cryptogramma acrostichoides*, State Threatened), harebell (*Campanula rotundifolia*), pale corydalis (*Capnoides sempervirens*), common polypody (*Polypodium virginianum*), rusty woodsia (*Woodsia ilvensis*), rough-leaved rice-grass (*Oryzopsis asperifolia*), geocaulon (*Geocaulon lividum*), hair grass (*Avenella flexuosa*), bastard-toadflax (*Comandra umbellata*), small pussytoes (*Antennaria howellii*), northern hawkweed (*Hieracium umbellatum*), and pearly everlasting (*Anaphalis margaritacea*). Herbaceous species typical of boreal forests are common within the glade in areas of partial canopy and include Canada mayflower (*Maianthemum canadense*), bunchberry



Banksi Glade volcanic bedrock glade. Photo by Joshua G. Cohen.

(*Cornus canadensis*), big-leaved aster (*Eurybia macrophylla*), cow-wheat (*Melampyrum lineare*), and twinflower (*Linnaea borealis*).

Additional rare species documented within the glade include ram's head lady-slipper (*Cypripedium arietinum*, State Special Concern), northern paintbrush (*Castilleja septentrionalis*, State Threatened), dwarf bilberry (*Vaccinium cespitosum*, State Threatened), and fragrant woodfern (*Dryopteris fragrans*, State Special Concern).

The Banksi Glade volcanic bedrock glade was surveyed August 10, 2024, and August 18, 2025. Ninety plant species were documented with 86 native species and 4 non-native species. The total FQI was 49.3 and the total mean C value was 5.2.

Threats: Species composition and structure are patterned by natural processes. Non-natives occur infrequently. Mullein (*Verbascum thapsus*) was noted locally within the western portion of the glade. Additional non-native species include yellow hawkweed (*Hieracium piloselloides*), sheep sorrel (*Rumex acetosella*), and Canada bluegrass (*Poa compressa*).

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and to maintain a natural buffer surrounding the glades to prevent the increase of a weedy seed source. The glades should be periodically monitored for invasive species infestations.



The Banksi Glade volcanic bedrock glade is characterized by irregular bedrock, diverse canopy composition, dense low shrubs, and a deep lichens. Photo by Jesse M. Lincoln.



Banksi Glade volcanic bedrock glade. Photos by Jesee M. Lincoln (above) and Joshua G. Cohen (below).



26. The Glade Coast
Natural Community Type: Volcanic Bedrock Glade
Rank: GU S2, uncertain globally and imperiled within the state
Element Occurrence Rank: A
Size: 506 acres (205 hectares)
Element Occurrence Identification Number: 27875

Site Description: This extensive volcanic bedrock glade occurs along the south-central portion of Isle Royale with glade spanning over three miles from Blueberry Cove to north of Schooner Island. The glade occurs inland from volcanic bedrock lakeshore, occurs intermixed with uneven-aged boreal forest, and occurs south of inland lakes and harbors including Lake Whittlesey, Siskiwit Lake, Chippewa Harbor, and Otter Lake. The glade has moderate to very steep topography and is locally terraced with lower glade adjacent to the volcanic bedrock lakeshore and upper glade occurring along the interior ridgeline, often above small exposures of volcanic cliff escarpments. The lower bedrock slope is approximately 30 m above Lake Superior. The second slope feature rises to about 50 m above the lake in a complex series of extensive exposed bedrock interrupted by dramatic cracks, forming complex structures of varying contiguity. Boreal forest occurs within these seams between the exposed bedrock. Numerous beaver-influenced wetlands (including poor fen and northern wet meadow) occur nested within the glade and beaver herbivory is common along the margins of the glade and these wetlands.

There are subtle floristic distinctions between the lower and upper band of glade driven by proximity to Lake Superior and elevation. The upper glade is characterized by increased importance of canopy white spruce (*Picea glauca*), paper birch (*Betula papyrifera*), and quaking aspen (*Populus tremuloides*), and jack pine (*Pinus banksiana*) is more prevalent in the lower glade. Canopy jack pine was noted to be semi-serotinous with cones opening due to high summer temperatures generated on the exposed bedrock.



The Glade Coast volcanic bedrock glade delineated in yellow on 2022 imagery.

The site is influenced by numerous factors, including drought from shallow soils associated with the steep sloping bedrock; extreme storms throughout the year; periodic fire from lightning strike; summer fog with especially high humidity closer to the lake, which allows for accumulation of deep reindeer lichens (*Cladonia* spp.); erosion on steep slopes preventing soil development; and moose and hare browse. Fire has likely been an important disturbance factor within the volcanic bedrock glade, and charring was noted on stumps and charcoal was observed locally in the soil. A fire in 1936 was reported to have affected this area.

The soils of the volcanic bedrock glade are shallow (typically 0-5 cm) organics overlying volcanic bedrock and range from strongly acidic (pH 5.0-5.5) to slightly acidic (pH 6.0) with soil chemistry depending on the content of the decomposing organic matter. Soil development is restricted to cracks, fissures, and low depressions with significant portions of the glade being characterized by exposed volcanic bedrock.

The scattered and stunted trees and shrubs are persistently subject to drought, wind, and freezing. Extreme cold and heat generate challenging growing conditions for the plants within the glade. Many trees within the volcanic bedrock glade are stressed, and canopy mortality is prevalent. Snags and coarse woody debris are common. Numerous jack pine snags were noted throughout the glade.

The canopy cohort of the glade is uneven-aged. Numerous canopy trees were cored across the glade with estimated ring counts ranging from 37 to 160. Cored canopy trees included jack pine, quaking aspen, and white spruce: a 16 cm jack pine was cored and estimated to be 170 years old (160 ring count); a 17.4 cm quaking aspen was cored and estimated to be 60 years old (56 ring count); and a 12.3 cm white spruce was cored and estimated to be over 43 years old (37 ring count).

The glade is characterized by a scattered and stunted overstory (5-25%) with diverse canopy composition including white spruce, jack pine, and paper birch. Less frequent canopy associates include northern white-cedar (*Thuja occidentalis*) and quaking aspen. Canopy trees typically range in diameter from 15 to 30 cm with some scattered jack pine, northern white-cedar, and white spruce ranging from 30 to 50 cm. Jack pine is locally dominant in the canopy, especially closer to the lakeshore and in more exposed sections of the glade. Quaking aspen, paper birch, balsam fir (*Abies balsamea*), white spruce, pin cherry (*Prunus pensylvanica*), northern white-cedar, and mountain-ash (*Sorbus decora*) occur in the boreal forest seams that occupy the large cracks between bedrock plates.



The Glade Coast volcanic bedrock glade. Photo by Jesse M. Lincoln

The understory of the volcanic bedrock glade is sparse (2-15%) with characteristic species including white spruce, jack pine, mountain-ash, paper birch, quaking aspen, balsam fir, and prairie willow (*Salix humilis*). The low shrub layer is patchy (10-25%) to locally dense (30-60%) with abundances of the various species shifting dramatically from infrequent to common across the glade. Common species include low sweet blueberry (*Vaccinium angustifolium*), common juniper (*Juniperus communis*), bearberry (*Arctostaphylos uva-ursi*), serviceberries (*Amelanchier* spp.), wild red raspberry (*Rubus strigosus*), wild rose (*Rosa acicularis*), bush-honeysuckle (*Diervilla lonicera*), thimbleberry (*Rubus parviflorus*), pin cherry, sand cherry (*Prunus pumilis*), soapberry (*Shepherdia canadensis*), creeping juniper (*J. horizontalis*), staghorn sumac (*Rhus typhina*), and squashberry (*Viburnum edule*, State Threatened). Tree seedlings occurring within the low shrub layer include white spruce, balsam fir, and paper birch. Bearberry, common juniper, creeping juniper, and low sweet blueberry are most prevalent along the zones of exposed bedrock. Prairie willow, bush-honeysuckle, bunchberry (*Cornus canadensis*), and soapberry are generally more frequent in the cracks and fissures between exposed bedrock where soil accumulates locally.

The ground cover ranges from sparse to patchy (10-30%) to patchy to locally dense (30-60%). Herbaceous species are concentrated where soils have accumulated along cracks, crevices, and depressions in the volcanic bedrock. A diverse array of lichens and mosses cover the exposed bedrock. Characteristic non-vascular species observed within the glade include reindeer lichens (*Cladonia mitis* and *C. rangiferina*) and feather moss (*Pleurozium schreberi*). Prevalent graminoids include hair grass (*Avenella flexuosa*), poverty grass (*Danthonia spicata*), ticklegrass (*Agrostis scabra*), western fescue (*Festuca occidentalis*), and rice-grass (*Pipatherum pungens*), with slender wheatgrass (*Elymus trachycaulus*) and rough-leaved rice-grass (*Oryzopsis asperifolia*) in the protected cracks between openings. Ferns and fern allies are common throughout the glade and include rusty woodsia (*Woodsia ilvensis*), American rock-brake (*Cryptogramma acrostichoides*, State Threatened), common polypody (*Polypodium virginianum*), and sand club moss (*Selaginella rupestris*). Bracken fern (*Pteridium aquilinum*) increases in importance as the canopy cover increases. Characteristic flowering plants include three-toothed cinquefoil (*Sibbaldiopsis tridentata*), pale corydalis (*Capnoides sempervirens*), wild strawberry (*Fragaria virginiana*), white lettuce (*Prenanthes alba*), bristly sarsaparilla (*Aralia hispida*), bastard-toadflax (*Comandra umbellata*), early saxifrage (*Micranthes virginiensis*), spreading dogbane (*Apocynum androsaemifolium*), yarrow (*Achillea millefolium*), goldenrods (*Solidago juncea* and *S. nemoralis*), harebell (*Campanula rotundifolia*), pearly everlasting (*Anaphalis margaritacea*), and fireweed (*Chamaenerion angustifolium*). Herbaceous species typical of boreal forests are common within the glade in areas of partial canopy and include Canada



The Glade Coast volcanic bedrock glade. Photo by Joshua G. Cohen.

mayflower (*Maianthemum canadense*), bunchberry (*Cornus canadensis*), big-leaved aster (*Eurybia macrophylla*), cow-wheat (*Melampyrum lineare*), northern hawkweed (*Hieracium umbellatum*), northern heart-leaved aster (*Symphyotrichum ciliolatum*), bracken fern, wood lily (*Lilium philadelphicum*), and barren-strawberry (*Geum fragarioides*). Seams within the glade that hold moisture and accumulate organic soils occur locally and are characterized by strings of wetland vegetation such as blue-joint (*Calamagrostis canadensis*) and mountain alder (*Alnus viridis*).

Rare plant species documented within the volcanic bedrock glade include American rock-brake, prairie buttercup (*Ranunculus rhomboideus*, State Threatened), northern paintbrush (*Castilleja septentrionalis*, State Threatened), and squashberry (*Viburnum edule*, State Threatened).

The Glade Coast volcanic bedrock glade was surveyed August 15, August 16, and August 17, 2024, and August 4, 2025. Ninety-three plant species were documented with 87 native species and 6 non-native species. The total FQI was 46.3 and the total mean C value was 4.8.

Threats: Species composition and structure are patterned by natural processes. Scattered non-native species occur infrequently and include hawkweeds (*Hieracium* spp), common St. John's-wort (*Hypericum perforatum*), hop clover (*Trifolium aureum*), and red clover (*T. pratense*).

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and to maintain a natural buffer surrounding the glades to prevent the increase of a weedy seed source. The glades should be periodically monitored for invasive species infestations.



The Glade Coast volcanic bedrock glade is characterized by a diverse ground cover. Herbaceous species are concentrated where soils have accumulated along cracks, crevices, and depressions in the volcanic bedrock. A diverse array of lichens and mosses cover the exposed bedrock. Photo by Jesse M. Lincoln.



The Glade Coast represents Michigan's largest and highest-quality example of volcanic bedrock glade. Photo by Joshua G. Cohen.



Numerous rare plant species were documented within The Glade Coast volcanic bedrock glade including American rock-brake, prairie buttercup (*Ranunculus rhomboideus*, State Threatened) (pictured above), northern paintbrush (*Castilleja septentrionalis*, State Threatened), and squashberry (*Viburnum edule,* State Threatened). Photo by Joshua G. Cohen.

27. Glade of Ages
Natural Community Type: Volcanic Bedrock Glade
Rank: GU S2, uncertain globally and imperiled within the state
Element Occurrence Rank: B
Size: 2.7 acres (1.1 hectares)
Element Occurrence Identification Number: 28350

Site Description: This small pocket of volcanic bedrock glade occurs along small unnamed peninsula along the northwestern shore of Isle Royale. The Rock of Ages Lighthouse is visible from this peninsula. The glade occurs adjacent to high-quality volcanic bedrock lakeshore to the south and west and volcanic lakeshore cliff to the north. The shoreline systems are backed on the landward side by boreal forest. The soils of the volcanic bedrock glade are shallow (typically 0-2 cm), acidic (pH 6.0-6.5) organics and loams overlying basalt. This glade and the adjacent bedrock lakeshore comprise the westernmost exposure of the Minong Flow, an extensive geologic feature that forms the backbone of the Minong Ridge on the northwestern portion of the island. The Minong Flow is part of the Portage Lake Volcanics and composed of dark-colored basalt. Soil chemistry is variable and depends on the local composition of decomposing plant and organic material. Soil development is restricted to cracks, fissures, and depressions with scattered portions of the glade being characterized by exposed volcanic bedrock. Shallow soils over bedrock, herbivory, and windthrow have contributed to the open physiognomy of the volcanic bedrock glade. Moose browse on balsam fir (*Abies balsamea*) was noted within the glade. A 21.6 cm northern white-cedar (*Thuja occidentalis*) was cored and estimated to be over 225 years old (111 growth rings on 5 cm of a partial core). We surveyed the glade following a severe rain event and noticed an area of intermittent seepage that flowed from the glade to the adjacent volcanic bedrock lakeshore. Blue-joint (*Calamagrostis canadensis*) was locally common within this wet area.



Glade of Ages volcanic bedrock glade delineated in yellow on 2022 imagery.

The glade is characterized by a scattered and stunted overstory (5-10%) with northern white-cedar and white spruce (*Picea glauca*). Canopy trees typically range in DBH from 10 to 30 cm. The understory is sparse (5-10%) with characteristic species including white spruce, northern white-cedar, pin cherry (*Prunus pensylvanica*), paper birch (*Betula papyrifera*), and balsam fir. The low shrub layer is diverse and patchy to dense (50-80%) with common species including common juniper (*Juniperus communis*), bearberry (*Arctostaphylos uva-ursi*), low sweet blueberry (*Vaccinium angustifolium*), Canada blueberry (*V. myrtilloides*), bush-honeysuckle (*Diervilla lonicera*), creeping juniper (*J. horizontalis*), shrubby cinquefoil (*Dasiphora fruticosa*), serviceberries (*Amelanchier bartramiana* and *A. sanguinea*), wild red raspberry (*Rubus strigosus*), wild rose (*Rosa acicularis*), pin cherry, and mountain-ash (*Sorbus decora*).

The ground cover ranges from patchy to locally dense (30-50%). Prevalent ground cover species include poverty grass (*Danthonia spicata*), geocaulon (*Geocaulon lividum*), yarrow (*Achillea millefolium*), hair grass (*Deschampsia cespitosa*), pale corydalis (*Capnoides sempervirens*), wild sarsaparilla (*Aralia nudicaulis*), hair grass (*Avenella flexuosa*), fireweed (*Chamaenerion angustifolium*), big-leaved aster (*Eurybia macrophylla*), wild strawberry (*Fragaria virginiana*), twinflower (*Linnaea borealis*), bunchberry (*Cornus canadensis*), common polypody (*Polypodium virginianum*), rough-leaved rice-grass (*Oryzopsis asperifolia*), cow-wheat (*Melampyrum lineare*), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), Canada mayflower (*Maianthemum canadense*), rusty woodsia (*Woodsia ilvensis*), and harebell (*Campanula rotundifolia*). Blue-joint occurs locally in wet areas within the glade. Downy oatgrass (*Trisetum spicatum*, State Special Concern) occurs locally within the glade but is more abundant within the adjacent volcanic lakeshore cliff and volcanic bedrock lakeshore.

The Glade of Ages volcanic bedrock glade was surveyed August 9, 2025. Forty-two plant species were documented, and no non-native species were recorded. The total FQI was 34.3 and the total mean C value was 5.3.

Threats: Species composition and structure are patterned by natural processes. No threats were observed during the surveys,

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and to maintain a natural buffer surrounding the glade to prevent the increase of a weedy seed source. The glade should be periodically monitored for invasive species infestations.



Glade of Ages volcanic bedrock glade. Photo by Joshua G. Cohen.

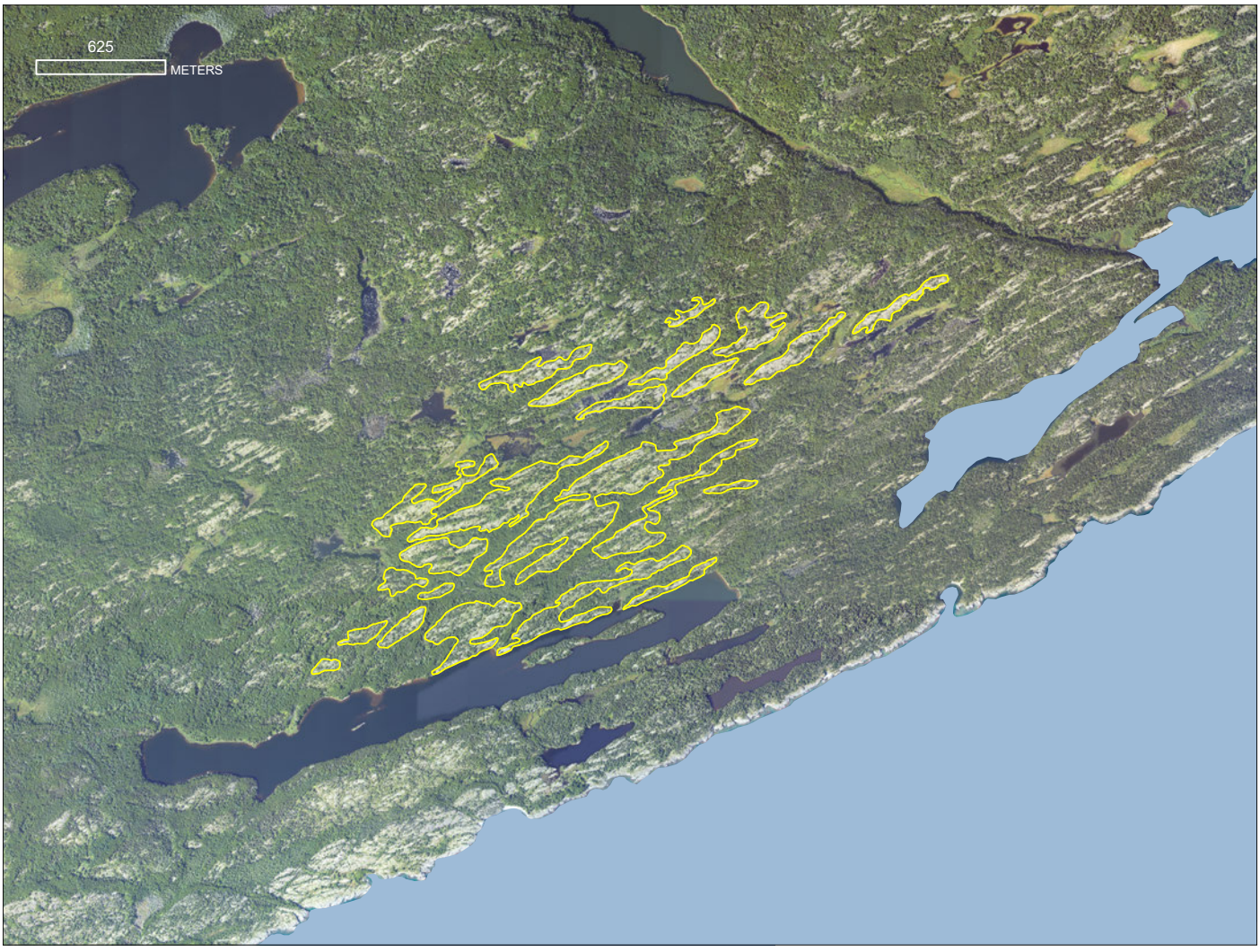


The Glade of Ages volcanic bedrock glade and the adjacent bedrock lakeshore comprise the westernmost exposure of the Minong Flow, an extensive geologic feature that forms the backbone of the Minong Ridge on the northwestern portion of Isle Royale. The Minong Flow is part of the Portage Lake Volcanics and composed of dark-colored basalt. Photos by Jesse M. Lincoln (above) and Joshua G. Cohen (below).



28. Lake Whittlesey
Natural Community Type: Volcanic Bedrock Glade
Rank: GU S2, uncertain globally and imperiled within the state
Element Occurrence Rank: A
Size: 235 acres (95 hectares)
Element Occurrence Identification Number: 27874

Site Description: This extensive volcanic bedrock glade occurs north of Lake Whittlesey. The glade occurs on sloping to moderate topography and is intermixed with recently burned boreal forest. Several beaver-influenced wetlands occur adjacent to the glade complex including poor fen, northern wet meadow, and rich conifer swamp. The soils of the volcanic bedrock glade are shallow (typically 0-5 cm) organics and loams overlying basalt and range from strongly acidic to slightly acidic (pH 5.5-6.5) with soil chemistry depending on the content of the decomposing organic matter. Soil development is restricted to cracks, fissures, and low depressions with significant portions of the glade being characterized by exposed volcanic bedrock. Shallow soils over bedrock, intense herbivory, periodic fire, and windthrow contribute to the open physiognomy of the volcanic bedrock glade. Wildfire occurred throughout this glade and adjacent boreal forest and based on tree ages within the glade and boreal forest, likely correspond to the 1936 wildfire. A lightning-struck jack pine (*Pinus banksiana*) was observed. Charring was noted on stumps throughout the glade, and charcoal was documented locally in the soil. Moose trails and pellets occur throughout the glade and boreal forest. Moose browse was noted up to 3 meters on understory balsam fir (*Abies balsamea*). Beaver-chewed quaking aspen (*Populus tremuloides*) and herbivory on understory saplings was also observed, especially along the margins of wetlands adjacent to the glade. Three canopy trees were cored across the glade: a 34 cm jack pine was cored and estimated to be over 64 years old (54 ring count); a 39.5 cm jack pine was cored and estimated to be over 66 years old (56 ring count); and a 45.8 cm jack pine was cored and estimated to be over 85 years old (75 ring count).



Lake Whittlesey volcanic bedrock glade delineated in yellow on 2022 imagery.

The scattered and stunted trees and shrubs are persistently exposed to drought, wind, and freezing. Extreme cold and heat generate very challenging growing conditions for the plants within the glade. Many trees within the volcanic bedrock glade are stressed, and canopy mortality is prevalent. Snags and coarse woody debris are common. A 39.5 cm white pine (*Pinus strobus*) snag was noted within the glade.

The glade is characterized by a scattered and stunted overstory (10-25%) with diverse canopy composition including white spruce (*Picea glauca*), jack pine, northern white-cedar (*Thuja occidentalis*), paper birch (*Betula papyrifera*), balsam fir, quaking aspen, white pine, red pine (*P. resinosa*), and red maple (*Acer rubrum*). There are subtle floristic distinctions between the higher-elevation and lower-elevation glade with the higher elevation glade typically exhibiting more open physiognomy and having more canopy pines. Canopy trees typically range in diameter from 10 to 30 cm. The understory is also sparse (5-20%) with characteristic species including white spruce, jack pine, paper birch, northern white-cedar, quaking aspen, red pine, pin cherry (*Prunus pensylvanica*), prairie willow (*Salix humilis*), and mountain alder (*Alnus viridis*). The low shrub layer is diverse and patchy to dense (30-50%) with common species including low sweet blueberry (*Vaccinium angustifolium*), common juniper (*Juniperus communis*), bearberry (*Arctostaphylos uva-ursi*), wild rose (*Rosa acicularis*), bush-honeysuckle (*Diervilla lonicera*), thimbleberry (*Rubus parviflorus*), mountain-ash (*Sorbus decora*), soapberry (*Shepherdia canadensis*), choke cherry (*Prunus virginiana*), staghorn sumac (*Rhus typhina*), mountain alder, and sweet gale (*Myrica gale*).

The ground cover ranges from sparse to patchy (10-30%) to patchy to locally dense (30-50%). Herbaceous species are concentrated where soils have accumulated along cracks, crevices, and depressions in the volcanic bedrock. A diverse array of lichens and mosses cover the exposed Portage Lake Volcanics within the volcanic bedrock glade. Characteristic non-vascular species observed within the glade include reindeer lichens (*Cladonia mitis* and *C. rangiferina*) and feather



Lake Whittlesey volcanic bedrock glade. Photo by Joshua G. Cohen.

moss (*Pleurozium schreberi*). Prevalent ground cover species include poverty grass (*Danthonia spicata*), harebell (*Campanula rotundifolia*), big-leaved aster (*Eurybia macrophylla*), rough-leaved rice-grass (*Oryzopsis asperifolia*), cow-wheat (*Melampyrum lineare*), pearly everlasting (*Anaphalis margaritacea*), common polypody (*Polypodium virginianum*), twinflower (*Linnaea borealis*), bunchberry (*Cornus canadensis*), wild sarsaparilla (*Aralia nudicaulis*), bluebead-lily (*Clintonia borealis*), American rock-brake (*Cryptogramma acrostichoides,* State Threatened), hair grass (*Avenella flexuosa*), bracken fern (*Pteridium aquilinum*), bastard-toadflax (*Comandra umbellata*), wild columbine (*Aquilegia canadensis*), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), and white lettuce (*Prenanthes alba*). Rare species documented within the volcanic bedrock glade include American rock-brake, northern paintbrush (*Castilleja septentrionalis*, State Threatened), and northern gooseberry (*Ribes oxyacanthoides,* State Special Concern).



Lake Whittlesey volcanic bedrock glade. Photos by Joshua G. Cohen.



The Lake Whittlesey volcanic bedrock glade was surveyed August 14, 2024. One hundred and seven plant species were documented with 102 native species and 5 non-native species. The total FQI was 50.7 and the total mean C value was 4.9.

Threats: Species composition and structure are patterned by natural processes. Non-natives occur infrequently and include common goat's beard (*Tragopogon pratensis*), hop clover (*Trifolium aureum*), yellow hawkweed (*Hieracium piloselloides*), orange hawkweed (*Hieracium aurantiacum*), and Canada bluegrass (*Poa compressa*).

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and to maintain a natural buffer surrounding the glades to prevent the increase of a weedy seed source. The glades should be periodically monitored for invasive species infestations.

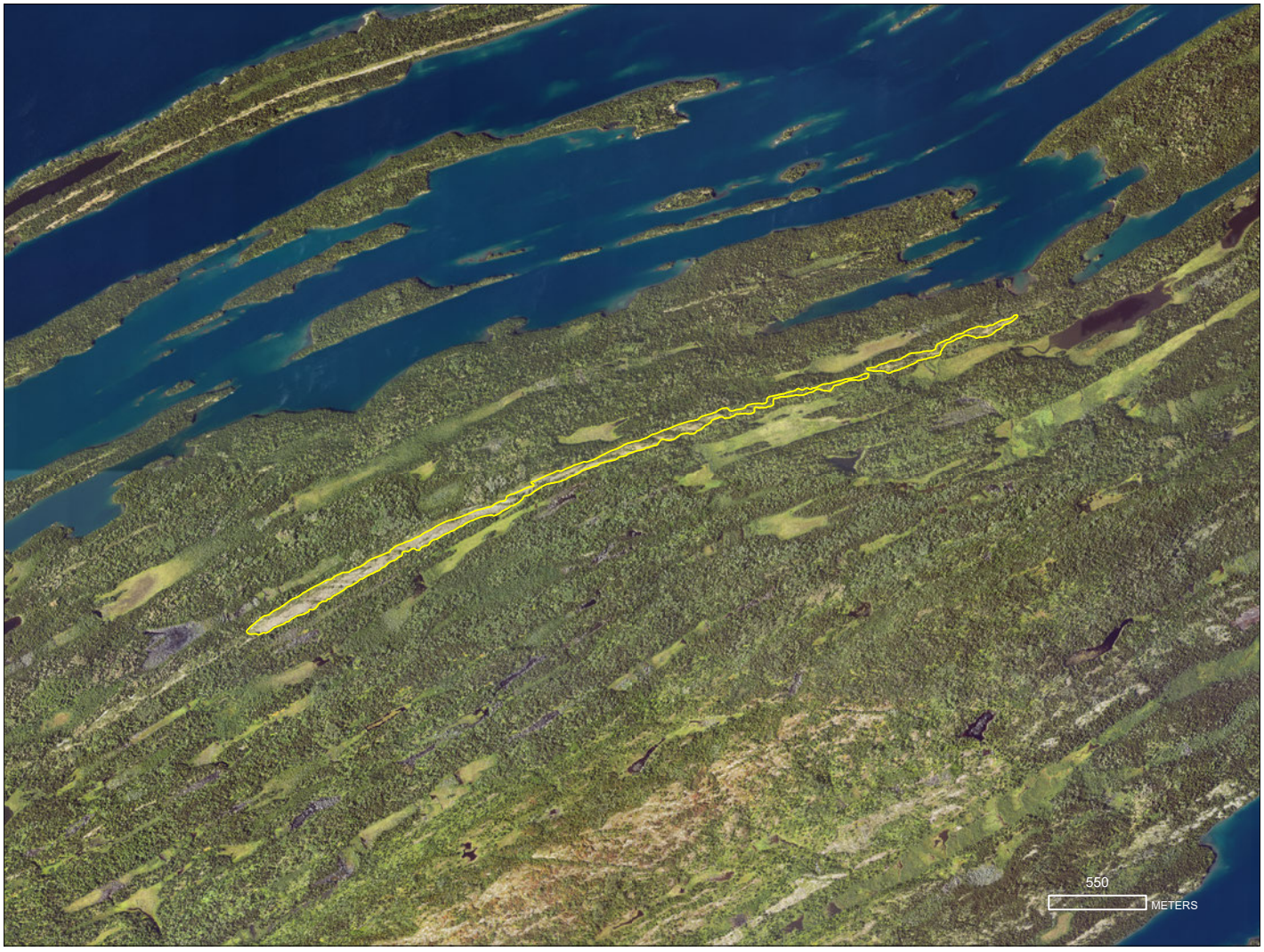


Moose browse was noted on multiple species including prairie willow (*Salix humilis*) (pictured above), balsam fir (*Abies balsamea*), beaked hazelnut (*Corylus cornuta*), paper birch (*Betula papyrifera*), yew (*Taxus canadensis*), white pine (*Pinus strobus*), and serviceberries (*Amelanchier* spp.). Photo by Joshua G. Cohen.

29. Lane Cove
Natural Community Type: Volcanic Bedrock Glade
Rank: GU S2, uncertain globally and imperiled within the state
Element Occurrence Rank: B
Size: 60 acres (24 hectares)
Element Occurrence Identification Number: 28333

Site Description:
The Lane Cove volcanic bedrock glade occurs west of Lane Cove along a ridgeline and runs for just under 3 miles. The glade occurs in a matrix of boreal forest with some pockets of dry-mesic northern forest. The glade slopes gently down to boreal forest and dry-mesic northern forest on the south side with extensive wetlands further south including poor fen, northern wet meadow, and poor conifer swamp. To the north of the glade is a steep volcanic cliff escarpment. Boreal forest and northern wet meadow also occur to the north of the glade. Moose scat and trails are scattered throughout the glade, and moose herbivory is especially prevalent on balsam fir (*Abies balsamea*), willows (*Salix* spp.), cherries (*Prunus* spp.), and black hawthorn (*Crataegus douglasii,* State Special Concern).

The soils of the volcanic bedrock glade are shallow (typically 2-5 cm), acidic (pH 5.5-6.5) organics and loams overlying volcanic bedrock. Soil chemistry is variable and depends on the local composition of decomposing plant and organic material (e.g., needle cast from pines locally increases the soil acidity). Soil development is restricted to cracks, fissures, and depressions with scattered portions of the glade being characterized by exposed volcanic bedrock. Shallow soils over bedrock, herbivory, periodic fire, and windthrow contribute to the open physiognomy of the volcanic bedrock glade. The western portion of the glade burned around 30 to 40 years ago and was likely the result of a lightning strike. Several lightning-struck red pine (*Pinus resinosa*) and white pine (*P. strobus*) were recorded. In the unburned area, a 55 cm red



Lane Cove volcanic bedrock glade delineated in yellow on 2022 imagery.

pine was cored and 143 growth rings were counted; a cm jack pine was cored and 128 growth rings were counted; a 60 cm red pine was cored and 63 growth rings were counted; and a 38 cm red pine was cored and 125 growth rings were counted. In the burned area, a 17 cm jack pine (*P. banksiana*) was cored and 26 growth rings were counted. Snags and coarse woody debris are common throughout areas impacted by wildfire. Treed drains and ravines occur within the glade and support boreal forest. These cooler forested inclusions provide shade and travel corridors for moose.

The scattered and stunted overstory of the glade varies from 0 to 5% cover in areas that burned and 5 to 25% cover in areas that did not burn. The canopy composition is diverse with dominant overstory trees including jack pine, white spruce (*Picea glauca*), quaking aspen (*Populus tremuloides*), northern white-cedar (*Thuja occidentalis*), white pine, and red pine. In unburned areas, canopy trees typically range in diameter from 20 to 50 cm, with scattered red and white pine reaching over 60 cm and becoming more prevalent in the canopy. Within the burned areas, canopy trees typically range in diameter from 10 to 20 cm.

The understory is sparse (5-15%) with characteristic species including serviceberries (*Amelanchier sanguinea* and *A. spicata*), beaked hazelnut (*Corylus cornuta*), choke cherry (*Prunus virginiana*), pin cherry (*Prunus pensylvanica*), staghorn sumac (*Rhus typhina*), and black hawthorn, which is locally common in the western portion of the glade along the lower slopes. The diverse low shrub layer is patchy to dense (40-60%) with common species including common juniper (*Juniperus communis*), serviceberries, choke cherry, bearberry (*Arctostaphylos uva-ursi*), bush-honeysuckle (*Diervilla lonicera*), wild rose (*Rosa acicularis*), snowberry, low sweet blueberry (*Vaccinium angustifolium*), Canada blueberry (*V. myrtilloides*), creeping juniper (*J. horizontalis*), New Jersey tea (*Ceanothus herbaceus*), soapberry (*Shepherdia canadensis*), squashberry (*Viburnum edule*, State Threatened), and staghorn sumac. New Jersey tea is locally common on southerly facing lower slopes and common juniper is abundant in areas of talus and unburned glade.



Lane Cove volcanic bedrock glade. Photo by Joshua G. Cohen.

The ground cover ranges from patchy to locally dense (30-65%). Herbaceous species are concentrated where soils have accumulated along cracks, crevices, and depressions in the volcanic bedrock. A diverse array of lichens and mosses cover the exposed bedrock. Characteristic non-vascular species observed within the glade include reindeer lichens (*Cladonia mitis* and *C. rangiferina*) and feather moss (*Pleurozium schreberi*). Prevalent ground cover species include pale corydalis (*Capnoides sempervirens*), hair grass (*Avenella flexuosa*), poverty grass (*Danthonia spicata*), small pussytoes (*Antennaria howellii*), rough-leaved rice-grass (*Oryzopsis asperifolia*), pearly everlasting (*Anaphalis margaritacea*), wild columbine (*Aquilegia canadensis*), early saxifrage (*Micranthes virginiensis*), prairie cinquefoil (*Drymocallis arguta*), harebell (*Campanula rotundifolia*), wormwood (*Artemisia campestris*), wild strawberry (*Fragaria virginiana*), prairie buttercup (*Ranunculus rhomboideus*, State Threatened), and American rock-brake (*Cryptogramma acrostichoides*, State Threatened). Ram's head lady-slipper (*Cypripedium arietinum*, State Special Concern) was documented along a draw between two of the glade exposures. Herbaceous species typical of boreal forests are common within the glade in areas of partial canopy and include Canada mayflower (*Maianthemum canadense*), bunchberry (*Cornus canadensis*), big-leaved aster (*Eurybia macrophylla*), wild sarsaparilla (*Aralia nudicaulis*), twinflower (*Linnaea borealis*), and pipsissewa (*Chimaphila umbellata*). Common polypody (*Polypodium virginianum*) is locally common in area of talus and along the escarpment that runs along the northern margin of the glade.

The Lane Cove volcanic bedrock glade was surveyed June 7 and June 8, 2025. Seventy plant species were documented with 65 native species and 5 non-native species. The total FQI was 41.0 and the total mean C value was 4.9.



Lane Cove volcanic bedrock glade. Photo by Joshua G. Cohen.

Threats: Species composition and structure are largely patterned by natural processes. However, the recent fire in the western portion of the glade has resulted in a pulse of non-native species including common goat's beard (*Tragopogon pratensis*), common mullein (*Verbascum thapsus*), hemp-nettle (*Galeopsis tetrahit*), common St. John's-wort (*Hypericum perforatum*), invasive hawkweeds (*Hieracium* spp.), and Canada bluegrass (*Poa compressa*).

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and to maintain a natural buffer surrounding the glades to prevent the increase of a weedy seed source. The glades should be periodically monitored for invasive species infestations.



Flowering black hawthorn (*Crataegus douglasii*, State Special Concern). Photo by Joshua G. Cohen.

30. Malone Bay
Natural Community Type: Volcanic Bedrock Glade
Rank: GU S2, uncertain globally and imperiled within the state
Element Occurrence Rank: BC
Size: 36 acres (15 hectares)
Element Occurrence Identification Number: 28339

Site Description: Volcanic bedrock glade occurs between Malone Bay and Siskiwit Lake just northwest of Hat Island. The glade occurs intermixed with boreal forest on moderate to rugged topography and locally slopes down to volcanic bedrock lakeshore along Malone Bay. The soils of the volcanic bedrock glade are shallow (typically 2-5 cm), acidic (pH 5.5-6.0) organics and loams overlying basalt. Soil chemistry is likely linked to the decomposition of the local organic material. Soil development is restricted to cracks, fissures, and low depressions with significant portions of the glade being characterized by exposed volcanic bedrock. Shallow soils over bedrock, herbivory, periodic fire, and windthrow contribute to the open physiognomy of the volcanic bedrock glade. A 51.3 cm jack pine (*Pinus banksiana*) was cored and estimated to be over 190 years old.

The glade is characterized by a scattered and stunted overstory (5-10%) with northern white-cedar (*Thuja occidentalis*), white spruce (*Picea glauca*), paper birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*), and jack pine. Canopy trees typically range in diameter from 20 to 50 cm. The understory is sparse to patchy (5-15%) with characteristic species including white spruce, northern white-cedar, paper birch (*Betula papyrifera*), mountain alder (*Alnus viridis*), quaking aspen, and serviceberries (*Amelanchier interior, A. sanguinea,* and *A. spicata*). The low shrub layer is diverse and patchy to dense (20-40%) with common species including common juniper (*Juniperus communis*), bearberry (*Arctostaphylos*



Malone Bay volcanic bedrock glade delineated in yellow on 2022 imagery.

uva-ursi), low sweet blueberry (*Vaccinium angustifolium*), wild rose (*Rosa acicularis*), serviceberries, thimbleberry (*Rubus parviflorus*), bush-honeysuckle (*Diervilla lonicera*), mountain-ash (*Sorbus decora*), squashberry (*Viburnum edule*, State Threatened), and prairie willow (*Salix humilis*).

The ground cover ranges from patchy to locally dense (40-60%). Herbaceous species are concentrated where soils have accumulated along cracks, crevices, and depressions in the volcanic bedrock. A diverse array of lichens and mosses cover the exposed bedrock. Characteristic non-vascular species observed within the glade include reindeer lichens (*Cladonia mitis* and *C. rangiferina*) and feather moss (*Pleurozium schreberi*). Lichen cover is locally deep (over 15 cm deep in places). Prevalent ground cover species include poverty grass (*Danthonia spicata*), harebell (*Campanula rotundifolia*), goldenrods (*Solidago juncea* and *S. nemoralis*), yarrow (*Achillea millefolium*), pale corydalis (*Capnoides sempervirens*), early saxifrage (*Micranthes virginiensis*), geocaulon (*Geocaulon lividum*), prairie cinquefoil (*Drymocallis arguta*), rough cinquefoil (*Potentilla norvegica*), wild strawberry (*Fragaria virginiana*), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), wild columbine (*Aquilegia canadensis*), hair grass (*Avenella flexuosa*), slender wheatgrass (*Elymus trachycaulus*), big-leaved aster (*Eurybia macrophylla*), ticklegrass (*Agrostis scabra*), pearly everlasting (*Anaphalis margaritacea*), and rough-leaved rice-grass (*Oryzopsis asperifolia*). Blue-joint (*Calamagrostis canadensis*) and mountain alder occur within depressions within the glade.

Rare species documented within the volcanic bedrock glade include American rock-brake (*Cryptogramma acrostichoides*, State Threatened), prairie buttercup (*Ranunculus rhomboideus*, State Threatened), and squashberry.

The Malone Bay volcanic bedrock glade was surveyed August 5, 2025. Seventy-nine plant species were documented with 71 native species and 8 non-native species. The total FQI was 42.1 and the total mean C value was 4.5.

Threats: Species composition and structure are patterned by natural processes. Non-natives are locally common within the glade, typically closer to the shoreline where there appears to be some foot traffic, and include mouse-ear chickweed (*Cerastium fontanum*), bull thistle (*Cirsium vulgare*), yellow hawkweed (*Hieracium caespitosum*), red clover (*Trifolium pratense*), Timothy (*Phleum pratense*), Canada bluegrass (*Poa compressa*), and Kentucky bluegrass (*Poa pratensis*).

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and to maintain a natural buffer surrounding the glades to prevent the increase of a weedy seed source. The glades should be periodically monitored for invasive species infestations.



Malone Bay volcanic bedrock glade. Photo by Joshua G. Cohen.



American rock-brake (*Cryptogramma acrostichoides*, State Threatened) was documented throughout the Malone Bay volcanic bedrock glade. Photo by Joshua G. Cohen.



Malone Bay volcanic bedrock glade. Photo by Joshua G. Cohen.

31. Moose Lake
Natural Community Type: Volcanic Bedrock Glade
Rank: GU S2, uncertain globally and imperiled within the state
Element Occurrence Rank: C
Size: 21 acres (8.5 hectares)
Element Occurrence Identification Number: 28367

Site Description: The Moose Lake volcanic bedrock glade occurs northeast of Moose Lake and North of Tobin Harbor. The glade occurs in six distinct polygons that span a mile-long stretch and is characterized by moderate to rugged topography that slopes down to Tobin Harbor. The glade is embedded in a matrix of boreal forest. The soils of the volcanic bedrock glade are shallow (typically 0-5 cm), acidic (pH 5.0-6.5) organics and loams overlying Portage Lake Volcanic basalt. Soil chemistry is variable and depends on the local composition of decomposing plant and organic material (e.g., needle cast from pines locally increases the soil acidity). Soil development is restricted to cracks, fissures, and depressions with scattered portions of the glade being characterized by exposed volcanic bedrock. Shallow soils over bedrock, herbivory, and windthrow have contributed to the open physiognomy of the volcanic bedrock glade. A 33.7 cm jack pine (*Pinus banksiana*) was cored and estimated to be over 67 years old (57 growth rings counted).

The glade is characterized by a scattered and stunted overstory (5-10%) with jack pine, white spruce (*Picea glauca*), northern white-cedar (*Thuja occidentalis*), white pine (*Pinus strobus*), and paper birch (*Betula papyrifera*). Canopy trees typically range in diameter from 10 to 30 cm with some larger northern white-cedar and white pine reaching 40 to 60 cm. The understory is sparse (5-10%) with characteristic species including white spruce, white pine, paper birch, serviceberries (*Amelanchier spicata* and *A. sanguinea*), and prairie willow (*Salix humilis*). The low shrub layer is diverse



Moose Lake volcanic bedrock glade delineated in yellow on 2022 imagery.

and patchy to dense (40-60%) with common species including common juniper (*Juniperus communis*), bearberry (*Arctostaphylos uva-ursi*), low sweet blueberry (*Vaccinium angustifolium*), bush-honeysuckle (*Diervilla lonicera*), serviceberries, wild rose (*Rosa acicularis*), wild red raspberry (*Rubus strigosus*), thimbleberry (*Rubus parviflorus*), staghorn sumac (*Rhus typhina*), yew (*Taxus canadensis*), snowberry (*Symphoricarpos albus* var. *albus*), and seedling balsam fir (*Abies balsamea*), white spruce, white pine, and mountain-ash (*Sorbus decora*).

The ground cover ranges from patchy to locally dense (30-40%). Prevalent ground cover species include harebell (*Campanula rotundifolia*), pearly everlasting (*Anaphalis margaritacea*), geocaulon (*Geocaulon lividum*), pale corydalis (*Capnoides sempervirens*), American rock-brake (*Cryptogramma acrostichoides*, State Threatened), prairie buttercup (*Ranunculus rhomboideus*, State Threatened), early saxifrage (*Micranthes virginiensis*), prairie cinquefoil (*Drymocallis arguta*), wild strawberry (*Fragaria virginiana*), goldenrods (*Solidago hispida* and *S. simplex*), yarrow (*Achillea millefolium*), glaucous white lettuce (*Prenanthes racemosa*), field chickweed (*Cerastium arvense*), barren-strawberry (*Geum fragarioides*), slender wheatgrass (*Elymus trachycaulus*), fireweed (*Chamaenerion angustifolium*), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), hair grass (*Avenella flexuosa*), poverty grass (*Danthonia spicata*), rough-leaved rice-grass (*Oryzopsis asperifolia*), and common polypody (*Polypodium virginianum*). Blue-joint (*Calamagrostis canadensis*) occurs in depressions within the glades. Herbaceous species typical of boreal forests are common within the glade in areas of partial canopy and include Canada mayflower (*Maianthemum canadense*), twinflower (*Linnaea borealis*), big-leaved aster (*Eurybia macrophylla*), wild sarsaparilla (*Aralia nudicaulis*), and cow-wheat (*Melampyrum lineare*). A diverse array of lichens and mosses cover the exposed Portage Lake Volcanics within the volcanic bedrock glade. Characteristic non-vascular species observed within the glade include reindeer lichens (*Cladonia mitis* and *C. rangiferina*) and feather moss (*Pleurozium schreberi*).

The Moose Lake volcanic bedrock glade was surveyed August 19, 2025. Eighty plant species were documented with 73 native species and 7 non-native species. The total FQI was 41.1 and the total mean C value was 4.6.



Moose Lake volcanic bedrock glade. Photo by Joshua G. Cohen.

Threats: Species composition and structure are patterned by natural processes. Numerous non-native species occur locally within the volcanic bedrock glade, especially closer to the ridgeline where there is more moose traffic. Locally common non-natives include Canada bluegrass (*Poa compressa*), Kentucky bluegrass (*P. pratensis*), mouse-ear chickweed (*Cerastium fontanum*), orange hawkweed (*Hieracium aurantiacum*), yellow hawkweed (*Hieracium caespitosum*), sheep sorrel (*Rumex acetosella*), and common mullein (*Verbascum thapsus*).

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and to maintain a natural buffer surrounding the glades to prevent the increase of a weedy seed source. The glades should be periodically monitored for invasive species infestations.



The Moose Lake volcanic bedrock glade is characterized by deep reindeer lichens (*Cladonia mitis* and *C. rangiferina*) and scattered large diamter white pine (*Pinus strobus*). Photo by Joshua G. Cohen.

32. Moose Lightning
Natural Community Type: Volcanic Bedrock Glade
Rank: GU S2, uncertain globally and imperiled within the state
Element Occurrence Rank: B
Size: 22 acres (8.9 hectares)
Element Occurrence Identification Number: 28346

Site Description: Over a mile of volcanic bedrock glade in three distinct blocks occurs southwest of Huginnin Cove and south of McGinty Cove. The glade occurs in a matrix of boreal forest and is immediately adjacent to a north/northwest-facing volcanic cliff escarpment along the northern margin of the glade. The glade is characterized by rugged topography. At its apex, the adjacent cliff is over 30 meters tall and typically ranges from 13 to 20 meters along the glade's northern margin.

Shallow soils over bedrock, herbivory, periodic fire, and windthrow contribute to the open physiognomy of the volcanic bedrock glade. Moose scat, trails, and beds are scattered throughout the glade and moose herbivory is especially prevalent on balsam fir (*Abies balsamea*), white pine (*Pinus strobus*), and serviceberries (*Amelanchier* spp.). The soils of the volcanic bedrock glade are shallow (typically 2-5 cm), acidic (pH 5.0-6.0) organics and loams overlying basalt. Soil chemistry is variable and depends on the local composition of decomposing plant and organic material (e.g., needle cast from white pine locally increases the soil acidity). Soil development is restricted to cracks, fissures, and depressions with scattered portions of the glade being characterized by exposed volcanic bedrock. The glade is uneven-aged with scattered supercanopy old-growth white pine overtopping northern white-cedar (*Thuja occidentalis*), white spruce (*Picea glauca*), and younger white pine. Conifers were cored within the glade to gauge tree age: a 70.5 cm white pine was cored and estimated to be over 210 years old (200 growth rings counted); a 49.3 cm northern white-cedar was cored and estimated to be over 160 years old (153 growth rings counted); and a 47.3 cm white pine was cored and estimated to be over 70 years old (60 growth rings counted). Cedar and white pine snags and coarse woody debris are common throughout the glade. Char was noted locally on coarse woody debris indicating that wildfire has impacted the glade.



Moose Lightning volcanic bedrock glade delineated in yellow on 2022 imagery.

The glade is characterized by scattered supercanopy old-growth white pine overtopping northern white-cedar, white spruce, quaking aspen (*Populus tremuloides*), and younger white pine. Canopy closure ranges from 10 to 25% and canopy trees range from 20 to 40 cm with the supercanopy white pine ranging from 50 to 80 cm. The understory is sparse (10-20%) with characteristic species including serviceberries (*Amelanchier interior* and *A. spicata*), pin cherry (*Prunus pensylvanica*), northern white-cedar, white pine, balsam fir, mountain-ash (*Sorbus decora*), and choke cherry (*Prunus virginiana*). The low shrub layer is diverse and patchy to dense (40-50%) with common species including bush-honeysuckle (*Diervilla lonicera*), low sweet blueberry (*Vaccinium angustifolium*), Canada blueberry (*V. myrtilloides*), common juniper (*Juniperus communis*), serviceberries, bearberry (*Arctostaphylos uva-ursi*), wild rose (*Rosa acicularis*), thimbleberry (*Rubus parviflorus*), skunk currant (*Ribes glandulosum*), and wild red raspberry (*Rubus strigosus*).

The ground cover ranges from patchy to locally dense (40-60%). Herbaceous species are concentrated where soils have accumulated along cracks, crevices, and depressions in the volcanic bedrock. A diverse array of lichens and mosses cover the exposed bedrock. Characteristic non-vascular species observed within the glade include reindeer lichens (*Cladonia mitis* and *C. rangiferina*) and feather moss (*Pleurozium schreberi*). Lichen cover is locally deep (over 6 inches deep in places). Prevalent ground cover species include poverty grass (*Danthonia spicata*), geocaulon (*Geocaulon lividum*), pearly everlasting (*Anaphalis margaritacea*), fireweed (*Chamaenerion angustifolium*), bluegrass (*Poa glauca*), ticklegrass (*Agrostis scabra*), hair grass (*Avenella flexuosa*), common polypody (*Polypodium virginianum*), rough cinquefoil (*Potentilla norvegica*), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), and pale corydalis (*Capnoides sempervirens*). Blue-joint (*Calamagrostis canadensis*) occurs locally in depressions within the glade. Herbaceous species typical of boreal forests are common within the glade in areas of partial canopy and include Canada mayflower (*Maianthemum canadense*), cow-wheat (*Melampyrum lineare*), wood millet (*Milium effusum*), twinflower (*Linnaea borealis*), rough-leaved rice-grass (*Oryzopsis asperifolia*), bluebead-lily (*Clintonia borealis*), big-leaved aster (*Eurybia macrophylla*),



Moose Lightning volcanic bedrock glade. Photo by Joshua G. Cohen.

bunchberry (*Cornus canadensis*), and wild sarsaparilla (*Aralia nudicaulis*). A small population of northern fairy-bells (*Prosartes trachycarpa*, State Threatened) was documented along the northern margin of the volcanic bedrock glade in the ecotone between volcanic bedrock glade and boreal forest. Northern fairy-bells was also documented to the north along a ridgetop within boreal forest.

The Moose Lightning volcanic bedrock glade was surveyed August 8 and August 9, 2025. Fifty-seven plant species were documented with 54 native species and 3 non-native species. The total FQI was 34 and the total mean C value was 4.5.

This site was surveyed the day of a severe thunderstorm that rolled off of Lake Superior from the north. The storm was characterized by heavy rainfall and frequent lightning and thunder. While ascending a nearby ridge top, we spooked a bedded moose that did not hear use approaching because of the continuous rumbling thunder. We were nearly upon the moose when it bolted from the ridgetop, hence the site's name of "Moose Lightning".

Threats: Species composition and structure are largely patterned by natural processes. Non-natives are locally common in the western portion of the glade and include yellow hawkweed (*Hieracium caespitosum*), orange hawkweed (*H.* aurantiacum), and redtop (*Agrostis gigantea*).

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and to maintain a natural buffer surrounding the glades to prevent the increase of a weedy seed source. The glades should be periodically monitored for invasive species infestations.



Northern fairy-bells (*Prosartes trachycarpa*, State Threatened) was documented along the northern margin of the volcanic bedrock glade in the ecotone between volcanic bedrock glade and boreal forest. Photo by Jesse M. Lincoln.

33. Mt. Saginaw
Natural Community Type: Volcanic Bedrock Glade
Rank: GU S2, uncertain globally and imperiled within the state
Element Occurrence Rank: BC
Size: 26 acres (10 hectares)
Element Occurrence Identification Number: 27872

Site Description: A small pocket of volcanic glade occurs along the ridgeline associated with Mount Saginaw to the east of Newt Lake. The glade occurs intermixed with open-canopied boreal forest that has been heavily browsed by moose. Shallow soils over bedrock, herbivory, periodic fire, and windthrow contribute to the open physiognomy of the volcanic bedrock glade. The soils of the volcanic bedrock glade are shallow (typically 2-5 cm), acidic (pH 5.5-6.0) organics and loams overlying volcanic bedrock. Soil development is restricted to cracks, fissures, and depressions with scattered portions of the glade being characterized by exposed volcanic bedrock. Moose trails and pellets occurred throughout the glade and boreal forest and browse on balsam fir (*Abies balsamea*) was especially prevalent. A 29 cm red maple (*Acer rubrum*) was cored and estimated to be over 100 years old.

The glade is characterized by a scattered overstory (10-25%) with diverse canopy composition including white pine (*Pinus strobus*), white spruce (*Picea glauca*), northern white-cedar (*Thuja occidentalis*), quaking aspen (*Populus tremuloides*), balsam fir, red maple, and paper birch (*Betula papyrifera*). Canopy trees typically range in diameter from 20 to 40 cm. The understory is sparse (5-10%) with characteristic species including balsam fir and white pine. The diverse low shrub layer is patchy to dense (40-60%) with common species including low sweet blueberry (*Vaccinium angustifolium*), common juniper (*Juniperus communis*), bearberry (*Arctostaphylos uva-ursi*), serviceberries (*Amelanchier bartramiana, A. interior,* and *A. sanguinea*), and bush-honeysuckle (*Diervilla lonicera*).



Mt. Saginaw volcanic bedrock glade delineated in yellow on 2022 imagery.

The ground cover ranges from patchy to locally dense (40-60%). Herbaceous species are concentrated where soils have accumulated along cracks, crevices, and depressions in the volcanic bedrock. Prevalent ground cover species include hair grass (*Avenella flexuosa*), poverty grass (*Danthonia spicata*), Canada mayflower (*Maianthemum canadense*), big-leaved aster (*Eurybia macrophylla*), rough-leaved rice-grass (*Oryzopsis asperifolia*), slender wheatgrass (*Elymus trachycaulus*), wild sarsaparilla (*Aralia nudicaulis*), pearly everlasting (*Anaphalis margaritacea*), bastard-toadflax (*Comandra umbellata*), rusty woodsia (*Woodsia ilvensis*), and American rock-brake (*Cryptogramma acrostichoides,* State Threatened). In addition, ram's head lady-slipper (*Cypripedium arietinum,* State Special Concern) was documented within this glade. A diverse array of lichens and mosses cover the exposed Portage Lake Volcanics within the volcanic bedrock glade. Characteristic non-vascular species observed within the glade include reindeer lichens (*Cladonia mitis* and *C. rangiferina*) and feather moss (*Pleurozium schreberi*).

The Mount Saginaw volcanic bedrock glade was surveyed August 11, 2024. Fifty-four plant species were documented with 50 native species and 2 non-native species. The total FQI was 33.1 and the total mean C value was 4.5.

Threats: Species composition and structure are patterned by natural processes. Non-natives occur infrequently and include yellow hawkweed (*Hieracium piloselloides*) and Canada bluegrass (*Poa compressa*).

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and to maintain a natural buffer surrounding the glade to prevent the increase of a weedy seed source. The glade should be periodically monitored for invasive species infestations.



Mt. Saginaw volcanic bedrock glade. Photo by Jesse M. Lincoln.

34. Ojibway
Natural Community Type: Volcanic Bedrock Glade
Rank: GU S2, uncertain globally and imperiled within the state
Element Occurrence Rank: BC
Size: 374 acres (151 hectares)
Element Occurrence Identification Number: 27869

Site Description: The Ojibway Glade is an extensive volcanic bedrock glade system that spans over 3.5 miles along the Greenstone Ridge from west of Mount Ojibway and Lake Ojibway east toward Mount Franklin. The glade encompasses the exposed ridgetop of the Greenstone Flow and a broad area of barren, southeast-facing basalt outcrops on the south side of the ridge. The glade is bordered to the north by a steep, northwest-facing volcanic cliff. The glade occurs intermixed with boreal forest on sloping to moderate topography. Several beaver-influenced wetlands occur south of the glade associated with the Lake Ojibway drainage and include northern shrub thicket, northern wet meadow, poor fen, and rich conifer swamp. Portions of the glade are prominently featured along the Greenstone Ridge Trail and Mount Ojibway Trail, and the trailside sections of glade are among the most highly-visited sections of Isle Royale. The Ojibway Fire Tower is located within the glade complex.

The soils of the volcanic bedrock glade are shallow (typically 1-4 cm) acidic (pH 6.0-6.3) organics and loams overlying volcanic bedrock. Soil development is restricted to cracks, fissures, and low depressions with significant portions of the glade being characterized by exposed volcanic bedrock. Shallow soils over bedrock, intense herbivory, periodic fire, and windthrow contribute to the open physiognomy of the volcanic bedrock glade. A wildfire occurred throughout this glade in the 1930s and is likely partially responsible for the open structure that persists today. Charr was noted on several stumps



Ojibway volcanic bedrock glade delineated in yellow on 2022 imagery.

and snags within the glade including on a 76.5 cm white pine (*Pinus strobus*) snag. A 32.5 cm white spruce (*Picea glauca*) was cored and estimated to be over 58 years old (48 ring count). Moose trails and pellets occur throughout the glade and boreal forest. Moose browse was noted on multiple species including balsam fir (*Abies balsamea*), beaked hazelnut (*Corylus cornuta*), paper birch (*Betula papyrifera*), yew (*Taxus canadensis*), white pine, and serviceberries (*Amelanchier* spp.). Moose browse was noted up to 3 meters on understory balsam fir. Beaver herbivory of understory saplings was observed, especially along the margins of wetlands adjacent to the glade. The scattered and stunted trees and shrubs are persistently subject to drought, wind, and freezing. Extreme cold and heat generate challenging growing conditions for the plants within the glade. Many trees within the volcanic bedrock glade are stressed, and canopy mortality is prevalent. Snags and coarse woody debris are common.

The glade is characterized by a scattered and stunted overstory (10-25%) with diverse canopy composition including quaking aspen (*Populus tremuloides*), white pine, white spruce, red maple (*Acer rubrum*), paper birch, northern white-cedar (*Thuja occidentalis*), jack pine (*P. banksiana*), and balsam fir. Canopy trees typically range in diameter from 15 to 40 cm. The understory is sparse (5-15%) with characteristic species including white spruce, paper birch, red maple, beaked hazelnut, prairie willow (*Salix humilis*), serviceberries (*Amelanchier sanguinea, A. interior,* and *A. spicata*), black hawthorn (*Crataegus douglasii*, State Special Concern), and round-leaved dogwood (*Cornus rugosa*). The low shrub layer is diverse and patchy (15-30%) with common species including common juniper (*Juniperus communis*), low sweet blueberry (*Vaccinium angustifolium*), bush-honeysuckle (*Diervilla lonicera*), serviceberries, choke cherry (*Prunus virginiana*), thimbleberry (*Rubus parviflorus*), wild rose (*Rosa blanda*), soapberry (*Sheperdia canadensis*), bearberry (*Arctostaphylos uva-ursi*), staghorn sumac (*Rhus typhina*), creeping juniper (*J. horizontalis*), snowberry (*Symphoricarpos albus* var. *albus*), yew, and seedling quaking aspen, red maple, jack pine, and white pine.

The ground cover ranges from patchy to locally dense (30-60%). Herbaceous species are concentrated where soils have accumulated along cracks, crevices, and depressions in the volcanic bedrock. A diverse array of lichens and mosses cover



Ojibway volcanic bedrock glade. Photo by Joshua G. Cohen.

the exposed Portage Lake Volcanics within the volcanic bedrock glade. Characteristic non-vascular species observed within the glade include reindeer lichens (*Cladonia mitis* and *C. rangiferina*) and feather moss (*Pleurozium schreberi*). Prevalent ground cover species include poverty grass (*Danthonia spicata*), pearly everlasting (*Anaphalis margaritacea*), big-leaved aster (*Eurybia macrophylla*), woodland strawberry (*Fragaria vesca*), bastard-toadflax (*Comandra umbellata*), northern hawkweed (*Hieracium umbellatum*), hairy goldenrod (*Solidago hispida*), harebell (*Campanula rotundifolia*), early saxifrage (*Micranthes virginiensis*), rusty woodsia (*Woodsia ilvensis*), wild columbine (*Aquilegia canadensis*), sand violet (*Viola adunca*), pale corydalis (*Capnoides sempervirens*), small pussytoes (*Antennaria howellii*), cow-wheat (*Melampyrum lineare*), and slender wheatgrass (*Elymus trachycaulus*). Rare species documented within the glade include ram's head lady-slipper (*Cypripedium arietinum*, State Special Concern), American rock-brake (*Cryptogramma acrostichoides*, State Threatened), and blue-lips (*Collinsia parviflora*, State Special Concern).



Ojibway volcanic bedrock glade. Photos by Joshua G. Cohen.



The Ojibway volcanic bedrock glade was surveyed August 09, 2024. One hundred and seventeen plant species were documented with 103 native species and 14 non-native species. The total FQI was 44.3 and the total mean C value was 4.1.

Threats: Species composition and structure are patterned by natural processes but are locally impacted non-native species infestations. The Greenstone Ridge Trail passes through this glade and has likely contributed to the introduction of non-native plants that occur within the glade but are concentrated closer to the trail. Non-natives include common mullein (*Verbascum thapsus*), hawkweeds (*Hieracium aurantiacum*, *H. caespitosum*, and *H. piloselloides*), Canada bluegrass (*Poa compressa*), bluegrass (*P. nemoralis*), helleborine (*Epipactis helleborine*), common St. John's-wort (*Hypericum perforatum*), ox-eye daisy (*Leucanthemum vulgare*), sheep sorrel (*Rumex acetosella*), common goat's beard (*Tragopogon pratensis*), Timothy (*Phleum pratense*), red clover (*Trifolium pratense*), and common speedwell (*Veronica officinalis*). Dense concentrations of these invasives have been pulled locally. Non-native species are less prevalent within the glade farther away from the trail.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and maintain a natural buffer surrounding the glades to prevent the increase of a weedy seed source. Efforts to control invasive species should be continued and monitored.



he Greenstone Ridge Trail passes through the Ojibway volcanic bedrock glade and has likely contributed to the introduction of non-native plants. To limit the spread of invasive plants, we recommend concentrating invasive plant control measures along the trail. Photo by Joshua G. Cohen.

35. Scoville Point
Natural Community Type: Volcanic Bedrock Glade
Rank: GU S2, uncertain globally and imperiled within the state
Element Occurrence Rank: C
Size: 10 acres (4 hectares)
Element Occurrence Identification Number: 28363

Site Description: Small pockets of volcanic bedrock glade occur along the Scoville Point peninsula. The glade is characterized by moderate to rugged topography and occurs adjacent to high-quality volcanic bedrock lakeshore and volcanic lakeshore cliff along the shoreline to the south. The bedrock systems are embedded in a matrix of boreal forest. The soils of the volcanic bedrock glade are shallow (typically 0-2 cm), acidic (pH 6.0-6.5) organics and loams overlying volcanic bedrock. Soil chemistry is variable and depends on the local composition of decomposing plant and organic material. Soil development is restricted to cracks, fissures, and depressions with scattered portions of the glade being characterized by exposed basalt. Shallow soils over bedrock, herbivory, and windthrow have contributed to the open physiognomy of the volcanic bedrock glade. Moose browse and scat were noted throughout the glade. A 14.3 cm quaking aspen (*Populus tremuloides*) was cored and estimated to be over 36 years old (26 growth rings counted).

The glade is characterized by a scattered and stunted overstory (10-20%) with quaking aspen, white spruce (*Picea glauca*), paper birch (*Betula papyrifera*), and northern white-cedar (*Thuja occidentalis*). Canopy trees typically range in diameter from 10 to 30 cm. The understory is sparse (5-10%) with characteristic species including white spruce, northern white-cedar, balsam fir (*Abies balsamea*), quaking aspen, and prairie willow (*Salix humilis*). The low shrub layer is diverse and patchy to dense (40-60%) with common species including common juniper (*Juniperus communis*), bearberry (*Arctostaphylos uva-ursi*), low sweet blueberry (*Vaccinium angustifolium*), bush-honeysuckle (*Diervilla lonicera*), creeping juniper (*J. horizontalis*), serviceberries (*Amelanchier spicata* and *A. sanguinea*), hairy honeysuckle (*Lonicera hirsuta*), and mountain alder (*Alnus viridis*).



Scoville Point volcanic bedrock glade delineated in yellow on 2022 imagery.

The ground cover ranges from patchy to locally dense (30-50%). Prevalent ground cover species include hair grass (*Avenella flexuosa*), poverty grass (*Danthonia spicata*), geocaulon (*Geocaulon lividum*), yarrow (*Achillea millefolium*), northern paintbrush (*Castilleja septentrionalis*, State Threatened), American rock-brake (*Cryptogramma acrostichoides*, State Threatened), rough-leaved rice-grass (*Oryzopsis asperifolia*), big-leaved aster (*Eurybia macrophylla*), wild strawberry (*Fragaria virginiana*), wild sarsaparilla (*Aralia nudicaulis*), Canada mayflower (*Maianthemum canadense*), early saxifrage (*Micranthes virginiensis*), harebell (*Campanula rotundifolia*), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), fescue (*Festuca saximontana*), and slender wheatgrass (*Elymus trachycaulus*). Downy oatgrass (*Trisetum spicatum*, State Special Concern) occurs locally within the glade but is more abundant within the adjacent volcanic lakeshore cliff and volcanic bedrock lakeshore. Blue-joint (*Calamagrostis canadensis*) occurs locally in wet areas within the glade. A diverse array of lichens and mosses cover the exposed bedrock. Characteristic non-vascular species observed within the glade include reindeer lichens (*Cladonia mitis* and *C. rangiferina*) and feather moss (*Pleurozium schreberi*).

The Scoville Point volcanic bedrock glade was surveyed August 17, 2025. Sixty-two plant species were documented with 56 native species and 6 non-native species. The total FQI was 36.2 and the total mean C value was 4.6.

Threat: Species composition and structure are patterned by natural processes. Weedy non-native species are common within this glade likely due to the trail to Scoville Point that passes through it. Non-natives observed within the glade include orange hawkweed (*Hieracium aurantiacum*), yellow hawkweed (*Hieracium caespitosum*), red clover (*Trifolium pratense*), redtop (*Agrostis gigantea*), Timothy (*Phleum pratense*), and Canada bluegrass (*Poa compressa*).

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and to maintain a natural buffer surrounding the glade to prevent the increase of a weedy seed source. Non-native species should be controlled along the trail that passes through to Scoville Point. The volcanic bedrock glade should be periodically monitored for invasive species infestations.



Scoville Point volcanic bedrock glade. Photo by Joshua G. Cohen.

36. Siskiwit Lake
Natural Community Type: Volcanic Bedrock Glade
Rank: GU S2, uncertain globally and imperiled within the state
Element Occurrence Rank: C
Size: 246 acres (99 hectares)
Element Occurrence Identification Number: 28336

Site Description: This extensive volcanic bedrock glade occurs north of Siskiwit Lake. Numerous pockets of glade occur intermixed with recently burned boreal forest and hardwood-conifer swamp. The glade occurs on sloping to moderate topography and typically becomes more continuous with higher elevation above Siskiwit Lake. Several beaver-influenced wetlands occur adjacent to the glade complex including northern wet meadow. The soils of the volcanic bedrock glade are shallow (typically 2-4 cm), acidic organics and loams overlying volcanic bedrock and range from strongly acidic to slightly acidic (pH 5.5-6.5) with soil chemistry depending on the content of the decomposing organic matter. Soil development is restricted to cracks, fissures, and low depressions with significant portions of the glade being characterized by exposed basalt and talus. Shallow soils over bedrock, intense herbivory, periodic fire, and windthrow contribute to the open physiognomy of the volcanic bedrock glade. Wildfire occurred throughout this glade and adjacent boreal forest and, based on tree ages within the glade and boreal forest, occurred around 90 years ago and likely was part of the Fire of 1936. Burnt snags and coarse woody debris from the wildfire occur throughout the glade. A 24.2 cm northern white-cedar (*Thuja occidentalis*) was cored and 47 growth rings were counted. Moose trails, pellets, and beds occur throughout the glade and boreal forest. Moose browse was prevalent on juneberries (*Amelanchier* spp.) and cherries (*Prunus* spp.).



Siskiwit Lake volcanic bedrock glade delineated in yellow on 2022 imagery.

The glade is characterized by a scattered and stunted overstory (5-25%) with diverse canopy composition, including white spruce (*Picea glauca*), northern white-cedar, paper birch (*Betula papyrifera*), white pine (*Pinus strobus*), quaking aspen (*Populus tremuloides*), red oak (*Quercus rubra*), and red maple (*Acer rubrum*). Less frequent canopy associates include balsam fir (*Abies balsamea*) and red pine (*Pinus resinosa*). Pines are more prevalent in the higher elevation portions of the glade and large white pine stumps occur locally, suggesting that larger white pines were more common prior to the wildfire. Canopy trees typically range in diameter from 10 to 30 cm. The understory is also sparse (5-15%) with characteristic species including white spruce, serviceberries (*Amelanchier interior* and *A. sanguinea*), choke cherry (*Prunus virginia*), pin cherry (*P. pensylvanica*), beaked hazelnut (*Corylus cornuta*), paper birch, northern white-cedar, quaking aspen, red oak, balsam fir, ninebark (*Physocarpus opulifolius*), prairie willow (*Salix humilis*), and black hawthorn (*Crataegus douglasii*, State Special Concern). The diverse low shrub layer is patchy to dense (40-60%) with common shrubs including staghorn sumac (*Rhus typhina*), bearberry (*Arctostaphylos uva-ursi*), thimbleberry (*Rubus parviflorus*), wild red raspberry (*Rubus strigosus*), soapberry (*Shepherdia canadensis*), Canada blueberry (*Vaccinium myrtilloides*), serviceberries, ninebark, pin cherry, bush-honeysuckle (*Diervilla lonicera*), common juniper (*Juniperus communis*), and wild rose (*Rosa acicularis*). Seedling paper birch, white spruce, quaking aspen, and mountain-ash (*Sorbus decora*) are also common in the low shrub layer.

The ground cover ranges from patchy to locally dense (50-70%). Herbaceous species are concentrated where soils have accumulated along cracks, crevices, and depressions in the volcanic bedrock. A diverse array of lichens and mosses cover the exposed bedrock. Characteristic non-vascular species observed within the glade include reindeer lichens (*Cladonia mitis* and *C. rangiferina*) and feather moss (*Pleurozium schreberi*). Prevalent ground cover species include poverty grass (*Danthonia spicata*), wild strawberry (*Fragaria virginiana*), pearly everlasting (*Anaphalis margaritacea*), wild sarsaparilla (*Aralia nudicaulis*), slender wheatgrass (*Elymus trachycaulus*), big-leaved aster (*Eurybia macrophylla*), twinflower (*Linnaea borealis*), western fescue (*Festuca occidentalis*), rusty woodsia (*Woodsia ilvensis*), rough-leaved rice-grass (*Oryzopsis asperifolia*), ticklegrass (*Agrostis scabra*), rock cress (*Boechera grahamii*), common polypody (*Polypodium virginianum*), fringed brome (*Bromus ciliatus*), harebell (*Campanula rotundifolia*), pale corydalis (*Capnoides sempervirens*), ram's head lady-slipper (*Cypripedium arietinum*, State Special Concern), bracken fern (*Pteridium aquilinum*), and goldenrods (*Solidago altissima* and *S. juncea*).



Siskiwit Lake volcanic bedrock glade. Photo by Joshua G. Cohen.

The Siskiwit Lake volcanic bedrock glade was surveyed August 3, 2025. One hundred and fove plant species were documented with 95 native species and 10 non-native species. The total FQI was 42 and the total mean C value was 4.1.

Threats: Species composition and structure are largely patterned by natural processes. However, non-native species are locally common throughout the glade and are likely a function of the intense wildfire and proximity of the glades to anthropogenic disturbances associated with Siskiwit Bay (i.e., mining, fishing, and logging settlements). Furthermore, the glades have been impacted by moose activity including browsing, bedding, and travel. It was noted that higher portions of the glade that function as a travel corridor for moose were characterized by higher concentrations of weedy plants and it is possible that moose traveling through these glades are contributing to the spread of non-native species. Scattered non-native species occur locally and include common mullein (*Verbascum thapsus*), red clover (*Trifolium pratense*), hop clover (*T. aureum*), Canada bluegrass (*Poa compressa*), bluegrass (*P. nemoralis*), Kentucky bluegrass (*P. pratensis*), common goat's beard (*Tragopogon pratensis*), sheep sorrel (*Rumex acetosella*), orange hawkweed (*Hieracium aurantiacum*), and yellow hawkweed (*H. caespitosum*).

Management Recommendation: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and to maintain a natural buffer surrounding the glades to prevent the increase of a weedy seed source. The glades should be periodically monitored for invasive species infestations.



Black hawthorn (*Crataegus douglasii*, State Special Concern) occurs locally within the Siskiwit Lake volcanic bedrock glade. Photo by Joshua G. Cohen.

37. Siskiwit Mine
Natural Community Type: Volcanic Bedrock Glade
Rank: GU S2, uncertain globally and imperiled within the state
Element Occurrence Rank: C
Size: 19 acres (8 hectares)
Element Occurrence Identification Number: 27865

Site Description: This is a small volcanic bedrock glade spanning a half mile stretch just north of the Siskiwit Mine and the Rock Harbor Trail. The glade occurs intermixed with boreal forest on moderate to sloping topography. Shallow soils over bedrock, intense herbivory, periodic fire, and windthrow contribute to the open physiognomy of the volcanic bedrock glade. The soils of the volcanic bedrock glade are shallow (typically 0-5 cm) acidic (pH 6.0-6.5) organics and loams overlying volcanic bedrock. Soil chemistry is likely linked to the decomposition of the local organic material. Soil development is restricted to cracks, fissures, and low depressions with significant portions of the glade being characterized by exposed basalt. Moose trails, pellets, and sheds occurred throughout the glade and boreal forest. Moose browse was noted up to 3 meters on understory balsam fir (*Abies balsamea*). Conifers throughout the glade were cored to gauge tree age: a 35 cm white spruce (*Picea glauca*) was cored and estimated to be over 67 years old (57 ring count); a 27 cm jack pine (*Pinus banksiana*) was cored and estimated to be over 70 years old (60 ring count); and a 18.5 cm jack pine was cored and estimated to be over 70 years old (60 ring count). The scattered and stunted trees and shrubs are persistently subject to drought, wind, and freezing. Extreme cold and heat generate challenging growing conditions for the plants within the glade. Many trees within the volcanic bedrock glade are stressed, and canopy mortality is prevalent. Snags and coarse woody debris are common.



Siskiwit Mine volcanic bedrock glade delineated in yellow on 2022 imagery.

The glade is characterized by scattered and stunted overstory (10-25%) with canopy composition including white spruce, quaking aspen (*Populus tremuloides*), paper birch (*Betula papyrifera*), northern white-cedar (*Thuja occidentalis*), white pine (*Pinus strobus*), balsam fir, and jack pine. Canopy trees typically range in diameter from 20 to 40 cm. The understory is sparse (2-5%) with characteristic species including serviceberries (*Amelanchier interior* and *A. spicata*), balsam fir, white spruce, northern white-cedar, prairie willow (*Salix humilis*), and mountain-ash (*Sorbus decora*). The low shrub layer is diverse and patchy to dense (40-60%) with common species including ground juniper (*Juniperus communis*), low sweet blueberry (*Vaccinium angustifolium*), Canada blueberry (*V. myrtilloides*), bearberry (*Arctostaphylos uva-ursi*), serviceberries, pin cherry (*Prunus pensylvanica*), soapberry (*Shepherdia canadensis*), wild rose (*Rosa acicularis*), yew (*Taxus canadensis*), and mountain-ash.

The ground cover ranges from patchy to locally dense (20-40%). Herbaceous species are concentrated where soils have accumulated along cracks, crevices, and depressions in the volcanic bedrock. A diverse array of lichens and mosses cover the exposed Portage Lake Volcanics within the volcanic bedrock glade. Characteristic non-vascular species observed within the glade include reindeer lichens (*Cladonia mitis* and *C. rangiferina*) and feather moss (*Pleurozium schreberi*). Prevalent ground cover species include poverty grass (*Danthonia spicata*), harebell (*Campanula rotundifolia*), hair grass (*Avenella flexuosa*), wild strawberry (*Fragaria virginiana*), big-leaved aster (*Eurybia macrophylla*), bracken fern (*Pteridium aquilinum*), Canada mayflower (*Maianthemum canadense*), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), rusty woodsia (*Woodsia ilvensis*), yarrow (*Achillea millefolium*), wild sarsaparilla (*Aralia nudicaulis*), bastard-toadflax (*Comandra umbellata*), early saxifrage (*Micranthes virginiensis*), pale corydalis (*Capnoides sempervirens*), pearly everlasting (*Anaphalis margaritacea*), American rock-brake (*Cryptogramma acrostichoides,* State Threatened), and rough-leaved rice-grass (*Oryzopsis asperifolia*).

The Siskiwit Mine volcanic bedrock glade was surveyed August 10, 2024. Seventy-three plant species were documented with 64 native species and 9 non-native species. The total FQI was 34.2 and the total mean C value was 4.0.



Siskiwit Mine volcanic bedrock glade. Photo by Jesse M. Lincoln.

Threats: Species composition and structure are patterned by natural processes. However, weedy non-native species are common within this glade, likely due to the past disturbance of the Siskiwit Mine, which occurs just south of the glade. An old trail emanating from the mine entrance passes through the glade. Non-natives observed within the glade include common mullein (*Verbascum thapsus*), ox-eye daisy (*Leucanthemum vulgare*), yellow hawkweed (*Hieracium caespitosum*), sheep sorrel (*Rumex acetosella*), common speedwell (*Veronica officinalis*), common goat's beard (*Tragopogon pratensis*), Canada bluegrass (*Poa compressa*), orange hawkweed (*Hieracium aurantiacum*), and Timothy (*Phleum pratense*). The glade improves in quality with increasing distance from the mine.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and maintain a natural buffer surrounding the glades to prevent the increase of a weedy seed source. If invasive species control efforts are implemented, they should be monitored.



Siskiwit Mine volcanic bedrock glade. Photo by Joshua G. Cohen.

38. Stone's Point
Natural Community Type: Volcanic Bedrock Glade
Rank: GU S2, uncertain globally and imperiled within the state
Element Occurrence Rank: AB
Size: 7.5 acres (3 hectares)
Element Occurrence Identification Number: 28373

Site Description: Just over half a mile of southwest to northeast-trending volcanic bedrock glade occurs along an unnamed point in the northeastern portion of Isle Royale. The glade is flanked to the north by volcanic lakeshore cliff, and volcanic bedrock lakeshore occurs along the southwestern and northeastern margins of the volcanic bedrock glade and volcanic lakeshore cliff. The volcanic systems are embedded within a matrix of boreal forest. The glade rises steeply and dramatically from the shoreline to heights of around 20 meters above the water. The glade is composed of two polygons and is characterized by rugged topography. The soils of the volcanic bedrock glade are shallow (typically 0-2 cm), acidic (pH 5.5-6.0) organics and loams overlying volcanic bedrock. Soil chemistry is variable and depends on the local composition of decomposing plant and organic material. Soil development is restricted to cracks, fissures, and depressions with scattered portions of the glade being characterized by exposed basalt. Shallow soils over bedrock, herbivory, and windthrow have contributed to the open physiognomy of the volcanic bedrock glade. A 10.7 cm northern white-cedar (*Thuja occidentalis*) was cored and estimated to be over 140 years old (130 growth rings).

The glade is characterized by a scattered and stunted overstory (2-5%) with northern white-cedar, white spruce (*Picea glauca*), and balsam fir (*Abies balsamea*). Canopy trees typically range in diameter from 10 to 30 cm. The understory is sparse (2-4%) with characteristic species including prairie willow (*Salix humilis*), pin cherry (*Prunus pensylvanica*),



Stone's Point volcanic bedrock glade delineated in yellow on 2022 imagery.

and northern white-cedar. The low shrub layer is diverse and dense (50-70%) with common species including common juniper (*Juniperus communis*), bearberry (*Arctostaphylos uva-ursi*), shrubby cinquefoil (*Dasiphora fruticosa*), service berries (*Amelanchier bartramiana, A. sanguinea,* and *A. spicata*), low sweet blueberry (*Vaccinium angustifolium*), Canada blueberry (*V. myrtilloides*), Alpine blueberry (*V. uliginosum*, State Threatened), creeping juniper (*J. horizontalis*), wild rose (*Rosa acicularis*), soapberry (*Shepherdia canadensis*), pin cherry, and squashberry (*Viburnum edule*, State Threatened).

The ground cover ranges from patchy to locally dense (30-50%). A diverse array of lichens and mosses cover the exposed Portage Lake Volcanics within the volcanic bedrock glade. Characteristic non-vascular species observed within the glade include reindeer lichens (*Cladonia mitis* and *C. rangiferina*) and feather moss (*Pleurozium schreberi*). Prevalent forbs include three-toothed cinquefoil (*Sibbaldiopsis tridentata*), goldenrods (*Solidago simplex* and *S. juncea*), geocaulon (*Geocaulon lividum*), yarrow (*Achillea millefolium*), pale corydalis (*Capnoides sempervirens*), wild strawberry (*Fragaria virginiana*), Kalm's hawkweed (*Hieracium kalmia*), northern crane's-bill (*Geranium bicknellii*), and harebell (*Campanula rotundifolia*). Prevalent grasses include hair grass (*Avenella flexuosa*), poverty grass (*Danthonia spicata*), slender wheatgrass (*Elymus trachycaulus*), and rough-leaved rice-grass (*Oryzopsis asperifolia*). Blue-joint (*Calamagrostis canadensis*) occurs locally in wet areas within the glade. Ferns and fern allies are relatively abundant with rusty woodsia (*Woodsia ilvensis*), common polypody (*Polypodium virginianum*), and sand club moss (*Selaginella rupestris*). Herbaceous species typical of boreal forests are common within the glade in areas of partial canopy and include bluebead-lily (*Clintonia borealis*), twinflower (*Linnaea borealis*), Canada mayflower (*Maianthemum canadense*), cow-wheat (*Melampyrum lineare*), and bunchberry (*Cornus canadensis*). High concentration of rare plant species were documented within the glade and include Alpine bluegrass (*Poa alpina*, State Threatened), bluegrass (*Poa interior*, State Special Concern), prairie cinquefoil (*Potentilla litoralis*, State Threatened), prickly saxifrage (*Saxifraga tricuspidata*, State Threatened), northern gooseberry (*Ribes oxyacanthoides*, State Special Concern), and alpine bilberry at the transition with the volcanic bedrock lakeshore and American rock-brake (*Cryptogramma acrostichoides*, State Threatened) along the highest points of the glade where exposed bedrock is prevalent.

The Stone's Point volcanic bedrock glade was surveyed August 22, 2025. Sixty-two plant species were documented with 61 native species and 1 non-native species. The total FQI was 45.7 and the total mean C value was 5.8. The site was named in hone of MNFI botanist Abraham Stone who suggested it should be a survey priority.



Stone's Point volcanic bedrock glade. Photo by Joshua G. Cohen.

Threats: Species composition and structure are patterned by natural processes. The non-native orange hawkweed (*Hieracium aurantiacum*) was noted infrequently within the glade.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and to maintain a natural buffer surrounding the glade to prevent the increase of a weedy seed source. The glade should be periodically monitored for invasive species infestations.



Stone's Point volcanic bedrock glade. Photos by Jesse M. Lincoln (above) and Joshua G. Cohen (below).



39. Sumner Lake
Natural Community Type: Volcanic Bedrock Glade
Rank: GU S2, uncertain globally and imperiled within the state
Element Occurrence Rank: BC
Size: 4.5 acres (1.8 hectares)
Element Occurrence Identification Number: 27870

Site Description: Small pockets of volcanic bedrock glade occur on top of an escarpment north of Sumner Lake. The glade occurs intermixed with boreal forest and dry-mesic northern forest and is located above a volcanic cliff along the north shore of Sumner Lake. Sumner Lake is flanked on the eastern and western margins by beaver-influenced poor fen. The soils of the volcanic bedrock glade are shallow (typically 2-5 cm), very acidic (pH 5.0-5.5) organics and loams overlying volcanic bedrock. Soil development is restricted to cracks, fissures, and depressions with scattered portions of the glade being characterized by exposed basalt. Shallow soils over bedrock, herbivory, periodic fire, and windthrow contribute to the open physiognomy of the volcanic bedrock glade. This glade complex is unique in that red pine (*Pinus resinosa*) and white pine (*P. strobus*) are prevalent in the canopy and fire scars occur on the living pines. It is possible that this site was historically burned by Indigenous peoples. Moose trails and pellets occur throughout the glade and adjacent boreal forest. Three canopy trees were cored within the glade: a 47 cm red pine was cored and estimated to be over 175 years old (155 rings counted on a partial core); a 44 cm red pine was cored and estimated to be over 135 years old (125 ring count); and a 68.8 cm white pine was cored and estimated to be over 170 years old (160 ring count).

The glade is characterized by a scattered overstory (10-25%) with diverse canopy composition including red pine, white pine, jack pine (*P. banksiana*), northern white-cedar (*Thuja occidentalis*), quaking aspen (*Populus tremuloides*), red maple (*Acer rubrum*), and paper birch (*Betula papyrifera*). Canopy trees typically range in diameter from 20 to 40 cm with some white pine and red pine reaching 50 to 70 cm. The understory is sparse (5-10%) with characteristic species includ-



Sumner Lake volcanic bedrock glade delineated in yellow on 2022 imagery.

ing balsam fir (*Abies balsamea*), white pine, northern white-cedar, and prairie willow (*Salix humilis*). The low shrub layer is diverse and patchy to dense (40-60%) with common species including bearberry (*Arctostaphylos uva-ursi*), common juniper (*Juniperus communis*), low sweet blueberry (*Vaccinium angustifolium*), wild rose (*Rosa blanda*), serviceberries (*Amelanchier sanguinea* and *A. spicata*), creeping juniper (*J. horizontalis*), soapberry (*Shepherdia canadensis*), and pine seedlings.

The ground cover ranges from patchy to locally dense (40-60%). Herbaceous species are concentrated where soils have accumulated along cracks, crevices, and depressions in the volcanic bedrock. A diverse array of lichens and mosses cover the exposed Portage Lake Volcanics within the volcanic bedrock glade. Characteristic non-vascular species observed within the glade include reindeer lichens (*Cladonia mitis* and *C. rangiferina*) and feather moss (*Pleurozium schreberi*). Prevalent ground cover species include hair grass (*Avenella flexuosa*), poverty grass (*Danthonia spicata*), Canada mayflower (*Maianthemum canadense*), big-leaved aster (*Eurybia macrophylla*), rough-leaved rice-grass (*Oryzopsis asperifolia*), spreading dogbane (*Apocynum androsaemifolium*), wild strawberry (*Fragaria virginiana*), bastard-toadflax (*Comandra umbellata*), white lettuce (*Prenanthes alba*), and hairy goldenrod (*Solidago hispida*)

The Sumner Lake volcanic bedrock glade was surveyed August 11, 2024. Fifty-two plant species were documented with 50 native species and 2 non-native species. The total FQI was 34.6 and the total mean C value was 4.8.

Threats: Species composition and structure are patterned by natural processes. Non-natives occur infrequently and include yellow hawkweed (*Hieracium piloselloides*) and Canada bluegrass (*Poa compressa*).

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and to maintain a natural buffer surrounding the glades to prevent the increase of a weedy seed source. The glades should be periodically monitored for invasive species infestations. We recommend evaluating the application of fire stewardship.



Sumner Lake volcanic bedrock glade. Photo by Joshua G. Cohen.



Sumner Lake volcanic bedrock glade is dominated by canopy white pine (*Pinus strobus*) and red pine (*P. resinosa*). Prevalence of pines in Isle Royale's volcanic bedrock glade is unusual and suggest a history of cultural burning. Several canopy pines exhibit fire scars. We recommend evaluating of implementing fire stewardship in this glade. Photos by Jesse M. Lincoln.



40. Three Mile
Natural Community Type: Volcanic Bedrock Glade
Rank: GU S2, uncertain globally and imperiled within the state
Element Occurrence Rank: BC
Size: 35 acres (14 hectares)
Element Occurrence Identification Number: 28366

Site Descriptions: Numerous pockets of volcanic bedrock glade occur along Rock Harbor northeast of Three-Mile campground. The glade occurs along a two-mile stretch and is characterized by moderate to rugged stair-stepped topography that slopes down to Rock Harbor. The glade is embedded in a matrix of boreal forest. The soils of the volcanic bedrock glade are shallow (typically 0-2 cm), acidic (pH 5.5-6.0) organics and loams overlying basalt. Soil chemistry is variable and depends on the local composition of decomposing plant and organic material; needle cast from white pine (*Pinus strobus*) locally increases the soil acidity. Soil development is restricted to cracks, fissures, and depressions with scattered portions of the glade being characterized by exposed volcanic bedrock. Shallow soils over bedrock, moose herbivory, and windthrow have contributed to the open physiognomy of the volcanic bedrock glade. Several conifers were cored across the glade to gauge tree age: a 4.0 cm jack pine (*Pinus banksiana*) was cored and estimated to be over 85 years old (75 growth rings counted); a 37.6 cm jack pine was cored and estimated to be over 140 years old (130 growth rings counted); and a 31.1 cm jack pine was cored and estimated to be over 120 years old (113 growth rings counted). Jack pine within the glade have semi-serotinous cones that can open following extreme heat within the glade.

The glade is characterized by a scattered and stunted overstory (5-25%) with jack pine, white spruce (*Picea glauca*), northern white-cedar (*Thuja occidentalis*), white pine, quaking aspen (*Populus tremuloides*), and balsam fir (*Abies balsamea*). Canopy trees typically range in diameter from 10 to 30 cm. The understory is sparse (5-15%) with characteristic species including jack pine, balsam fir, white spruce, paper birch (*Betula papyrifera*), mountain-ash (*Sorbus decora*), pin cherry (*Prunus pensylvanica*), prairie willow (*Salix humilis*), mountain alder (*Alnus viridis*), serviceberries (*Amelanchier spicata* and *A. sanguinea*), and soapberry (*Shepherdia canadensis*). The diverse low shrub layer is patchy to dense (40-60%) with common species including common juniper (*Juniperus communis*), bearberry (*Arctostaphylos uva-ursi*), low sweet blueberry (*Vaccinium angustifolium*), bush-honeysuckle (*Diervilla lonicera*), creeping juniper (*J. horizontalis*), serviceberries (*Amelanchier spicata* and *A. sanguinea*), wild rose (*Rosa acicularis*), thimbleberry (*Rubus parviflorus*), pin cherry, wild red raspberry (*Rubus strigosus*), hairy honeysuckle (*Lonicera hirsuta*), Canada blueberry



Three Mile volcanic bedrock glade. Photo by Jesse M. Lincoln.



Three Mile volcanic bedrock glade delineated in yellow on 2022 imagery.

(*Vaccinium myrtilloides*), soapberry, squashberry (*Viburnum edule,* State Threatened), and seedling white pine, mountain-ash, and white spruce.

The ground cover ranges from patchy to locally dense (20-40%). Prevalent ground cover species include hair grass (*Avenella flexuosa*), poverty grass (*Danthonia spicata*), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), Canada mayflower (*Maianthemum canadense*), big-leaved aster (*Eurybia macrophylla*), small pussytoes (*Antennaria howellii*), yarrow (*Achillea millefolium*), goldenrods (*Solidago hispida* and *S. simplex*), barren-strawberry (*Geum fragarioides*), harebell (*Campanula rotundifolia*), pearly everlasting (*Anaphalis margaritacea*), cow-wheat (*Melampyrum lineare*), wild strawberry (*Fragaria virginiana*), American rock-brake (*Cryptogramma acrostichoides*, State Threatened), common polypody (*Polypodium virginianum*), pale corydalis (*Capnoides sempervirens*), wild sarsaparilla (*Aralia nudicaulis*), ticklegrass (*Agrostis scabra*), fireweed (*Chamaenerion angustifolium*), geocaulon (*Geocaulon lividum*), glaucous white lettuce (*Prenanthes racemosa*), slender wheatgrass (*Elymus trachycaulus*), and Kalm's hawkweed (*Hieracium kalmii*). Bluegrass (*Poa interior,* State Special Concern) occurs locally. A diverse array of lichens and mosses cover the exposed Portage Lake Volcanics within the volcanic bedrock glade. Characteristic non-vascular species observed within the glade include reindeer lichens (*Cladonia mitis* and *C. rangiferina*) and feather moss (*Pleurozium schreberi*).

The Three-Mile volcanic bedrock glade was surveyed August 18, 2025. Eighty-seven plant species were documented with 80 native species and 7 non-native species. The total FQI was 42.9 and the total mean C value was 4.6.

A wolf was observed eating from a moose carcass along the margin of the Three-Mile trail nearby this glade. Wolf scat was noted along the trail through the glade. The moose carcass was over 2.5 meters long and the wolf had pulled over 6 meters of sinew from the carcass along the water edge to nearby boreal forest. Beaver felled aspens were noted in a crevice between two pockets of glade.

Threats: Species composition and structure are patterned by natural processes but have been impacted by the trail that passes through portions of the glade. Weedy non-native species are common within this glade and include common speedwell (*Veronica officinalis*), red clover (*Trifolium pratense*), Timothy (*Phleum pratense*), Canada bluegrass (*Poa compressa*), Kentucky bluegrass (*P. pratensis*), common goat's beard (*Tragopogon pratensis*), redtop (*Agrostis gigantea*), and yellow hawkweed (*Hieracium caespitosum*). The trail is causing erosion of soil as well as vascular and non-vascular flora. In addition, the trail facilitates foot traffic throughout the glade and likely facilitates the spread of non-natives throughout the glade.



Three Mile volcanic bedrock glade. Photo by Jesse M. Lincoln.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and to maintain a natural buffer surrounding the glade to prevent the increase of a weedy seed source. Non-native species should be controlled along the trail that passes through the glade. The volcanic bedrock glade should be periodically monitored for invasive species infestations.



Three Mile volcanic bedrock glade. Photo by Joshua G. Cohen.



A wolf was observed eating from a moose carcass in Rock Harbor just off of Three-Mile trail nearby this glade. Wolf scat was noted along the trail through the glade. The moose carcass was over 2.5 meters long and the wolf had pulled over 6 meters of sinew from the carcass along the water edge to nearby boreal forest. Photo by Joshua G. Cohen



Three Mile volcanic bedrock glade. Photos by Joshua G. Cohen (above) and Jesse M. Lincoln (below).



41. Tobin Creek
Natural Community Type: Volcanic Bedrock Glade
Rank: GU S2, uncertain globally and imperiled within the state
Element Occurrence Rank: B
Size: 183 acres (74 hectares)
Element Occurrence Identification Number: 27866

Site Description: The Tobin Creek volcanic bedrock glade spans over 1.5 miles south of Tobin Creek and east of the Mount Ojibway Trail. This extensive glade occurs intermixed with boreal forest on sloping to moderate topography. Several beaver-influenced wetlands occur south of the glade (associated with the Tobin Creek drainage) and north of the glade (associated with the Lake Ojibway drainage) and include northern shrub thicket, northern wet meadow, poor fen, rich conifer swamp, and northern hardwood swamp. A unique perched and flooded northern hardwood swamp occurs locally along the upper margin of the glade. This swamp has been flooded by beaver, and the canopy black ash (*Fraxinus nigra*) have died. The wetland is oozing over the upper margin of the glade with wetland plants on the margin including spotted touch-me-not (*Impatiens capensis*) and blue-joint (*Calamagrostis canadensis*). Beaver-felled trees occur along the margin of this flooding.

The soils of the volcanic bedrock glade are shallow (typically 2-5 cm), acidic (pH 6.0-6.5) organics and loams overlying basalt. Soil development is restricted to cracks, fissures, and low depressions with significant portions of the glade being characterized by exposed volcanic bedrock. Shallow soils over bedrock, intense herbivory, periodic fire, and windthrow contribute to the open physiognomy of the volcanic bedrock glade. Wildfire has impacted this glade. Char was noted on several stumps. Moose trails and pellets occur throughout the glade and boreal forest. Moose browse was documented on multiple species including balsam fir (*Abies balsamea*), beaked hazelnut (*Corylus cornuta*), paper birch (*Betula*



Tobin Creek volcanic bedrock glade delineated in yellow on 2022 imagery.

papyrifera), yew (*Taxus canadensis*), white pine (*Pinus strobus*), and serviceberries (*Amelanchier* spp.). Moose browse was noted up to 3 meters on understory balsam fir. Beaver herbivory of understory saplings was noted, especially along the margins of wetlands adjacent to the glade.

The scattered and stunted trees and shrubs are persistently subject to drought, wind, and freezing. Extreme cold and heat generate challenging growing conditions for the plants within the glade. Many trees within the volcanic bedrock glade are stressed, and canopy mortality is prevalent. Snags and coarse woody debris are common. An 80 cm white pine snag was noted within the glade. Several conifers were cored within the glade to gauge tree age: a 31 cm white spruce (*Picea glauca*) was cored and estimated to be over 68 years old (58 ring count) and a 51 cm white pine was cored and estimated to be over 72 years old (62 ring count).

This glade includes a unique talus field. A large accumulation of volcanic talus occurs between two of the bedrock knobs. It is unclear if this feature is anthropogenic (e.g., from mining) or if it is the result of a natural process. However, because the talus is smooth and appears water worked, we suspect that the accumulation of talus resulted from a glacial event, such as the breaking of an extensive lake dam causing a river spillway to deposit the talus.

The glade is characterized by a scattered and stunted overstory (5-15%) with diverse canopy composition including quaking aspen (*Populus tremuloides*), red maple (*Acer rubrum*), white spruce, paper birch, and white pine. Canopy trees typically range in diameter from 15 to 40 cm with some larger white pine and quaking aspen reaching 50 to 60 cm. The understory is sparse (5-20%) with characteristic species including white spruce, quaking aspen, pin cherry (*Prunus pensylvanica*), beaked hazelnut, and round-leaved dogwood (*Cornus rugosa*). The low shrub layer is diverse and patchy to dense (30-50%) with common species including common juniper (*Juniperus communis*), low sweet blueberry (*Vaccinium angustifolium*), bush-honeysuckle (*Diervilla lonicera*), serviceberries (*Amelanchier sanguinea*, *A. interior*, and *A. spicata*), choke cherry (*Prunus virginiana*), soapberry (*Sheperdia canadensis*), bearberry (*Arctostaphylos uva-ursi*), creeping juniper (*J. horizontalis*), wild rose (*Rosa blanda*), staghorn sumac (*Rhus typhina*), thimbleberry (*Rubus parviflorus*), yew, and seedling mountain-ash (*Sorbus decora*), balsam fir, red maple, and white spruce.

The ground cover ranges from patchy to locally dense (30-50%). Herbaceous species are concentrated where soils have accumulated along cracks, crevices, and depressions in the volcanic bedrock. A diverse array of lichens and mosses cover the exposed Portage Lake Volcanics within the volcanic bedrock glade. Characteristic non-vascular species observed within the glade include reindeer lichens (*Cladonia mitis* and *C. rangiferina*) and feather moss (*Pleurozium schreberi*). Prevalent ground cover species include poverty grass (*Danthonia spicata*), bastard-toadflax (*Comandra umbellata*),



Tobin Creek volcanic bedrock glade. Photo by Joshua G. Cohen.

goldenrods (*Solidago hispida, S. juncea,* and *S. nemoralis*), red honeysuckle (*Lonicera dioica*), big-leaved aster (*Eurybia macrophylla*), hair grass (*Avenella flexuosa*), woodland strawberry (*Fragaria vesca*), barren-strawberry (*Geum fragarioides*), wild columbine (*Aquilegia canadensis*), Canada mayflower (*Maianthemum canadense*), bracken fern (*Pteridium aquilinum*), slender wheatgrass (*Elymus trachycaulus*), rusty woodsia (*Woodsia ilvensis*), pearly everlasting (*Anaphalis margaritacea*), pale corydalis (*Capnoides sempervirens*), harebell (*Campanula rotundifolia*), small pussytoes (*Antennaria howellii*), early saxifrage (*Micranthes virginiensis*), and yarrow (*Achillea millefolium*). Rare species documented within the glade include ram's head lady-slipper (*Cypripedium arietinum,* State Special Concern), American rock-brake (*Cryptogramma acrostichoides*, State Threatened), and blue-lips (*Collinsia parviflora,* State Special Concern).

The Tobin Creek Glade volcanic bedrock glade was surveyed August 09, 2024. Ninety-two plant species were documented with 83 native species and 9 non-native species. The total FQI was 40.3 and the total mean C value was 4.2.

Threats: Species composition and structure are patterned by natural processes. The Mount Ojibway Trail passes through this glade and has likely contributed to the localized introduction of non-native plants in the glade. Non-natives occur infrequently within the glade and include common mullein (*Verbascum thapsus*), hawkweeds (*Hieracium aurantiacum, H. caespitosum,* and *H. piloselloides*), Canada bluegrass (*Poa compressa*), helleborine (*Epipactis helleborine*), common St. John's-wort (*Hypericum perforatum*), common goat's beard (*Tragopogon pratensis*), and Timothy (*Phleum pratense*).

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and maintain a natural buffer surrounding the glades to prevent the increase of a weedy seed source. Efforts to control invasive species should be implemented and monitored.



Tobin Creek volcanic bedrock glade. Photo by Joshua G. Cohen.



A talus field occurs within the Tobin Creek volcanic bedrock glade. We suspect that this geologic feature resulted from a glacial event, such as the breaking of a dam causing a river spillway to deposit the talus. Photo by Joshua G. Cohen.



A beaver-flooded hardwood swamp occurs perched above and immediately adjacent to the lowest band of bedrock exposure within the Tobin Creek volcanic bedrock glade. Photo by Joshua G. Cohen.

42. Tobin Harbor
Natural Community Type: Volcanic Bedrock Glade
Rank: GU S2, uncertain globally and imperiled within the state
Element Occurrence Rank: B
Size: 25 acres (10 hectares)
Element Occurrence Identification Number: 28368

Site Description: This volcanic bedrock glade occurs north of Tobin Harbor and spans close to a mile. The glade occurs intermixed with boreal forest on moderate to rugged topography and has multiple terraces. The glade is locally backed by small volcanic cliff escarpments that are 3 to 7 meters tall. The soils of the volcanic bedrock glade are shallow (typically 0-5 cm), acidic (pH 5.0-6.5) organics and loams overlying basalt. Soil chemistry is variable and depends on the local composition of decomposing plant and organic material (e.g., needle cast from pine locally increases the soil acidity). Soil development is restricted to cracks, fissures, and depressions with scattered portions of the glade being characterized by exposed volcanic bedrock. Shallow soils over bedrock, herbivory, and windthrow have contributed to the open physiognomy of the volcanic bedrock glade. Conifers were cored within the glade to gauge tree age: a 37 cm jack pine (*Pinus banksiana*) was cored and estimated to be over 100 years old (94 growth rings counted) and a 31 cm white spruce (*Picea glauca*) was cored and estimated to be over 100 years old (93 growth rings counted). The scattered and stunted trees and shrubs are persistently stressed by drought, wind, and freezing. Extreme cold and heat generate challenging growing conditions for the plants within the glade.

The scattered and stunted overstory (5-15%) is characterized by jack pine, white spruce, northern white-cedar (*Thuja occidentalis*), white pine (*Pinus strobus*), and quaking aspen (*Populus tremuloides*). Canopy trees typically range in diameter from 10 to 30 cm with some larger northern white-cedar and pines reaching 40 to 50 cm. The understory is sparse to patchy (10-20%) with characteristic species including white pine, jack pine, quaking aspen, balsam fir (*Abies balsamea*),



Tobin Harbor volcanic bedrock glade delineated in yellow on 2022 imagery.

and serviceberries (*Amelanchier spicata* and *A. sanguinea*). Notably, several tamarack (*Larix laricina*) saplings were documented within this glade. The low shrub layer is diverse and patchy to dense (40-60%) with common species including common juniper (*Juniperus communis*), bearberry (*Arctostaphylos uva-ursi*), low sweet blueberry (*Vaccinium angustifolium*), Canada blueberry (*V. myrtilloides*), bush-honeysuckle (*Diervilla lonicera*), serviceberries, wild rose (*Rosa acicularis*), prairie willow (*Salix humilis*), creeping juniper (*J. horizontalis*), and seedling white spruce, jack pine, white pine, and quaking aspen.

The ground cover ranges from patchy to locally dense (30-45%). Prevalent ground cover species include harebell (*Campanula rotundifolia*), small pussytoes (*Antennaria howellii*), geocaulon (*Geocaulon lividum*), pale corydalis (*Capnoides sempervirens*), American rock-brake (*Cryptogramma acrostichoides*, State Threatened), prairie buttercup (*Ranunculus rhomboideus*, State Threatened), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), rough-leaved rice-grass (*Oryzopsis asperifolia*), common polypody (*Polypodium virginianum*), pale corydalis (*Capnoides sempervirens*), rusty woodsia (*Woodsia ilvensis*), yarrow (*Achillea millefolium*), early saxifrage (*Micranthes virginiensis*), and Kalm's hawkweed (*Hieracium kalmii*).

Herbaceous species typical of boreal forests are common within the glade in areas of partial canopy and include Canada mayflower (*Maianthemum canadense*), bunchberry (*Cornus canadensis*), twinflower (*Linnaea borealis*), big-leaved aster (*Eurybia macrophylla*), wild sarsaparilla (*Aralia nudicaulis*), wintergreen (*Gaultheria procumbens*), bluebead-lily (*Clintonia borealis*), bracken fern (*Pteridium aquilinum*), and cow-wheat (*Melampyrum lineare*). Fragrant woodfern (*Dryopteris fragrans*, State Special Concern) and bluegrass (*Poa interior,* State Special Concern) occur locally.

A diverse array of lichens and mosses cover the exposed Portage Lake Volcanics within the volcanic bedrock glade. Characteristic non-vascular species observed within the glade include reindeer lichens (*Cladonia mitis* and *C. rangiferina*) and feather moss (*Pleurozium schreberi*).

The Tobin Harbor volcanic bedrock glade was surveyed August 19, 2025. Sixty-nine plant species were documented with 66 native species and 3 non-native species. The total FQI was 39.9 and the total mean C value was 4.8.

Moose signs including trails, scat, and bedding were noted throughout the glades and adjacent boreal forest. Moose herbivory within the glade likely contributes to the open physiognomy. Three wolf pups were observed within the glade. Hundreds of hornets, wasps, and yellow jackets were observed feeding on scale associated with jack pine needles.



Tobin Harbor volcanic bedrock glade. Photo by Jesse M. Lincoln.

Threats: Species composition and structure are patterned by natural processes. Non-natives observed within the glade include Canada bluegrass (*Poa compressa*), orange hawkweed (*Hieracium aurantiacum*), and yellow hawkweed (*Hieracium caespitosum*).

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and to maintain a natural buffer surrounding the glades to prevent the increase of a weedy seed source. The glades should be periodically monitored for invasive species infestations.

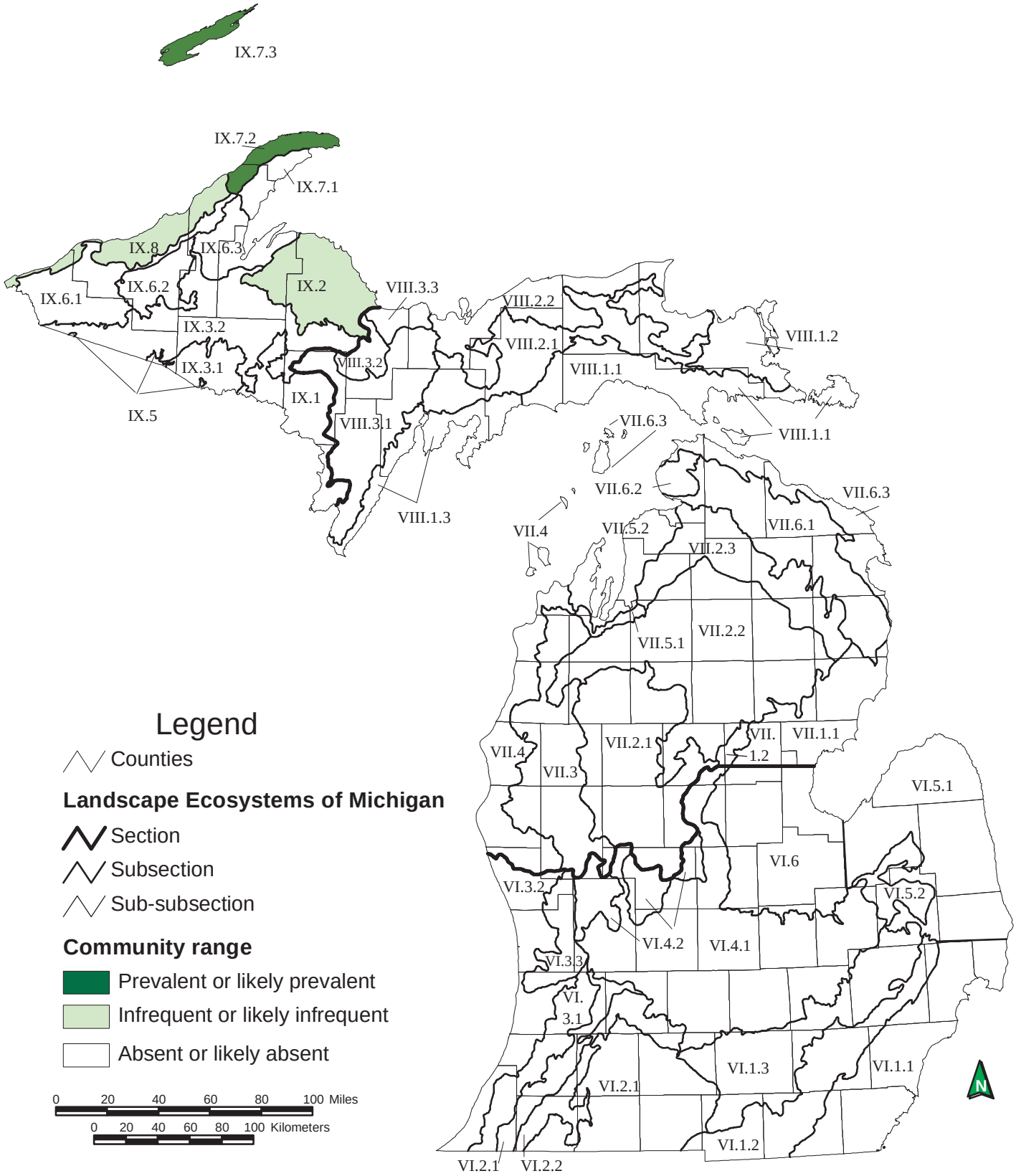


Tobin Harbor volcanic bedrock glade. Photos by Jesse M. Lincoln.



VOLCANIC BEDROCK LAKESHORE

Overview: Volcanic bedrock lakeshore is a sparsely vegetated community dominated by mosses and lichens, with a scattered coverage of vascular plants. The community is located primarily along the Lake Superior shoreline on the Keweenaw Peninsula and Isle Royale. This Great Lakes coastal plant community includes all types of volcanic bedrock, including basalt, conglomerate composed of volcanic rock, and rhyolite (Cohen et al. 2015, Cohen et al. 2025).



Map 14. Distribution of volcanic bedrock lakeshore in Michigan (Albert et al. 2008).

43. Minong Shores
Natural Community Type: Volcanic Bedrock Lakeshore
Rank: G4G5 S2, apparently secure to secure globally and imperiled within the state
Element Occurrence Rank: A
Size: 214 acres (87 hectares)
Element Occurrence Identification Number: 27880

Site Description: Moderate to steeply sloping volcanic bedrock lakeshore occurs along over 12 miles of Lake Superior shoreline extending from Conglomerate Bay southwest towards Schooner Island. The majority of this shoreline is characterized by volcanic bedrock lakeshore with localized stretches of volcanic lakeshore cliff and pockets of volcanic cobble shore occurring in protected coves. The volcanic bedrock lakeshore is backed by volcanic bedrock glade and open-canopied boreal forest that is frequently impacted by Lake Superior storms and experiences high turnover of canopy trees. The majority of the lakeshore is composed of massive basalt, with small inclusions of sandstone and conglomerates between basalt layers. All bedrock that forms the shoreline are part of the Portage Lake Volcanics. The volcanic bedrock lakeshore ranges in width from 10 to 60 meters wide and the extent of the open conditions corresponds to slope of bedrock and stochastic exposure to varying degree of storms. Near the water's edge, storm waves regularly scour the rock, limiting soil development. Both wave splash and rain provide moisture for plants as well as the source for splash pools. Ice scours and abrades the bedrock shoreline during the winter. Lichens are prevalent close to the lake, while vascular plants are most prevalent above the zone of active storm waves and ice scour. Vegetation is sparse and restricted to cracks, crevices, depressions, and the margins of splash pools. Soil accumulates where there are more cracks and fissures in the bedrock. The "wave-splashed zone" ranges from 3 to 7 meters above the lake level and supports little vascular vegetation. Freezing rain and mist coat both the rock and vegetation, and in combination with high winds, result in stunted trees and



Minong Shores volcanic bedrock lakeshore delineated in yellow on 2022 imagery.

shrubs along the shore. Fog occurs frequently in the summer, allowing plants more characteristic of cooler northern or high elevation habitats to survive beyond their normal range.

Frequent wave action, regular exposure to storms, and the resistant nature of bedrock limit soil development along the shoreline. Small amounts of organic matter accumulate in cracks, crevices, joints, vesicles, flats, and depressions in the bedrock. In addition, driftwood occurs throughout and provides local sites for accumulation of organic matter and soil. Shallow organics mixed with mineral soil (0-5 cm) occur locally along the volcanic bedrock lakeshore and range from slightly acidic to alkaline (pH 6.0-8.0). Soil chemistry is likely linked to the decomposition of the local organic material. Organics (2-4 cm) accumulate locally along the margins of splash pools and range from slightly acidic to alkaline (pH 6.5-8.0).

Floristic composition along the Minong Shores volcanic bedrock lakeshore exhibits a complex, vertical structure dependent on the frequency and type of disturbance. These “zones” form pockets of similar vegetation and often appear as horizontal bands visually separable by the presence of variable non-vascular flora. The wave-splashed zone is dark in color due to a dominance of lake zone lichen (*Staurothele fissa*) and shows the least amount of biomass and vascular plant diversity. A “lichen zone” occurs in near-shore sections that are exposed to storm wave action and shows a higher prevalence of colorful crustose lichens and increasing vascular plant abundance. Sphagnum-lined splash pools occur throughout wave-affected areas and are hotspots for local floristic diversity. A “glade zone” occurs along upper margins of the lakeshore and displays glade-like conditions with scattered trees, a dense cover of shrubs, and increased vascular plants, fruticose lichen, and mosses. A “boreal zone” supporting pockets of boreal forest occurs in protected fissures or perched on isolated outcrops that are elevated above wave and ice action. Distinctions between zones vary in strength throughout the lakeshore depending on the degree of bedrock slope, shoreline aspect and orientation, and exposure to wind, wave, and ice.



Minong Shores volcanic bedrock lakeshore. Photo by Joshua G. Cohen.



The Minong Shores volcanic bedrock lakeshore is large, complex, and irregular, often intergrading to volcanic lakeshore cliff, volcanic cobble lakeshore, volcanic bedrock glade, and boreal forest. Despite the variable nature of the system, there are consistent patterns of vegetation corresponding with proximity to the shoreline. These are the “wave-splashed zone”, “lichen zone”, “splash pool zone”, “glade zone”, and “boreal zone”. The “wave-splashed zone” is 2 to 3 m above the water level and is impacted by waves nearly daily and is mostly bare rock with lakezone lichen (*Staurothele fissa*) covering most areas and herbaceous species covering < 1% and restricted to nooks, crevasses, and other small, protected zones. The “lichen zone” is generally 2 to 10 m above the water level, depending on slope of the bedrock. This zone is impacted by annual storms and winter ice scour. It is characterized by an extremely diverse suite of lichens and sparse vegetation. Throughout the “lichen zone” are depressions where water from wave splash consistently pools and mosses accumulate, forming isolated splash pools supporting characteristic wetland vegetation. The “splash pool zone” is embedded within this “lichen zone” and is not depicted in the diagram below. The “glade zone” occurs above the “lichen zone” along the upper margin of the volcanic bedrock lakeshore forming a narrow band of glade-like structure and composition. The “boreal zone” supporting small pockets of boreal forest occurs in protected fissures or perched on isolated outcrops that are elevated above wave and ice action. Photos by Jesse M. Lincoln.



The volcanic bedrock lakeshore is sparsely vegetated and dominated by non-vascular species with herbaceous plants (2-5%) and scattered tree and shrub cover (1-8%) restricted to the inland edge, cracks and crevices within the bedrock, and margins of splash pools. A diverse array of lichens and mosses occur on the exposed bedrock. Non-vascular plants cover 60 to 90% of the rock face and composition varies depending on exposure to the sun and water and angle of the rock. Documented non-vascular plants include horsehair lichens (*Bryoria* spp.), reindeer lichens (*Cladonia* spp.), rock ramalina (*Ramalina intermedia*), elegant sunburst lichen (*Rusavskia elegans*), map lichens (*Rhizocarpon* spp.), and blistered rock tripe (*Umbilicaria hyperborea*). Characteristic vascular plants include harebell (*Campanula rotundifolia*), wild strawberry (*Fragaria virginiana*), hair grass (*Deschampsia cespitosa*), Gillman's goldenrod (*Solidago simplex*), sand violet (*Viola adunca*), poverty grass (*Danthonia spicata*), upland white goldenrod (*Solidago ptarmicoides*), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), tufted bulrush (*Trichophorum cespitosum*), Kalm's lobelia (*Lobelia kalmii*), bastard-toadflax (*Comandra umbellata*), grass-leaved goldenrod (*Euthamia graminifolia*), yarrow (*Achillea millefolium*), bird's-eye primrose (*Primula mistassinica*), pearly everlasting (*Anaphalis margaritacea*), northern hawkweed (*Hieracium umbellatum*), common polypody (*Polypodium virginianum*), dwarf raspberry (*Rubus pubescens*), early saxifrage (*Micranthes virginiensis*), ticklegrass (*Agrostis scabra*), bristly sarsaparilla (*Aralia hispida*), and hair grass (*Avenella flexuosa*).

The wave-splashed zone or splash zone, impacted by daily waves, is characterized by bare bedrock with a black film of lakezone lichen (*Staurothele fissa*). Herbaceous species are infrequent in this wave-washed zone and are restricted to cracks and crevices with typical species including ticklegrass, Gilman's goldenrod, upland white goldenrod, hair grass, bird's-eye primrose, downy oatgrass (*Trisetum spicatum*, State Special Concern), harebell, yarrow, tufted bulrush, and Kalm's lobelia.

Splash pools occur throughout the lakeshore system, especially towards the shoreline where near-permanent pooling allows for sphagnum development at the margins of the pools. Common species flanking the margins of the splash pools include blue-joint (*Calamagrostis canadensis*), false asphodel (*Triantha glutinosa*), tufted bulrush, bird's-eye primrose, leatherleaf (*Chamaedaphne calyculata*), Labrador-tea (*Rhododendron groenlandicum*), bog rosemary (*Andromeda glaucophylla*), sweet gale (*Myrica gale*), round-leaved sundew (*Drosera rotundifolia*), small cranberry (*Vaccinium oxycoccos*), butterwort (*Pinguicula vulgaris*, State Special Concern), wild blue flag (*Iris versicolor*), small green wood orchid (*Platanthera clavellata*), bog goldenrod (*Solidago uliginosa*), sedge (*Carex echinata*), and rush (*Juncus brevicaudatus*).



Minong Shores volcanic bedrock lakeshore. Photo by Jesse M. Lincoln.



Numerous rare plants were documented along the Minong Shores volcanic bedrock lakeshore including downy oatgrass (*Trisetum spicatum*, State Special Concern) (above) and mountain fir moss (*Huperzia appressa*, State Endangered) (below). Photos by Joshua G. Cohen (above) and Jesse M. Lincoln (below).



The low shrub layer (4-8%) is diverse with characteristic species including common juniper, creeping juniper (*Juniperus horizontalis*), bearberry (*Arctostaphylos uva-ursi*), shrubby cinquefoil (*Dasiphora fruticosa*), wild rose (*Rosa acicularis*), sweet gale (*Myrica gale*), thimbleberry (*Rubus parviflorus*), bush-honeysuckle (*Diervilla lonicera*), low sweet blueberry (*Vaccinium angustifolium*), and serviceberries (*Amelanchier bartramiana* and *A. interior*) along with seedling northern white-cedar and paper birch (*Betula papyrifera*). Along the lower margin of the volcanic bedrock lakeshore, woody species are generally contorted and low growing.

Scattered tall shrubs and saplings (2-5%) are typically restricted to the upper margins away from the most active shoreline or in protected crevasses and include serviceberries, mountain alder (*Alnus viridis*), squashberry (*Viburnum edule*, State Threatened), ninebark (*Physocarpus opulifolius*), northern white-cedar, jack pine (*Pinus banksiana*), paper birch, red-osier dogwood (*Cornus sericea*), mountain-ash (*Sorbus decora*), prairie willow (*Salix humilis*), pin cherry (*Prunus pensylvanica*), mountain maple (*Acer spicatum*), and quaking aspen (*Populus tremuloides*).

Scattered and stunted trees (1-2%) include northern white-cedar, white spruce, jack pine, paper birch, quaking aspen, and balsam fir. Trees typically range from 2 to 10 cm diameter and 1 to 5 m tall. Numerous conifers were cored along the shoreline to gauge age: a 35.1 cm northern white-cedar (*Thuja occidentalis*) along the upper margin of the volcanic bedrock lakeshore was cored and estimated to be over 121 years old; a 27 cm northern white-cedar along the upper margin of the volcanic bedrock lakeshore was cored and estimated to be over 220 years old; a 52.4 cm dbh northern white cedar had a count of 243 years on 15.2 cm of a partial core and was estimated to be over 400; a prostrate 6 cm northern white-cedar was cored and estimated to be 70 years old; an extremely large jack pine (Pinus banksiana) had a 45.5 cm dbh but was not aged, though a nearby jack pine 20.8 cm dbh and 160 rings; and a 3 cm common juniper (*Juniperus communis*) was cored and estimated to be 70 years old.



Splash pools occur along the lower margin of the Minong Shores volcanic bedrock lakeshore. Photo by Joshua G. Cohen.



Twisted and stunted jack pine (*Pinus banksiana*) occur along the upper margin of the Minong Shores volcanic bedrock lakeshore in the “glade zone”. Photo by Joshua The G. Cohen.



Growing-season fog lifting along the Minong Shores volcanic bedrock lakeshore. Photo by Jesse M. Lincoln.

Along the upper margin of the shoreline, volcanic bedrock lakeshore intergrades with volcanic bedrock glade. This zone is characterized by a sparse canopy of jack pine, white spruce, paper birch, and quaking aspen. Common juniper is the dominant shrub with other prevalent species including wild rose, creeping juniper, prairie willow, low sweet blueberry, and serviceberries. Graminoids include hair grass (*Avenella flexuosa*), slender wheatgrass (*Elymus trachycaulus*), and rice-grass (*Piptatherum pungens*). Forbs include pearly everlasting, early saxifrage, wood lily (*Lilium philadelphicum*), and pale corydalis (*Capnoides sempervirens*). Ferns are abundant and include American rock-brake (*Cryptogramma acrostichoides*, State Threatened), rusty woodsia (*Woodsia ilvensis*), and common polypody. Dense reindeer lichens cover much of the exposed bedrock.

Rare plants documented along this stretch of shoreline include downy oatgrass, American rock-brake, lime-encrusted saxifrage (*Saxifraga paniculata*, State Threatened), pale Indian paintbrush (*Castilleja septentrionalis*, State Threatened), eyebright (*Euphrasia hudsoniana*, State Threatened), mountain fir moss (*Huperzia appressa*, State Endangered), fragrant woodfern (*Dryopteris fragrans*, State Special Concern), butterwort, pearlwort (*Sagina nodosa*, State Threatened), and squashberry. Squashberry is especially common along the margins of the bedrock lakeshore and the adjacent bedrock glade and along shrubby drainages passing through the volcanic bedrock lakeshore. Fragrant woodfern was documented infrequently on north-facing vertical rock faces along the shoreline.

The Minong Shores volcanic bedrock lakeshore was surveyed August 15, August 16, and August 17, 2024. One hundred plant species were documented with 98 native species and 2 non-native species. The total FQI was 60.4 and the total mean C value was 5.9.

Threats: Species composition and structure are patterned by natural processes. Non-natives were infrequently observed within the volcanic bedrock lakeshore shore include Canada bluegrass (*Poa compressa*) and yellow hawkweed (*Hieracium caespitosum*).

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to maintain a natural buffer surrounding the lakeshore to prevent the increase of a weedy seed source. The volcanic bedrock lakeshore should be periodically monitored for invasive species infestations.





Squashberry (*Viburnum edule*, State Threatened) is locally common along the upper margins of the Minong Shores volcanic bedrock lakeshore and is especially prevalent in protected fissures with inclusions of boreal forest.



Minong Shores volcanic bedrock lakeshore. Photos by Jesse M. Lincoln.



44. Mott Island
Natural Community Type: Volcanic Bedrock Lakeshore
Rank: G4G5 S2, apparently secure to secure globally and imperiled within the state
Element Occurrence Rank: B
Size: 9 acres (3.6 hectares)
Element Occurrence Identification Number: 28362

Site Description: This short stretch of volcanic bedrock lakeshore occurs along the northeastern portion of Mott Island with inclusions of volcanic lakeshore cliff. Approximately 0.64 miles of volcanic bedrock lakeshore intergrades with 0.33 miles of volcanic lakeshore cliff. Pockets of volcanic cobble shore occur locally, and the shoreline is backed by boreal forest with some small pockets of volcanic bedrock glade. Limited soil development takes place on the volcanic bedrock. The bedrock composition of Mott Island is basalt of the Portage Lake Volcanics. The only places where plants are able to establish are in cracks, crevices, joints, vesicles, flats, margins of splash pools, and depressions in the bedrock, where small amounts of organic matter accumulate. Shallow organics (0-5 cm) occur locally along the volcanic bedrock lakeshore and are circumneutral to alkaline (pH 7.0-8.). Soil chemistry is linked to the decomposition of the local organic material. A 10 cm northern white-cedar (*Thuja occidentalis*) was cored and estimated to be over 110 years old (98 growth rings).

The shoreline is primarily southeasterly facing but different aspects occur as the shoreline meanders and provide diverse climatic microhabitats for the high diversity of plants found along this stretch. The volcanic bedrock lakeshore ranges from moderately sloping to rugged and ranges in width from 2 to 5 meters wide. Frequent wave activity, high erosional resistance of the bedrock, and a lack of soil-retaining sites produce a sparsely vegetated lakeshore with flora concentrated along the upland margin above the wave-washed zone and otherwise restricted to cracks, crevices, depressions, and the margins of splash pools. The wave-splashed zone ranges in width from 2 to 4 meters and typically lacks vascular



Mott Island volcanic bedrock lakeshore delineated in yellow on 2022 imagery.

vegetation. Near the water's edge, storm waves regularly scour the rock. Both wave splash and rain provide moisture for plants as well as the source for splash pools. Ice scours and abrades the bedrock shoreline during the winter. Freezing rain and mist coat both the rock and vegetation, and in combination with high winds, result in dwarf shrubs and stunted trees along the shore. Fog occurs frequently in the summer, allowing plants more characteristic of cooler northern or high-elevation habitats to survive beyond their normal range. Well-developed splash pools are a prevalent feature of the shoreline.

Characteristic vascular plants in the herbaceous layer (2-4%) of the volcanic bedrock lakeshore include harebell (*Campanula rotundifolia*), hair grass (*Deschampsia cespitosa*), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), bird's-eye primrose (*Primula mistassinica*), poverty grass (*Danthonia spicata*), tufted bulrush (*Trichophorum cespitosum*), yarrow (*Achillea millefolium*), prairie cinquefoil (*Drymocallis arguta*), and glaucous white lettuce (*Prenanthes racemosa*). Common species flanking the margins of the splash pools including tufted bulrush, butterwort (*Pinguicula vulgaris*, State Special Concern), bird's-eye primrose, Kalm's lobelia (*Lobelia kalmii*), false asphodel (*Triantha glutinosa*), round-leaved sundew (*Drosera rotundifolia*), blue-joint (*Calamagrostis canadensis*), leatherleaf (*Chamaedaphne calyculata*), Labrador-tea (*Rhododendron groenlandicum*), mountain alder (*Alnus viridis*), and Alpine bilberry (*Vaccinium uliginosum*, State Threatened). Additional rare plants documented along this stretch of shoreline include downy oatgrass (*Trisetum spicatum*, State Special Concern), and lime-encrusted saxifrage (*Saxifraga paniculata*, State Threatened). Butterwort is locally common along the margins of splash pools within the volcanic bedrock lakeshore. Black crowberry (*Empetrum nigrum*, State Threatened) occurs along the adjacent volcanic lakeshore cliff. A diverse array of lichens and mosses occur on the exposed bedrock.

The low shrub layer (1-2%) is diverse with characteristic species including common juniper (*Juniperus communis*), creeping juniper (*J. horizontalis*), bearberry (*Arctostaphylos uva-ursi*), soapberry (*Shepherdia canadensis*), round-leaved serviceberry (*Amelanchier sanguinea*), wild rose (*Rosa acicularis*), ninebark (*Physocarpus opulifolius*), wild red raspberry (*Rubus strigosus*), mountain alder, low sweet blueberry (*Vaccinium angustifolium*), Canada blueberry (*V. myrtilloides*), Labrador-tea, and bush-honeysuckle (*Diervilla lonicera*) along with seedling northern white-cedar, white spruce (*Picea glauca*), paper birch (*Betula papyrifera*), and mountain-ash (*Sorbus decora*). Scattered tall shrubs and saplings (<1%) are typically restricted to the upper margin and include northern white-cedar, paper birch, white spruce, quaking aspen (*Populus tremuloides*), mountain-ash, Bebb's willow (*Salix bebbiana*), and mountain alder. Scattered and stunted trees (<1%) include northern white-cedar, white spruce, and quaking aspen.



Mott Island volcanic bedrock lakeshore. Photo by Joshua G. Cohen.

The Mott Island volcanic bedrock lakeshore was surveyed August 16, 2025. Forty-three plant species were documented and no non-native species were recorded. The total FQI was 38.7 and the total mean C value was 5.9.

Threats: Species composition and structure are patterned by natural processes. No invasive plant species were recorded during the surveys. A trail passes through portions of the adjacent volcanic bedrock glade and boreal forest.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and to maintain a natural buffer surrounding the lakeshore to prevent the increase of a weedy seed source. The volcanic bedrock lakeshore should be periodically monitored for invasive species infestations. Non-native species should be controlled along the trail that circumnavigates Mott Island.



Harsh growing conditions result in numerous gnarled and twisted trees and shrubs including northern white-cedar (*Thuja occidentalis*) and creeping juniper (*Juniperus horizontalis*). Photos by Jesse M. Lincoln.



45. Sam Hill
Natural Community Type: Volcanic Bedrock Lakeshore
Rank: G4G5 S2, apparently secure to secure globally and imperiled within the state
Element Occurrence Rank: B
Size: 0.7 acres (0.3 hectares)
Element Occurrence Identification Number: 28349

Site Description: This gently sloping volcanic bedrock lakeshore occurs along a tenth of a mile of Lake Superior shoreline along a small unnamed peninsula along the northwestern shore of Isle Royale. The lakeshore occurs adjacent to high-quality volcanic bedrock glade inland, volcanic lakeshore cliff to the north, and volcanic cobble shore to the southwest. These shoreline systems are backed by boreal forest. This bedrock lakeshore and the adjacent bedrock glade comprise the westernmost exposure of the Minong Flow, an extensive geologic feature that forms the backbone of the Minong Ridge on the northwestern portion of the island. The Minong Flow is part of the Portage Lake Volcanics and composed of dark-colored basalt. Limited soil development takes place on the volcanic bedrock. The volcanic bedrock lakeshore ranges in width from 5 to 10 meters wide. Frequent wave activity, high erosional resistance of the bedrock, and a lack of soil-retaining sites produce a sparsely vegetated lakeshore with flora concentrated along the upland margin above the wave-washed zone and otherwise restricted to cracks, crevices, depressions, and the margins of splash pools. Shallow organics (0-5 cm) occur locally along the volcanic bedrock lakeshore and are alkaline (pH 7.5-7.8). Soil chemistry is linked to the decomposition of the local organic material. The wave-splashed zone ranges in width from 3 to 7 meters and is lacking vascular vegetation. Near the water's edge, storm waves regularly scour the rock. Both wave splash and rain provide moisture for plants as well as the source for splash pools. Ice scours and abrades the bedrock shoreline during the winter. Freezing rain and mist coat both the rock and vegetation, and in combination with high winds, result in dwarf



Sam Hill volcanic bedrock lakeshore delineated in yellow on 2022 imagery.

shrubs and stunted trees along the shore. Fog occurs frequently in the summer, allowing plants more characteristic of cooler northern or high elevation habitats to survive beyond their normal range. Because of the location of this volcanic bedrock lakeshore on a westerly facing Peninsula and because of its gentle slope, well-developed splash pools are a prevalent feature of the shoreline. A 21.6 cm northern white-cedar (*Thuja occidentalis*) in the adjacent volcanic bedrock glade was cored and estimated to be over 225 years old (111 growth rings on 5 cm of a partial core). We surveyed the bedrock lakeshore following a severe rain event and noticed an area of intermittent seepage that flowed from the adjacent glade through the volcanic bedrock lakeshore. Blue-joint (*Calamagrostis canadensis*) was locally common within this wet area.

The volcanic bedrock lakeshore is sparsely vegetated with herbaceous plants and scattered tree and shrub cover restricted to the inland edge, cracks and crevices within the bedrock, and margins of splash pools. A diverse array of lichens and mosses occur on the exposed bedrock. Characteristic vascular plants in the herbaceous layer (4-8%) include glaucous white lettuce (*Prenanthes racemosa*), tufted bulrush (*Trichophorum cespitosum*), harebell (*Campanula rotundifolia*), yarrow (*Achillea millefolium*), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), ticklegrass (*Agrostis scabra*), hair grass (*Deschampsia cespitosa*), bird's-eye primrose (*Primula mistassinica*), hairy goldenrod (*Solidago hispida*), wild strawberry (*Fragaria virginiana*), butterwort (*Pinguicula vulgaris*, State Special Concern), Kalm's lobelia (*Lobelia kalmii*), and false asphodel (*Triantha glutinosa*). Common species flanking the margins of the splash pools including tufted bulrush, butterwort, bird's-eye primrose (*Primula mistassinica*), Kalm's lobelia, false asphodel, round-leaved sundew (*Drosera rotundifolia*), blue-joint, leatherleaf (*Chamaedaphne calyculata*), shrubby cinquefoil (*Dasiphora fruticosa*), bog rosemary (*Andromeda glaucophylla*), and mountain alder (*Alnus viridis*). Rare plants documented along this stretch of shoreline include downy oatgrass (*Trisetum spicatum*, State Special Concern) and black crowberry (*Empetrum nigrum*, State Threatened) along the volcanic lakeshore cliff and butterwort along the margins of splash pools within the volcanic bedrock lakeshore.



The Sam Hill volcanic bedrock lakeshore is characterized by well developed splash pools. Surveys for boreal chorus frogs (*Pseudacris maculata*, State Special Concern) are recommended along this shore. Photo by Joshua G. Cohen.

The low shrub layer (4-8%) is diverse with characteristic species including common juniper (*Juniperus communis*), creeping juniper (*J. horizontalis*), bearberry (*Arctostaphylos uva-ursi*), shrubby cinquefoil, ninebark (*Physocarpus opulifolius*), and black crowberry, along with seedling northern white-cedar, white spruce (*Picea glauca*), and mountain-ash (*Sorbus decora*). Scattered tall shrubs and saplings (1-4%) are typically restricted to the upper margin and include northern white-cedar, white spruce, mountain-ash, mountain alder, and northern juneberry (*Amelanchier bartramiana*). Scattered and stunted trees (1-2%) include northern white-cedar and white spruce.

The Sam Hill volcanic bedrock lakeshore was surveyed August 9, 2025. Thirty-three plant species were documented, and no non-native species were recorded. The total FQI was 37.9 and the total mean C value was 6.6.

The site is named after Samuel W. Hill, a geologist who surveyed Isle Royale along with Douglass Houghton. Samuel Hill was known for his colorful language and a propensity for profanity. When folks would retell his stories, they would substitute “Sam Hill” for the inappropriate words. The phrase “What in Sam Hill?” spread beyond the Keweenaw Peninsula and became part of the American vernacular.

Threat: Species composition and structure are patterned by natural processes. No invasive plant species were recorded during the surveys.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to maintain a natural buffer surrounding the lakeshore to prevent the increase of a weedy seed source. The volcanic bedrock lakeshore should be periodically monitored for invasive species infestations.



The Sam Hill volcanic bedrock lakeshore and adjacent Glade of Ages volcanic bedrock glade comprise the westernmost exposure of the Minong Flow, an extensive geologic feature that forms the backbone of the Minong Ridge on the northwestern portion of Isle Royale. Photo by Joshua G. Cohen.



Sam Hill volcanic bedrock lakeshore. Photos by Jesse M. Lincoln (above) and Joshua G. Cohen (below).



46. Scoville Point
Natural Community Type: Volcanic Bedrock Lakeshore
Rank: G4G5 S2, apparently secure to secure globally and imperiled within the state
Element Occurrence Rank: B
Size: 6.8 acres (2.7 hectares)
Element Occurrence Identification Number: 28364

Site Description: Volcanic bedrock lakeshore occurs along the northeastern portion of Scoville Point. Approximately 0.5 miles of volcanic bedrock lakeshore intergrades with 0.25 miles of volcanic lakeshore cliff. Pockets of volcanic cobble shore occur locally, and the shoreline is backed by boreal forest and volcanic bedrock glade. Bedrock composition of Scoville Point is basalt of the Portage Lake Volcanics. Shallow organics (0-4 cm) occur locally along the volcanic bedrock lakeshore and are slightly acidic to alkaline (pH 6.8-7.5). Soil chemistry is linked to the decomposition of the local organic material. Frequent wave activity, high erosional resistance of the bedrock, and a lack of soil-retaining sites produce a sparsely vegetated lakeshore with flora concentrated along the upland margin above the wave-washed zone and otherwise restricted to cracks, crevices, depressions, and the margins of splash pools. A 10 cm northern white-cedar (*Thuja occidentalis*) was cored and estimated to be over 100 years old (90 growth rings).

The shoreline is primarily southeasterly facing, but different aspects occur as the shoreline meanders and provide diverse climatic microhabitats for the high diversity of plants found along this stretch. The volcanic bedrock lakeshore ranges from moderately sloping to rugged and ranges in width from 10 to 20 meters wide. The wave-splashed zone ranges in width from 5 to 10 meters and is typically lacking in vascular vegetation. Near the water's edge, storm waves regularly scour the rock. Both wave splash and rain provide moisture for plants as well as the source for splash pools. Ice scours and abrades the bedrock shoreline during the winter. Freezing rain and mist coat both the rock and vegetation, and in combination with high winds, result in dwarf shrubs and stunted trees along the shore. Fog occurs frequently in the



Scoville Point volcanic bedrock lakeshore delineated in yellow on 2022 imagery.

summer, allowing plants more characteristic of cooler northern or high elevation habitats to survive beyond their normal range. The shoreline was surveyed on a high wind day, and 2-to-4-meter waves were crashing along the shoreline and actively feeding the splash pools. Well-developed splash pools are a prevalent feature of the shoreline with several perched pools occurring along the upper portions of the volcanic bedrock lakeshore. These pools provide breeding habitat for boreal chorus frogs (*Pseudacris maculata*, State Special Concern), which were heard singing in the spring of 2025 and observed during field surveys.

The volcanic bedrock lakeshore is sparsely vegetated with herbaceous plants and scattered tree and shrub cover restricted to the inland edge, cracks and crevices within the bedrock, and margins of splash pools. A diverse array of lichens and mosses occur on the exposed bedrock. Characteristic vascular plants in the herbaceous layer (2-4%) include poverty grass (*Danthonia spicata*), hairy goldenrod (*Solidago hispida*), harebell (*Campanula rotundifolia*), hair grass (*Deschampsia cespitosa*), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), bird's-eye primrose (*Primula mistassinica*), wild strawberry (*Fragaria virginiana*), wormwood (*Artemisia campestris*), tufted bulrush (*Trichophorum cespitosum*), yarrow (*Achillea millefolium*), early saxifrage (*Micranthes virginiensis*), rusty woodsia (*Woodsia ilvensis*), blue-joint (*Calamagrostis canadensis*), grass-leaved goldenrod (*Euthamia graminifolia*), geocaulon (*Geocaulon lividum*), small pussytoes (*Antennaria howellii*), fireweed (*Chamaenerion angustifolium*), and glaucous white lettuce (*Prenanthes racemosa*). Common species flanking the margins of the splash pools including tufted bulrush, butterwort (*Pinguicula vulgaris*, State Special Concern), bird's-eye primrose, Kalm's lobelia (*Lobelia kalmii*), blue-joint, Sphagnum, leatherleaf (*Chamaedaphne calyculata*), Labrador-tea (*Rhododendron groenlandicum*), bog rosemary (*Andromeda glaucophylla*), Alpine bilberry (*Vaccinium uliginosum*, State Threatened), and sweet gale (*Myrica gale*).

The low shrub layer (1-2%) is diverse with characteristic species including bearberry (*Arctostaphylos uva-ursi*), common juniper (*Juniperus communis*), creeping juniper (*J. horizontalis*), wild red raspberry (*Rubus strigosus*), round-leaved serviceberry (*Amelanchier sanguinea*), shrubby cinquefoil (*Dasiphora fruticosa*), hairy honeysuckle (*Lonicera hirsuta*), ninebark (*Physocarpus opulifolius*), low sweet blueberry (*Vaccinium angustifolium*), Canada blueberry (*V. myrtilloides*), prairie willow (*Salix humilis*), squashberry (*Viburnum edule*, State Threatened), mountain alder (*Alnus viridis*), Alpine bilberry, black crowberry (*Empetrum nigrum*, State Threatened), and bush-honeysuckle (*Diervilla lonicera*) with seedling northern white-cedar, paper birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*), and mountain-ash (*Sorbus decora*). Scattered tall shrubs and saplings (<1%) are typically restricted to the upper margin and include northern white-cedar, paper birch, white spruce (*Picea glauca*), quaking aspen, balsam fir (*Abies balsamea*), mountain-ash, prairie willow, and mountain alder. Scattered and stunted trees (<1%) include northern white-cedar and white spruce. Rare plants documented along this stretch of shoreline include downy oatgrass (*Trisetum spicatum*, State Special Concern), prickly saxifrage (*Saxifraga tricuspidata*, State Threatened), eyebright (*Euphrasia nemorosa*, State Threatened), pearlwort



Scoville Point volcanic bedrock lakeshore. Photo by Joshua G. Cohen.

(*Sagina nodosa*, State Threatened), butterwort, mountain fir moss (*Huperzia appressa*, State Endangered), Alpine bilberry, squashberry, and black crowberry.

The Scoville Point volcanic bedrock lakeshore was surveyed August 17, 2025. Sixty-eight plant species were documented with 66 native species and 2 non-native species. The total FQI was 49.5 and the total mean C value was 6.0.

Threats: Species composition and structure are patterned by natural processes. Non-natives observed within the volcanic bedrock lakeshore shore and adjacent volcanic bedrock glade include Canada bluegrass (*Poa compressa*) and yellow



Waves crashing on the volcanic bedrock lakeshore. Photos by Jesse M. Lincoln (above) and Joshua G. Cohen (below)



hawkweed (*Hieracium caespitosum*). A trail passes through portions of the adjacent volcanic bedrock glade and boreal forest.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to maintain a natural buffer surrounding the lakeshore to prevent the increase of a weedy seed source. Non-native species should be controlled along the trail that passes through to Scoville Point. The volcanic bedrock lakeshore should be periodically monitored for invasive species infestations.



Scoville Point volcanic bedrock lakeshore. Photos by Jesse M. Lincoln.





A high concentration of rare plants occur along the Scoville Point volcanic bedrock lakeshore and volcanic lakeshore cliff including butterwort (*Pinguicula vulgaris*, State Special Concern) (above). In addition, splash pools along this shoreline provide breeding habitat for boreal chorus frogs (*Pseudacris maculata*, State Special Concern) (below). Photos by Joshua G. Cohen.



47. Stone's Point
Natural Community Type: Volcanic Bedrock Lakeshore
Rank: G4G5 S2, apparently secure to secure globally and imperiled within the state
Element Occurrence Rank: B
Size: 1 acres (0.4 hectares)
Element Occurrence Identification Number: 28375

Site Description: This volcanic bedrock lakeshore is moderately sloping to rugged and occurs along a tenth of a mile of Lake Superior shoreline along an unnamed point along the northeastern shore of Isle Royale. The volcanic bedrock lakeshore grades to volcanic lakeshore cliff along the shoreline and to volcanic bedrock glade inland. These volcanic systems are embedded in a matrix of boreal forest. The volcanic bedrock lakeshore ranges in width from 5 to 10 meters wide. The wave-splashed zone ranges in width from 3 to 7 meters and is lacking vascular vegetation. The bedrock composition is basalt of the Portage Lake Volcanics. Near the water's edge, storm waves regularly scour the rock. Both wave splash and rain provide moisture for plants as well as the source for splash pools. Ice scours and abrades the bedrock shoreline during the winter. Freezing rain and mist coat both the rock and vegetation, and in combination with high winds, result in dwarf shrubs and stunted trees along the shore. Fog occurs frequently in the summer, allowing plants more characteristic of cooler northern or high elevation habitats to survive beyond their normal range. Well-developed splash pools are a prevalent feature of the shoreline. Limited soil development takes place on the volcanic bedrock lakeshore. The only places where plants are able to establish are in cracks, crevices, joints, vesicles, flats, margins of splash pools, and depressions in the bedrock, where small amounts of organic matter accumulate. Shallow organics (0-5 cm) occur locally along the volcanic bedrock lakeshore and are alkaline (pH 7.8-8.0). Soil chemistry is linked to the decomposition of the local organic material. A 10.7 cm northern white-cedar (*Thuja occidentalis*) was cored and estimated to be over 140 years old (130 growth rings).

The volcanic bedrock lakeshore is sparsely vegetated with herbaceous plants and scattered tree and shrub cover restricted to the inland edge, cracks and crevices within the bedrock, and margins of splash pools. A diverse array of lichens and mosses occur on the exposed bedrock. Characteristic vascular plants in the herbaceous layer (2-4%) include tufted



Stone's Point volcanic bedrock lakeshore delineated in yellow on 2022 imagery.

bulrush (*Trichophorum cespitosum*), harebell (*Campanula rotundifolia*), yarrow (*Achillea millefolium*), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), butterwort (*Pinguicula vulgaris*, State Special Concern), grass-leaved goldenrod (*Euthamia graminifolia*), sand violet (*Viola adunca*), Kalm's lobelia (*Lobelia kalmii*), glaucous white lettuce (*Prenanthes racemosa*), hair grass (*Deschampsia cespitosa*), bird's-eye primrose (*Primula mistassinica*), and prickly saxifrage (*Saxifraga tricuspidata*, State Threatened). Common species flanking the margins of the splash pools include tufted bulrush, butterwort, Kalm's lobelia, and shrubby cinquefoil (*Dasiphora fruticosa*). Rare plants documented along this stretch of shoreline include downy oatgrass (*Trisetum spicatum*, State Special Concern), Alpine blueberry (*Vaccinium uliginosum*, State Threatened), prairie cinquefoil (*Potentilla litoralis*, State Threatened), Alpine bluegrass (*Poa alpina*, State Threatened), butterwort, prickly saxifrage, and squashberry (*Viburnum edule*, State Threatened).

Characteristic species of the low shrub layer (1-2%) include creeping juniper (*Juniperus horizontalis*), common juniper (*J. communis*), shrubby cinquefoil (*Dasiphora fruticosa*), alpine blueberry, ninebark (*Physocarpus opulifolius*), red-osier dogwood (*Cornus sericea*), sweet gale (*Myrica gale*), squashberry, and white spruce (*Picea glauca*). Scattered tall shrubs and saplings (<1%) are typically restricted to the upper margin and include northern white-cedar, paper birch (*Betula papyrifera*), red-osier dogwood, and mountain-ash (*Sorbus decora*). Scattered and stunted trees (1-2%) include northern white-cedar and paper birch.

The Stone's Point volcanic bedrock lakeshore was surveyed August 22, 2025. Thirty-five plant species were documented with no non-native species. The total FQI was 37.9 and the total mean C value was 6.4.

Threats: Species composition and structure are patterned by natural processes. No invasive plant species were recorded during the surveys.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to maintain a natural buffer surrounding the lakeshore to prevent the increase of a weedy seed source. The volcanic bedrock lakeshore should be periodically monitored for invasive species infestations.



Stone's Point volcanic bedrock lakeshore. Photo by Joshua G. Cohen.



Characteristic plants flanking the splash pool margins include tufted bulrush (*Trichophorum cespitosum*), shrubby cinquefoil (*Dasiphora fruticosa*), and butterwort (*Pinguicula vulgaris*, State Special Concern). Photo by Joshua G. Cohen.



Stone's Point volcanic bedrock lakeshore. Photo by Joshua G. Cohen.



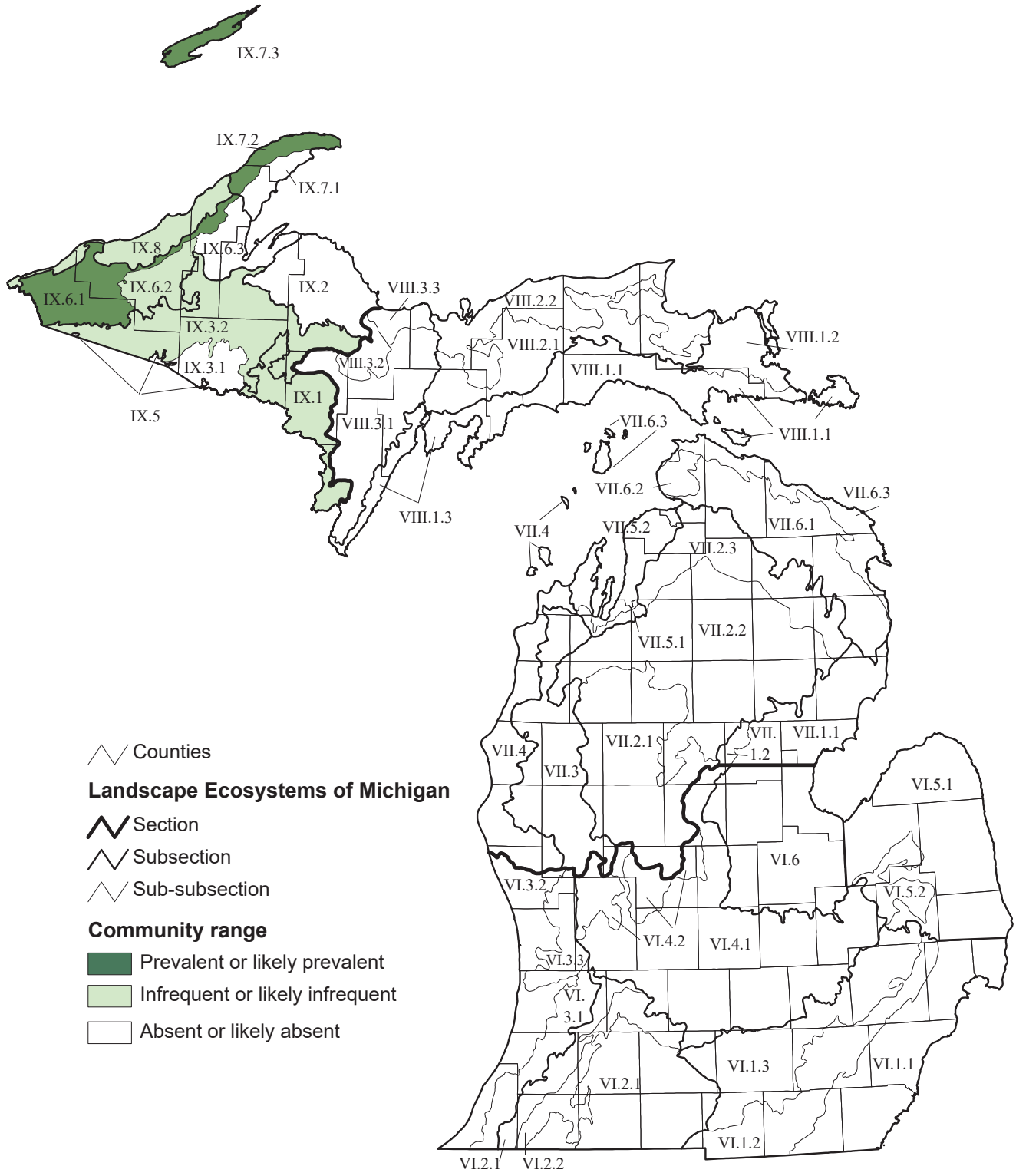
Stone's Point volcanic bedrock lakeshore. Photo by Jesse M. Lincoln.



Prickly saxifrage (*Saxifraga tricuspidata*, State Threatened). Photo by Jesse M. Lincoln.

VOLCANIC CLIFF

Overview: Volcanic cliff consists of sparsely vegetated vertical or near-vertical exposures of volcanic bedrock. Volcanic cliff occurs on inland exposures of the resistant Middle Keweenawan volcanic rock, which runs from the north tip of the Keweenaw Peninsula south into Wisconsin and also along the entire length of Isle Royale. The cliffs can be as high as 80 meters (260 ft). There is little soil development on the steep rock face of the cliffs. Thin, slightly acidic to circumneutral mineral and organic deposits accumulate in crevices in the rock face, on the upper lip of the cliffs, on ledges, and at the base of the cliff face. Plant growth and establishment are limited by the lack of suitable substrate; constant erosion; and exposure to wind, ice, and desiccating conditions (Cohen et al. 2015, Cohen et al. 2025).



Map 15. Distribution of volcanic cliff in Michigan (Albert et al. 2008).

48. Chippewa Harbor
Natural Community Type: Volcanic cliff
Rank: G4G5 S2, apparently secure to secure globally and imperiled within the state
Element Occurrence Rank: A
Size: 10 acres (4.0 hectares)
Element Occurrence Identification Number: 27878

Site Description: A 0.5 mile stretch of volcanic cliff occurs along the southern shore of the eastern arm of Chippewa Harbor on Isle Royale. The cliff is composed of vertical exposures of Portage Lake Volcanic basalt. Volcanic bedrock glade occurs along the top of the escarpment, and the cliff and glade are nested within uneven-aged boreal forest. The north-facing volcanic cliff typically ranges from 20 to 30 meters tall but is as low as 3 to 7 meters locally and reaches up to 40 meters at its maximum height. Two distinct escarpments make up this element occurrence with the larger western escarpment being significantly longer and taller and containing two terraces with boreal forest between the two terraces and sloping talus occurring locally at the foot of the lower terrace. Very shallow (0-2 cm) fine-textured, organic soils accumulate on ledges and in crevices in the bedrock. Sampled soils from the lip of the cliff were strongly acidic (pH 4.5) with charcoal noted in the soil. Soil chemistry depends on the local composition of the organic matter. A 20 cm jack pine (*Pinus banksiana*) near the top of the cliff was cored and estimated to be over 80 years old (69 ring count).

Vegetation is sparse, being generally restricted to the flat, exposed bedrock at the upper edge of the cliff (i.e., lip), cracks and joints in the cliff face, ledges along the cliff face, and along the cliff base where talus or volcanic blocks occur locally. Sparse herbaceous cover (3-8%) includes common polypody (*Polypodium virginianum*), hair grass (*Avenella flexuosa*), rusty woodsia (*Woodsia ilvensis*), bristly sarsaparilla (*Aralia hispida*), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), American rock-brake (*Cryptogramma acrostichoides*, State Threatened), dwarf raspberry (*Rubus pubescens*), fragrant



Chippewa Harbor volcanic cliff delineated in yellow on 2022 imagery.

woodfern (*Dryopteris fragrans*, State Special Concern), bluegrass (*Poa glauca*), harebell (*Campanula rotundifolia*), twinflower (*Linnaea borealis*), early saxifrage (*Micranthes virginiensis*), and slender wheatgrass (*Elymus trachycaulus*). In addition, lichens, mosses, and liverworts are locally common along the north-facing cliff face.

Sparse shrub cover (2-5%) includes common juniper (*Juniperus communis*), bearberry (*Arctostaphylos uva-ursi*), low sweet blueberry (*Vaccinium angustifolium*), serviceberries (*Amelanchier interior* and *A. spicata*), mountain-ash (*Sorbus decora*), Canadian fly honeysuckle (*Lonicera canadensis*), and squashberry (*Viburnum edule,* State Threatened). Scattered trees and tall shrubs (2-5%) occur along the lip and on ledges and crevices and include northern white-cedar (*Thuja occidentalis*), jack pine, white spruce (*Picea glauca*), balsam fir (*Abies balsamea*), mountain-ash, serviceberries (*Amelanchier interior* and *A. spicata*), and mountain maple (*Acer spicatum*). Jack pine is especially prevalent near the top of the larger cliff escarpment.

The Chippewa Harbor volcanic cliff was surveyed August 15, 2024. Twenty-eight plant species were documented with no non-native species recorded. The total FQI was 33.3 and the total mean C value was 6.3.

Numerous peregrine falcons (*Falco peregrinus*, State Threatened) and merlin (*Falco columbarius,* State Special Concern) were observed during the course of the survey. White wash along the cliff face suggests that peregrine falcons are using this cliff escarpment for nesting and targeted surveys are merited.

Threats: Species composition and structure are patterned by natural processes. No non-native species were recorded during the course of the survey.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to maintain a buffer of natural communities surrounding the volcanic cliff to prevent the increase of a weedy seed source and desiccation.



Chippewa Harbor volcanic cliff. Photo by Jesse M. Lincoln.



Chippewa Harbor volcanic cliff. Photos by Joshua G. Cohen.





Chippewa Harbor volcanic cliff. Photos by Jesse M. Lincoln (above) and Joshua G. Cohen (below).



49. Feldtmann Ridge
Natural Community Type: Volcanic cliff
Rank: G4G5 S2, apparently secure to secure globally and imperiled within the state
Element Occurrence Rank: A
Size: 100 acres (40 hectares)
Element Occurrence Identification Number: 28358

Site Description: The Feldtmann Ridge is an extensive exposure of north-facing conglomerate layers within the Copper Harbor Conglomerate sedimentary complex. Surveys identified three discrete cliff polygons. The eastern cliff is around 2,200 m long and is a multi-tiered system that rises to around 80 meters in irregular, stair-stepped segments with vertical rock faces of varying height and is largely embedded in a mesic northern forest. There is an 800 m gap between the eastern and the western escarpment. The western cliff is much more sheer, and the unbroken rock face rises about 50 m or more from the forest below and is likely the largest unbroken vertical rock face on the island. The western cliff is around 1,900 m long. A third, much smaller polygon is 130 m south of the western cliff and is embedded in mesic northern forest. It is around 10 m at its tallest and runs for around 800 m. At their lowest stature the cliffs are 3 to 10 meters tall but reach 30 to 85 meters at their apex.

The cliffs occur within a forested matrix that includes old-growth mesic northern forest to the north of the escarpment along the lower slopes of the Feldtmann Ridge and also mesic northern forest on the terraces between the stair-stepped cliffs and above portions of the cliff. Conglomerate glade occurs at the top of the cliffs and is characterized by high cover of non-native species. The dominance of weeds within the glade suggests past anthropogenic disturbance possibly associated with the watch tower. The Feldtmann Trail passes through these weedy glade openings.



Feldtmann Ridge volcanic cliff delineated in yellow on 2022 imagery.

Moose trails occur throughout the adjacent mesic northern forest, especially along the toe slope. There was moose browse on vegetation extending far over the edge of the cliff in several places and a moose jawbone was documented at the base of one of the escarpments.

There is little soil development on the steep rock face of the cliffs. Some organic soil development occurs in crevices in the rock face and on the upper lip of the cliffs. The soils are characterized by shallow (0-2 cm), acidic organics. Soils along the volcanic cliff have variable soil chemistry depending on the local composition of decomposing plants and organic material.

A 49.1 cm northern white-cedar (*Thuja occidentalis*) was cored and estimated to be over 150 years old (counted 130 growth rings on a partial core). There are narrow areas with white pine (*Pinus strobus*) at the top of the cliff in places, and these support very old wind-battered trees with near-Krumholtz form. A 53.4 cm diameter white pine had 77 rings and no rot. Many white pine were 50 to 70 cm in diameter but filled with rot and likely are much older. A 57.9 cm white pine had 149 rings on 7.8 cm of core and was estimated to be over 300 years old. A 15.9 cm black spruce (*Picea mariana*) had 142 rings. Cedar cascading over the escarpment edges and growing in cracks on the vertical face were inaccessible and are likely extremely old.

Vegetation is sparse along the conglomerate cliff and is generally restricted to the flat, exposed bedrock at the upper edge of the cliff (i.e., lip), cracks and joints in the cliff face, and ledges along the cliff face. Sparse herbaceous cover (<1%) includes fragile fern (*Cystopteris fragilis*), dolls-eyes (*Actaea pachypoda*), poverty grass (*Danthonia spicata*), rose twisted-stalk (*Streptopus lanceolatus*), small enchanter's-nightshade (*Circaea alpina*), bunchberry (*Cornus canadensis*), Canada mayflower (*Maianthemum canadense*), naked miterwort (*Mitella nuda*), bluebead-lily (*Clintonia borealis*), harebell (*Campanula rotundifolia*), wild sarsaparilla (*Aralia nudicaulis*), bluegrass (*Poa glauca*), common polypody



Feldtmann Ridge volcanic cliff. Photo by Jesse M. Lincoln.

(*Polypodium virginianum*), hair grass (*Avenella flexuosa*), and slender rock-brake (*Cryptogramma stelleri*). Lichens, mosses, and liverworts are locally common along the north-facing cliff faces.

Sparse low shrub cover (<1%) includes yew (*Taxus canadensis*), mountain maple (*Acer spicatum*), Canada blueberry (*Vaccinium myrtilloides*), and bush-honeysuckle (*Diervilla lonicera*). Scattered trees and tall shrubs (<1%) occur along the lip and on ledges and crevices and include northern white-cedar, paper birch (*Betula papyrifera*), white spruce (*Picea glauca*), balsam fir (*Abies balsamea*), white pine, mountain alder (*Alnus viridis*), serviceberry (*Amelanchier interior*), beaked hazelnut (*Corylus cornuta*), mountain-ash (*Sorbus decora*), and mountain maple.



Feldtmann Ridge volcanic cliff. Photos by Joshua G. Cohen (above) and Jesse M. Lincoln (below).



The Feldtmann Ridge volcanic cliff was surveyed on August 15, 2025. Twenty-nine plant species were documented no non-native species were recorded. The total FQI was 28 and the total mean C value was 5.2.

Threats: Species composition and structure are patterned by natural processes. No invasive plant species were documented during the survey of the cliffs. Numerous non-native weeds occur in the glades above the cliff escarpment including bluegrasses (*Poa pratensis, P. compressa, P. nemoralis*) and invasive hawkweeds (*Hieracium* spp).

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to maintain a buffer of natural communities surrounding the volcanic cliff to limit disturbance along the edges, which can promote the spread of weeds and desiccation.



Portions of the cliff had extremely old white pine growing at the top. These were aged and estimated to be over 300 years old. Photo by Jesse M. Lincoln.

50. Lake Whittlesey
Natural Community Type: Volcanic cliff
Rank: G4G5 S2, apparently secure to secure globally and imperiled within the state
Element Occurrence Rank: A
Size: 9.8 acres (3.9 hectares)
Element Occurrence Identification Number: 27881

Site Description: A 0.75 mile stretch of volcanic cliff occurs along the southern shore of Lake Whittlesey on Isle Royale. The basalt cliff is composed of a vertical exposure of Portage Lake Volcanics. Volcanic bedrock glade occurs along the top of the escarpment, and the cliff and glade are nested within uneven-aged boreal forest. The north-facing volcanic cliff ranges from 20 to 30 meters tall and includes two distinct escarpments that both include portions immediately adjacent to Lake Whittlesey. Very shallow (0-2 cm) fine-textured, organic soils accumulate on ledges and in crevices in the bedrock. Sampled soils from the lip of the cliff were strongly acidic (pH 4.5-5.0). Soil chemistry depends on the local composition of the organic matter. A 26 cm jack pine (*Pinus banksiana*) near the top of the cliff was cored and estimated to be over 152 years old (142 ring count).

Vegetation is sparse, being generally restricted to the flat, exposed bedrock at the upper edge of the cliff (i.e., lip), cracks and joints in the cliff face, ledges along the cliff face, and along the cliff base where talus or volcanic blocks occur locally. Sparse herbaceous cover (2-4%) includes common polypody (*Polypodium virginianum*), fireweed (*Chamaenerion angustifolium*), American rock-brake (*Cryptogramma acrostichoides*, State Threatened), fragrant woodfern (*Dryopteris fragrans*, State Special Concern), and pale corydalis (*Capnoides sempervirens*). Lichens, mosses, and liverworts are locally common along the north-facing cliff face.



Lake Whittlesey volcanic cliff delineated in yellow on 2022 imagery.

Sparse shrub cover (2-4%) includes sweet gale (*Myrica gale*), common juniper (*Juniperus communis*), bearberry (*Arctostaphylos uva-ursi*), squashberry (*Viburnum edule*, State Threatened), serviceberry (*Amelanchier* sp.), and seedling northern white-cedar (*Thuja occidentalis*), white spruce (*Picea glauca*), and jack pine. Scattered trees and tall shrubs (1-4%) occur along the lip and on ledges and crevices and include northern white-cedar, jack pine, white spruce, paper birch (*Betula papyrifera*), mountain-ash (*Sorbus decora*), and mountain maple (*Acer spicatum*).

The Lake Whittlesey volcanic cliff was surveyed August 16 and 17, 2024. Nineteen plant species were documented with no non-native species recorded. The total FQI was 25.7 and the total mean C value was 5.9.

Threats: Species composition and structure are patterned by natural processes. No non-native species were recorded during the course of the survey.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to maintain a buffer of natural communities surrounding the volcanic cliff to prevent the increase of a weedy seed source and desiccation.



Lake Whittlesey volcanic cliff. Photo by Jesse M. Lincoln.



Lake Whittlesey volcanic cliff. Photos by Jesse M. Lincoln (above) and Joshua G. Cohen (below).





The north-facing cliff face along Lake Whittlesey is characterized by a diverse array of lichens, mosses, and liverworts with scattered and stunted northern white-cedar (*Thuja occidentalis*) growing from crevices in the bedrock. Photos by Jesse M. Lincoln.



51. McGinty Cove
Natural Community Type: Volcanic cliff
Rank: G4G5 S2, apparently secure to secure globally and imperiled within the state
Element Occurrence Rank: AB
Size: 1.8 acres (0.7 hectares)
Element Occurrence Identification Number: 28345

Site Description: A 0.2 mile stretch of volcanic cliff occurs south of McGinty Cove along a north/northwest facing exposure. The interior cliff occurs above volcanic lakeshore cliff with a narrow band of boreal forest between the terraced escarpments. Volcanic bedrock glade occurs along the top of the escarpment and the cliff and glade are nested within uneven-aged boreal forest. The volcanic cliff typically ranges from 10 to 20 meters tall but reaches up to 60 to 100 meters at its highest.

There is little soil development on the steep rock face of the cliffs. Some organic soil development occurs in crevices in the rock face and on the upper lip of the cliffs. The soils are characterized by shallow (0-2 cm) organics. Soils along the volcanic cliff have variable soil chemistry depending on the local composition of decomposing plants and organic material.

Peregrine falcon (*Falco peregrinus*, State Threatened) were documented exhibiting territorial behavior and were seen perched on an upper ledge of the cliff. In addition, we observed two falcons engaged in coordinated hunting. Moose trails, browse, and scat were documented along the top of the cliff.



McGinty Cove volcanic cliff delineated in yellow on 2022 imagery.

The vegetation of the volcanic cliff is sparse, being generally restricted to the flat, exposed bedrock at the upper edge of the cliff (i.e., lip), cracks and joints in the cliff face, ledges along the cliff face, and along the cliff base where talus or volcanic blocks occur locally. Sparse herbaceous cover (5-10%) includes bluebead-lily (*Clintonia borealis*), wild sarsaparilla (*Aralia nudicaulis*), star-flower (*Trientalis borealis*), Canada mayflower (*Maianthemum canadense*), harebell (*Campanula rotundifolia*), common polypody (*Polypodium virginianum*), rose twisted-stalk (*Streptopus lanceolatus*), oak fern (*Gymnocarpium dryopteris*), and fragile fern (*Cystopteris fragilis*). In addition, lichens, mosses, and liverworts are locally common along the northwest-facing cliff face.

The low shrub cover is sparse (5-10%) and includes bush-honeysuckle (*Diervilla lonicera*), mountain maple (*Acer spicatum*), yew (*Taxus canadensis*), and thimbleberry (*Rubus parviflorus*). Scattered trees and tall shrubs (2-8%) occur along the lip and on ledges and crevices and include northern white-cedar (*Thuja occidentalis*), white spruce (*Picea glauca*), balsam fir (*Abies balsamea*), mountain-ash (*Sorbus decora*), and mountain maple.

The McGinty Cove volcanic cliff was surveyed August 8, 2025. Thirteen plant species were documented and no non-native species were recorded. The total FQI was 16.9 and the total mean C value was 4.7.

Threats: Species composition and structure are patterned by natural processes. No non-native species were recorded during the course of the survey.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to maintain a buffer of natural communities surrounding the volcanic cliff to prevent the increase of a weedy seed source and desiccation.



McGinty Cove volcanic cliff. Photo by Joshua G. Cohen.

52. Moose Lightning
Natural Community Type: Volcanic cliff
Rank: G4G5 S2, apparently secure to secure globally and imperiled within the state
Element Occurrence Rank: AB
Size: 2.9 acres (1.1 hectares)
Element Occurrence Identification Number: 28347

Site Description: These cliffs are composed of two polygons of north-facing escarpment that occur along the margin of volcanic bedrock glade embedded in a matrix of boreal forest. The cliffs run for approximately a half mile and are typically 15 to 20 meters tall but reach 25 to 35 meters at their apex. There is little soil development on the steep rock face of the cliffs. The cliffs are composed of Portage Lake Volcanic basalt and include some of the westernmost exposures of the Minong Flow. Some organic soil development occurs in crevices in the rock face and on the upper lip of the cliffs. The soils are characterized by shallow (0-2 cm), acidic (pH 6.0) organics. Soils along the volcanic cliff have variable soil chemistry depending on the local composition of decomposing plants and organic material. Fire-charred coarse woody debris was documented along the volcanic bedrock glade at the top of the cliff. A 49.3 cm northern white-cedar (*Thuja occidentalis*) cored along the top of the cliffs was estimated to be over 165 years old (153 growth rings counted). Moose trails, browse, and scat were documented in the adjacent volcanic bedrock glade and boreal forest.

Vegetation of the volcanic cliff is sparse, being generally restricted to the flat, exposed bedrock at the upper edge of the cliff (i.e., lip), cracks and joints in the cliff face, ledges along the cliff face, and along the cliff base where talus or volcanic



Moose Lightning volcanic cliff delineated in yellow on 2022 imagery.

blocks occur locally. Sparse herbaceous cover (4-8%) includes lady fern (*Athyrium angustum*), harebell (*Campanula rotundifolia*), bunchberry (*Cornus canadensis*), spinulose woodfern (*Dryopteris carthusiana*), evergreen woodfern (*D. intermedia*), fragrant woodfern (*D. fragrans*, State Special Concern), spotted touch-me-not (*Impatiens capensis*), wild sarsaparilla (*Aralia nudicaulis*), twinflower (*Linnaea borealis*), Canada mayflower (*Maianthemum canadense*), common polypody (*Polypodium virginianum*), rose twisted-stalk (*Streptopus lanceolatus*), star-flower (*Trientalis borealis*), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), and rusty woodsia (*Woodsia ilvensis*). Lichens, mosses, and liverworts are locally common along the north/northwest-facing cliff faces.

The sparse low shrub cover (2-4%) includes bush-honeysuckle (*Diervilla lonicera*), mountain maple (*Acer spicatum*), bearberry (*Arctostaphylos uva-ursi*), wild red raspberry (*Rubus strigosus*), and thimbleberry (*Rubus parviflorus*). Scattered trees and tall shrubs (1-2%) occur along the lip and on ledges and crevices and include northern white-cedar, white spruce (*Picea glauca*), balsam fir (*Abies balsamea*), mountain-ash (*Sorbus decora*), and paper birch (*Betula papyrifera*).

The Moose Lightning volcanic cliff was surveyed on August 9, 2025. Thirty plant species were documented with 28 native species and 2 non-native species. The total FQI was 26.3 and the total mean C value was 4.8.

Threats: Species composition and structure are patterned by natural processes. The non-natives yellow hawkweed (*Hieracium caespitosum*) and bluegrass (*Poa nemoralis*) occur locally.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to maintain a buffer of natural communities surrounding the volcanic cliff to prevent the increase of a weedy seed source and desiccation.



Moose Lightning volcanic cliff. Photo by Joshua G. Cohen.



Moose Lightning volcanic cliff. Photos by Joshua G. Cohen (above) and Jesse M. Lincoln (below).



53. Sumner Lake
Natural Community Type: Volcanic cliff
Rank: G4G5 S2, apparently secure to secure globally and imperiled within the state
Element Occurrence Rank: AB
Size: 1.6 acres (0.6 hectares)
Element Occurrence Identification Number: 27877

Site Description: A 0.1 mile stretch of volcanic cliff occurs along the northwestern shore of Sumner Lake on Isle Royale. The basalt cliff is composed of two sections of vertical exposures on either side of an escarpment formed from Portage Lake Volcanics. The northern section faces north, while the southern section faces south and directly abuts Sumner Lake. Volcanic bedrock glade occurs along the top of the escarpment between the two cliff sections, and the cliff and glade are nested within uneven-aged boreal forest. The volcanic cliffs typically range from 7 to 15 meters tall. Very shallow (0-2 cm) fine-textured, organic soils accumulate on ledges and in crevices in the bedrock. Sampled soils from the lip of the cliff were strongly acidic (pH 5.0). Soil chemistry depends on the local composition of the organic matter. A 68.8 cm white pine (*Pinus strobus*) near the top of the cliff was cored and estimated to be over 170 years old (160 growth rings counted).

Vegetation of the volcanic cliff is sparse, being generally restricted to the flat, exposed bedrock at the upper edge of the cliff (i.e., lip), cracks and joints in the cliff face, ledges along the cliff face, and along the cliff base where talus or volcanic blocks occur locally. Sparse herbaceous cover (2-8%) includes hair grass (*Avenella flexuosa*), harebell (*Campanula rotundifolia*), bluegrass (*Poa glauca*), polypody (*Polypodium virginianum*), and Canada mayflower (*Maianthemum canadense*). In addition, lichens and mosses are locally common along the cliff face. Sparse shrub cover (5-10%) includes common juniper (*Juniperus communis*), bearberry (*Arctostaphylos uva-ursi*), Canada blueberry (*V. myrtilloides*), wild red raspberry (*Rubus strigosus*), and bush-honeysuckle (*Diervilla lonicera*). Scattered trees and tall shrubs (2-5%) occur along the lip and on ledges and crevices and include northern white-cedar (*Thuja occidentalis*), white pine, paper birch (*Betula papyrifera*), white spruce (*Picea glauca*), balsam fir (*Abies balsamea*), mountain-ash (*Sorbus decora*), and pin cherry (*Prunus pensylvanica*).



Sumner Lake volcanic cliff delineated in yellow on 2022 imagery.

The Sumner Lake volcanic cliff was surveyed August 11, 2024. Seventeen plant species were documented with no non-native species recorded. The total FQI was 19 and the total mean C value was 4.6.

Threats: Species composition and structure are patterned by natural processes. No non-native species were recorded during the course of the survey.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to maintain a buffer of natural communities surrounding the volcanic cliff to prevent the increase of a weedy seed source and desiccation.

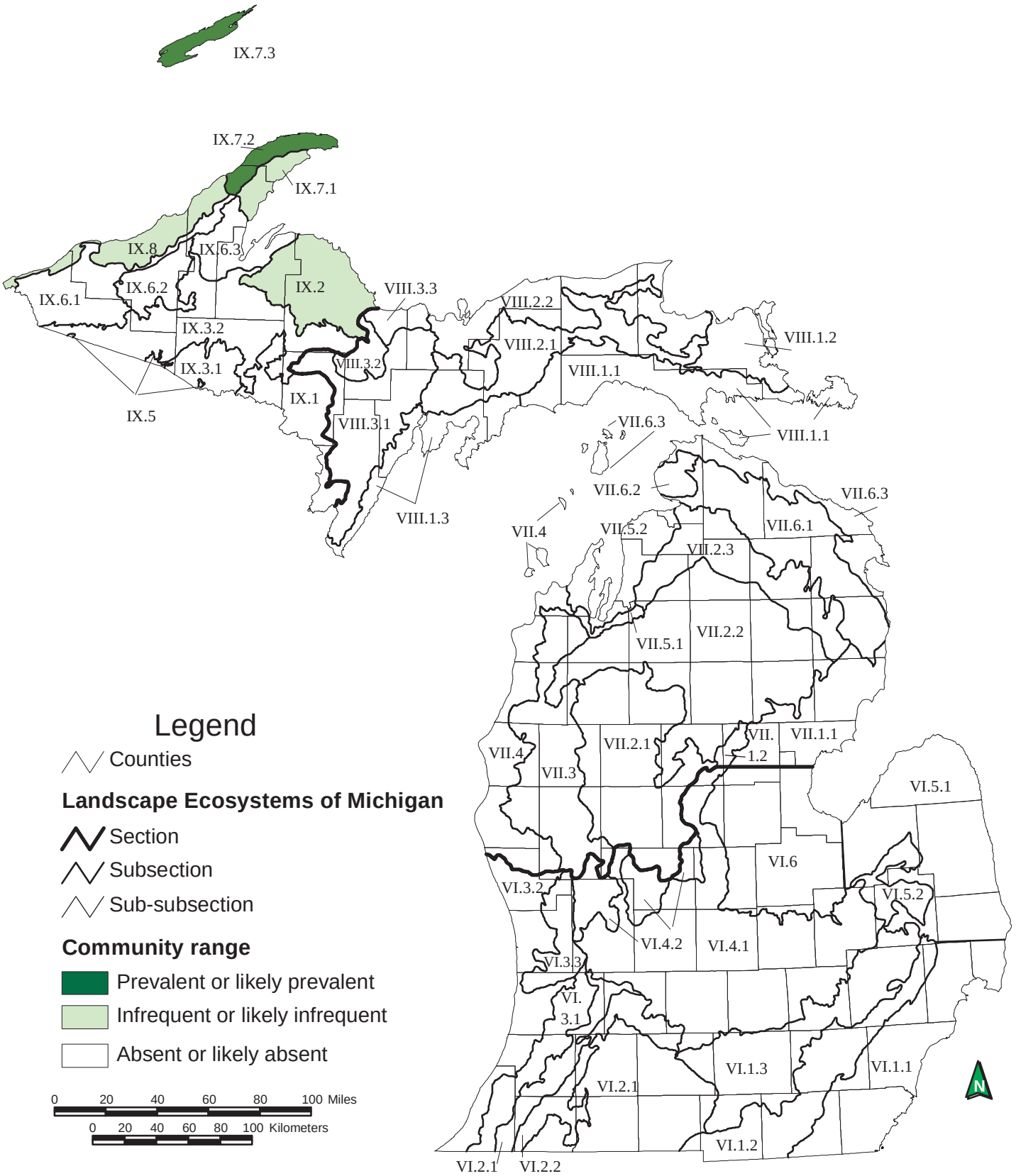


Sumner Lake volcanic cliff. Photos by Joshua G. Cohen (above) and Jesse M. Lincoln (below).



VOLCANIC COBBLE SHORE

Overview: Volcanic cobble shore occurs along Lake Superior, predominantly in coves and gently curving bays between rocky points. These mostly unvegetated shores are often terraced, with the highest cobble beach ridge typically supporting a shrub zone several meters above Lake Superior (Cohen et al. 2015, Cohen et al. 2025).



Map 16. Distribution of volcanic cobble shore in Michigan (Albert et al. 2008).

54. Huginnin Cove
Natural Community Type: Volcanic Cobble Shore
Rank: G4G5 S2, apparently secure to secure globally and imperiled within the state
Element Occurrence Rank: B
Size: 1.9 acres (0.8 hectares)
Element Occurrence Identification Number: 28342

Site Description: Approximately a third of a mile of volcanic cobble shore occurs along the north shore of Isle Royale east and west of Huginnin Cove. Two polygons of volcanic cobble shore occur intermixed with volcanic lakeshore cliff and volcanic bedrock lakeshore. The shoreline is backed by boreal forest occurring on rugged topography. Pockets of volcanic cliff and volcanic bedrock glade occur nested within the boreal forest. The areas of cobble shore are typically narrow (2-3 meters wide). The cobble shores are composed of cobbles from weathering, glacial erosion, and wave action breaking down basalt and conglomerate. Cobbles are variable in size and include occasional large slabs and boulders. Soil development is minimal and is limited to the narrow spaces between the cobbles. The shallow organic soils have variable chemistry depending on the local composition of decomposing plant and organic material. Near the water's edge, storm waves regularly reorganize the cobble and erode the soil. During the winter, ice scours and abrades the rock. Freezing rain and mist coat both the rock and vegetation, and in combination with high winds, result in dwarf shrubs and stunted trees along the shore. In general, coves, bays, and high energy stretches of shoreline along Isle Royale support volcanic cobble shore. The position of Isle Royale in unprotected waters of Lake Superior result in the island experiencing frequent high winds across the island and high waves along the shorelines.

The volcanic cobble shore is sparsely vegetated with a scattered coverage of vascular plants. Plant diversity is low due to wave and ice action and the lack of soil development. Vascular plants occur above the zone of active storm waves and ice



Huginnin Cove volcanic cobble shore delineated in yellow on 2022 imagery.

scour. Wave action and ice scour are strongest near the lakeshore, producing a wave-washed zone that is almost devoid of vegetation. With greater distance above the lake, plant cover increases. On the high, dry rocks, scattered mosses, lichens, herbs, and woody plants occur locally. Herbs and woody plants are restricted to areas where there is limited soil development between cobbles and at the margin of the adjacent boreal forest. Scattered tree saplings and tall shrubs (1-2%) along the upper margin of the volcanic cobble shore include northern white-cedar (*Thuja occidentalis*), white spruce (*Picea glauca*), paper birch (*Betula papyrifera*), white pine (*Pinus strobus*), mountain-ash (*Sorbus decora*), quaking aspen (*Populus tremuloides*), pin cherry (*Prunus pensylvanica*), prairie willow (*Salix humilis*), and mountain alder (*Alnus viridis*). Occasional low shrubs (1-2%) include wild rose (*Rosa acicularis*), ninebark (*Physocarpus opulifolius*), Canada blueberry (*Vaccinium myrtilloides*), wild red raspberry (*Rubus strigosus*), red-osier dogwood (*Cornus sericea*), and bush-honeysuckle (*Diervilla lonicera*). Recorded ground cover (2-4%) include fireweed (*Chamaenerion angustifolium*), harebell (*Campanula rotundifolia*), Gillman's goldenrod (*Solidago simplex*), hair grass (*Deschampsia cespitosa*), bird's-eye primrose (*Primula mistassinica*), spotted touch-me-not (*Impatiens capensis*), beach pea (*Lathyrus japonicus*), bunchberry (*Cornus canadensis*), oak fern (*Gymnocarpium dryopteris*), and butterwort (*Pinguicula vulgaris,* State Special Concern).

The Huggin Cove volcanic cobble shore was surveyed August 7 and August 8, 2025. Twenty-four plant species were documented, and no non-native species were recorded. The total FQI was 24.5 and the total mean C value was 5.

Threats: Species composition and structure are patterned by natural processes. No invasive plants were documented within the volcanic cobble shore. A hiking trail occurs just north of the eastern polygon of volcanic cobble shore. Foot traffic is limited, seasonal, and concentrated along the shoreline near the camp sites.

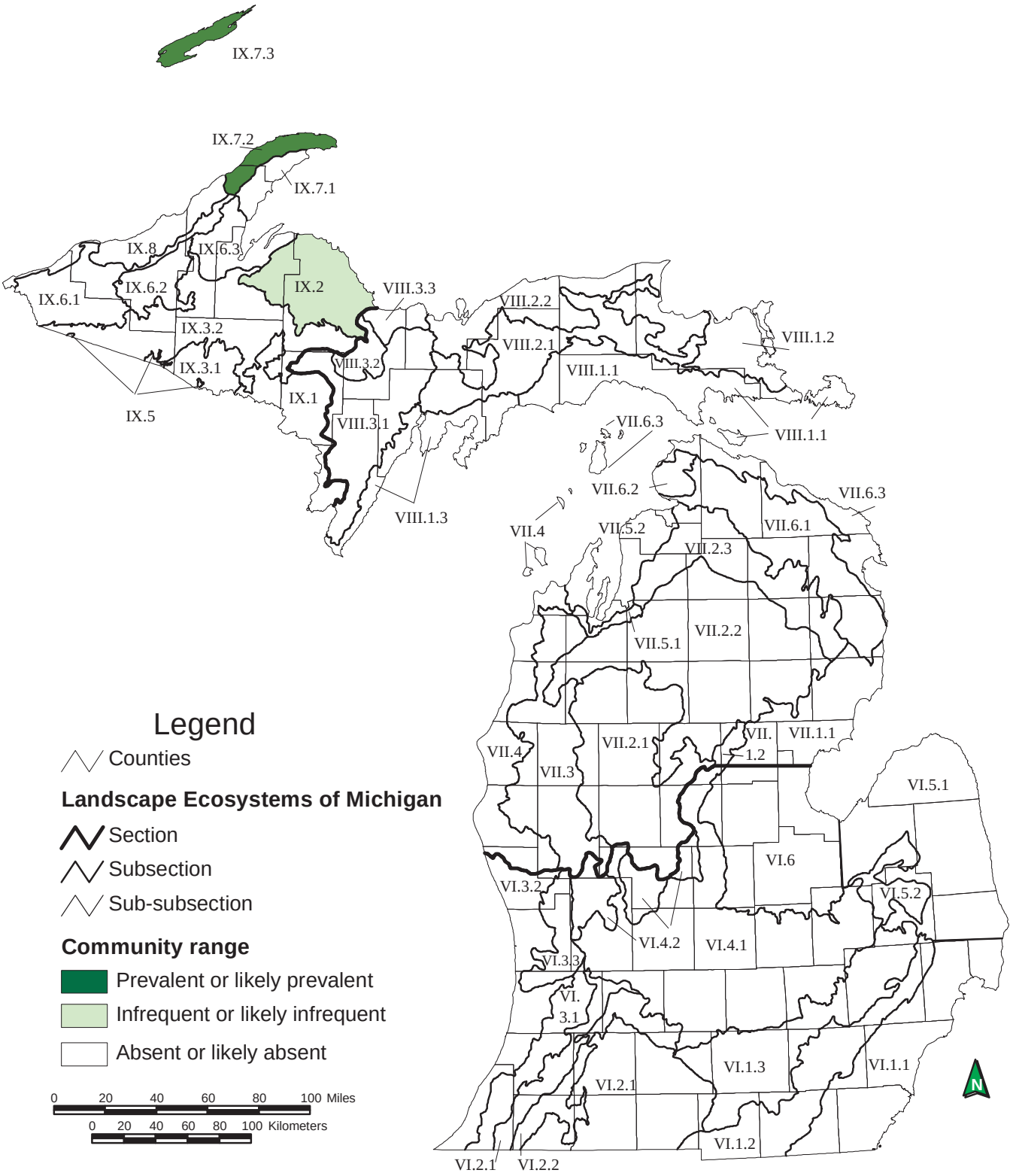
Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to maintain a buffer of natural communities surrounding the volcanic cobble shore**.** The shoreline should be monitored for invasive species infestations.



Huginnin Cove volcanic cobble shore. Photo by Joshua G. Cohen.

VOLCANIC LAKESHORE CLIFF

Overview: Volcanic lakeshore cliff consists of vertical or near-vertical exposures of bedrock, which support less than 25% vascular plant coverage, although lichens, mosses, and liverworts are abundant on some rock surfaces. Volcanic lakeshore cliff ranges in height from 3 to 80 meters (10 to 260 ft) and occurs on Lake Superior along the Keweenaw Bay shoreline of the Keweenaw Peninsula and along the northern shoreline of Isle Royale. Volcanic lakeshore cliff is characterized by high site moisture due to the proximity to Lake Superior and a stressed and unstable environment because of severe waves, wind, and winter ice. Volcanic lakeshore cliff is one of the rarest natural community types in Michigan with just four occurrence documented in the state (Cohen et al. 2015, Cohen et al. 2025).



Map 17. Distribution of volcanic lakeshore cliff in Michigan (Albert et al. 2008).

55. Amygdaloid Island
Natural Community Type: Volcanic Lakeshore Cliff
Rank: GU S1, uncertain globally and critically imperiled within the state
Element Occurrence Rank: B
Size: 4.5 acres (1.8 hectares)
Element Occurrence Identification Number: 28372

Site Description: Just over half a mile of north-facing volcanic lakeshore cliff occurs along the northeastern shore of Amygdaloid Island. The volcanic lakeshore cliff occurs intermixed with volcanic bedrock lakeshore and volcanic cobble shore. The shoreline is backed by volcanic bedrock glade and boreal forest. The volcanic lakeshore cliff consists of vertical or near-vertical exposures of Portage Lake Volcanics. The cliffs typically range in height from 3 to 7 meters. The shoreline is primarily north-facing but different aspects occur as the shoreline meanders and provide diverse climatic microhabitats for the high diversity of plants found along this stretch. There is little soil development on the steep rock face of the cliffs. Some organic soil development occurs in crevices in the rock face and on the upper lip of the cliffs. The soils are characterized by shallow (0-2 cm), acidic organics (pH 5.5-6.0). Soils along the volcanic lakeshore cliff have variable soil chemistry depending on the local composition of decomposing plants and organic material.

These cliffs are characterized by high site moisture due to the proximity to Lake Superior and a stressed and unstable environment because of severe waves, wind, and winter ice. The cliffs are exposed to continual wave action from Lake Superior. During winter, ice adds to the erosive environment along the shore. The wave-splashed and ice-scoured zone of the cliff is 2 to 5 meters up the cliff and is completely bare of vegetation. Near the water's edge, storm waves regularly scour the rock. Both wave splash and rain provide moisture for plants as well as the source for the splash pools. Ice scours and abrades the bedrock shoreline during the winter. Freezing rain and mist coat both the rock and vegetation, and



Amygdaloid Island volcanic lakeshore cliff delineated in yellow on 2022 imagery.

in combination with high winds, result in dwarf shrubs and stunted trees along the shore. Fog occurs frequently in the summer, allowing plants more characteristic of cooler northern or high elevation habitats to survive beyond their normal range. A 15 cm white spruce (*Picea glauca*) was cored and estimated to be over 125 years old (116 ring count).

Vascular plant cover is sparse along the volcanic lakeshore cliff and is generally restricted to the flat, exposed bedrock at the upper edge of the cliff (the lip), in cracks and joints in the cliff face, on ledges, and along the cliff base. Mosses and lichens are locally common on the exposed cliff face, typically above the wave-splashed zone. The upper edge of the cliff is backed by boreal forest and volcanic bedrock glade. Characteristic herbaceous species (1-2%) include three-toothed cinquefoil (*Sibbaldiopsis tridentata*), Gillman's goldenrod (*Solidago simplex*), rusty woodsia (*Woodsia ilvensis*), yarrow (*Achillea millefolium*), rock cress (*Boechera retrofracta*), fescue (*Festuca saximontana*), harebell (*Campanula rotundifolia*), common polypody (*Polypodium virginianum*), pale corydalis (*Capnoides sempervirens*), bluegrass (*Poa glauca*), downy oatgrass (*Trisetum spicatum*, State Special Concern), bunchberry (*Cornus canadensis*), hair grass (*Avenella flexuosa*), geocaulon (*Geocaulon lividum*), blue-joint (*Calamagrostis canadensis*), northern stitchwort (*Stellaria borealis*), sand violet (*Viola adunca*), fireweed (*Chamaenerion angustifolium*), bluebead-lily (*Clintonia borealis*), hair grass (*Deschampsia cespitosa*), and dwarf raspberry (*Rubus pubescens*).

The low shrub layer is sparse (1-2%) with common juniper (*Juniperus communis*), creeping juniper (*J. horizontalis*), bearberry (*Arctostaphylos uva-ursi*), bush-honeysuckle (*Diervilla lonicera*), ninebark (*Physocarpus opulifolius*), wild rose (*Rosa acicularis*), soapberry (*Shepherdia canadensis*), low sweet blueberry (*Vaccinium angustifolium*), and squashberry (*Viburnum edule*, State Threatened). Tall shrubs and tree saplings (1-2%) include mountain alder (*Alnus viridis*), prairie willow (*Salix humilis*), northern juneberry (*Amelanchier bartramiana*), northern white-cedar (*Thuja occidentalis*), paper birch (*Betula papyrifera*), white spruce, and balsam fir (*Abies balsamea*). Scattered trees (<1%) include northern white-cedar, paper birch, balsam fir, and mountain-ash (*Sorbus decora*).

The Amygdaloid Island volcanic lakeshore cliff was surveyed August 21, 2025. Thirty-three plant species were documented with 32 native species and 1 non-native species. The total FQI was 29.9 and the total mean C value was 5.2.

Threats: Species composition and structure are patterned by natural processes. No invasive plant species were recorded during the surveys.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to maintain a natural buffer surrounding the lakeshore to prevent the increase of a weedy seed source. The volcanic lakeshore cliff should be periodically monitored for invasive species infestations.



Amygdaloid Island volcanic lakeshore cliff. Photo by Joshua G. Cohen.

56. Minong Shores
Natural Community Type: Volcanic Lakeshore Cliff
Rank: GU S1, uncertain globally and critically imperiled within the state
Element Occurrence Rank: A
Size: 18 acres (7.2 hectares)
Element Occurrence Identification Number: 27882

Site Description: Approximately a mile of volcanic lakeshore cliff occurs embedded within a 12-mile stretch of volcanic bedrock lakeshore that spans from Conglomerate Harbor to Schooner Island. The majority of this shoreline is characterized by volcanic bedrock lakeshore with localized stretches of volcanic lakeshore cliff and pockets of volcanic cobble shore occurring in protected coves. The shoreline is backed by volcanic bedrock glade and open-canopied boreal forest that is frequently impacted by Lake Superior storms and experiences high turnover of canopy trees. The volcanic lakeshore cliff consists of vertical or near-vertical exposures of Portage Lake Volcanics. The cliffs range in height from 6 to 15 meters and are typically less than 0.1 miles in extent. There is little soil development on the steep rock face of the cliffs. Some organic soil development occurs in crevices in the rock face and on the upper lip of the cliffs. Shallow (2-5 cm) organic soils collected from the upper lip were acidic (pH 4.5-6.0). Soils along the volcanic lakeshore cliff have variable soil chemistry depending on the local composition of decomposing plants and organic material.

These cliffs are characterized by high site moisture due to the proximity to Lake Superior and a stressed and unstable environment because of severe waves, wind, and winter ice. The cliffs are exposed to almost continual wave action from Lake Superior. The wave-splashed and ice-scoured zone of the cliff is 2 to 3 meters up the cliff and is completely bare of vegetation. Near the water's edge, storm waves regularly scour the rock. Both wave splash and rain provide moisture



Minong Shores volcanic lakeshore cliff delineated in yellow on 2022 imagery.

for plants as well as the source for the splash pools. Ice scours and abrades the bedrock shoreline during the winter. Fog occurs frequently in the summer, allowing plants more characteristic of cooler northern or high elevation habitats to survive beyond their normal range. Freezing rain and mist coat both the rock and vegetation, and in combination with high winds, result in dwarf shrubs and stunted trees along the shore. A 30.5 cm northern white-cedar (*Thuja occidentalis*) was cored along the top of the volcanic lakeshore cliff and was estimated to be over 300 years old (243 rings counted).

Vascular plant cover is sparse along the volcanic lakeshore cliff and is generally restricted to the flat, exposed bedrock at the upper edge of the cliff (the lip), in cracks and joints in the cliff face, on ledges, and along the cliff base. Mosses, lichens, and liverworts are locally common on the exposed cliff face, typically above the wave-splashed zone. The upper edge of the cliff is typically backed by volcanic bedrock glade or boreal forest, with abundant windthrown trees resulting from strong lake winds. Vegetation is primarily restricted to the upper portion of the cliff face. Characteristic herbaceous species (2-5%) include harebell (*Campanula rotundifolia*), hairy goldenrod (*Solidago hispida*), upland white goldenrod (*S. ptarmicoides*), fireweed (*Chamaenerion angustifolium*), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), early saxifrage (*Micranthes virginiensis*), yarrow (*Achillea millefolium*), wormwood (*Artemisia campestris*), dwarf raspberry (*Rubus pubescens*), poverty grass (*Danthonia spicata*), and wild columbine (*Aquilegia canadensis*). In addition, several rare species occur along the cliff and include downy oatgrass (*Trisetum spicatum*, State Special Concern) and lime-encrusted saxifrage (*Saxifraga paniculata*, State Threatened).

The low shrub layer (2-5%) includes common juniper (*Juniperus communis*), creeping juniper (*J. horizontalis*), low sweet blueberry (*Vaccinium angustifolium*), swamp dewberry (*Rubus hispidus*), serviceberry (*Amelanchier* sp.), ninebark (*Physocarpus opulifolius*), and seedling northern white-cedar and white spruce (*Picea glauca*). Tall shrubs and tree saplings (2-5%) include northern white-cedar, white spruce, paper birch (*Betula papyrifera*), balsam poplar (*Populus balsamifera*), pin cherry (*Prunus pensylvanica*), and mountain alder (*Alnus viridis*). Scattered trees (1-2%) include northern white-cedar, white spruce, paper birch, and jack pine (*Pinus banksiana*).

The Minong volcanic lakeshore cliff was surveyed August 13, August 15, August 16, and August 17, 2024. Thirty-three plant species were documented, and no non-native species were recorded. The total FQI was 30.4 and the total mean C value was 5.3.

Threats: Species composition and structure are patterned by natural processes. Non-native species recorded within the adjacent volcanic bedrock lakeshore include infrequent yellow hawkweed (*Hieracium caespitosum*) and Canada bluegrass (*Poa compressa*).

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to maintain a natural buffer surrounding the lakeshore to prevent the increase of a weedy seed source. The volcanic lakeshore cliff should be periodically monitored for invasive species infestations.



A striking stretch of the Minong Shores volcanic lakeshore cliff north of the Chippewa Harbor entrance. These cliffs are characterized by high site moisture due to the proximity to Lake Superior and a stressed and unstable environment because of severe waves, wind, and winter ice. The cliffs are exposed to almost continual wave action from Lake Superior. The wave-splashed and ice-scoured zone of the cliff is 2 to 3 meters up the cliff and is completely bare of vegetation (the dark band just above the water). Photo by Jesse M. Lincoln.



The Minong Shores volcanic lakeshore cliff spans approximately a mile of volcanic lakeshore cliff and occurs embedded within a 12-mile stretch of volcanic bedrock lakeshore from Conglomerate Harbor to Schooner Island. The majority of this shoreline is characterized by volcanic bedrock lakeshore with localized stretches of volcanic lakeshore cliff and pockets of volcanic cobble shore in protected coves. The volcanic lakeshore cliff consists of vertical or near-vertical exposures of Portage Lake Volcanics that range in height from 6 to 15 meters and are typically less than 0.1 miles in extent. Photos by Joshua G. Cohen (above) and Jesse M. Lincoln (below).





Lime-encrusted saxifrage (*Saxifraga paniculata*, State Threatened) occurs locally along the Minong Shores volcanic lakeshore cliff. lime-encrusted pores are visibly present on the teeth of the leaf margins (below). Photos by Joshua G. Cohen (above) and Jesse M. Lincoln (below).





The shoreline from Conglomerate Harbor to Schooner Island faces primarily south and southeast but different aspects occur locally and provide diverse climatic microhabitats and increase the floristic diversity of the Minong Shores volcanic lakeshore cliff. Photos by Jesse M. Lincoln (top) and Joshua G. Cohen (middle and bottom).

57. Mott Island
Natural Community Type: Volcanic Lakeshore Cliff
Rank: GU S1, uncertain globally and critically imperiled within the state
Element Occurrence Rank: B
Size: 3 acres (1.2hectares)
Element Occurrence Identification Number: 28361

Site Description: Approximately a third of a mile of southeast-facing volcanic lakeshore cliff occurs along the northeastern shore of Mott Island. Five polygons of volcanic lakeshore cliff occur intermixed with volcanic bedrock lakeshore and volcanic cobble shore. The majority of the shoreline is backed by boreal forest with local pockets of volcanic bedrock glade. The volcanic lakeshore cliff consists of vertical or near-vertical exposures of Portage Lake Volcanics. The cliffs typically range in height from 3 to 10 meters. The shoreline is primarily southeasterly facing but different aspects occur as the shoreline meanders and provide diverse climatic microhabitats for the high diversity of plants found along this stretch. There is little soil development on the steep rock face of the cliffs. Some organic soil development occurs in crevices in the rock face and on the upper lip of the cliffs. The soils are characterized by shallow (0-2 cm) organics and loams. Soils along the volcanic lakeshore cliff have variable soil chemistry depending on the local composition of decomposing plants and organic material. Soils sampled from the adjacent volcanic bedrock lakeshore are alkaline (pH 7.5-7.8).

These cliffs are characterized by high site moisture due to the proximity to Lake Superior and a stressed and unstable environment because of severe waves, wind, and winter ice. The cliffs are exposed to continual wave action from Lake Superior. During winter, ice adds to the erosive environment along the shore. The wave-splashed and ice-scoured zone of the cliff is 2 to 3 meters up the cliff and is completely bare of vegetation. Near the water's edge, storm waves regularly scour the rock. Both wave splash and rain provide moisture for plants as well as the source for splash pools. Ice scours and abrades the bedrock shoreline during the winter. Freezing rain and mist coat both the rock and vegetation, and in combination with high winds, result in dwarf shrubs and stunted trees along the shore. Fog occurs frequently in the growing season, allowing plants more characteristic of cooler northern or high-elevation habitats to survive beyond their



Mott Island volcanic lakeshore cliff delineated in yellow on 2022 imagery.

normal range. A 10 cm northern white-cedar (*Thuja occidentalis*) in the adjacent volcanic bedrock lakeshore was cored and estimated to be over 110 years old (98 growth rings).

Vascular plant cover is sparse along the volcanic lakeshore cliff and is generally restricted to the flat, exposed bedrock at the upper edge of the cliff (the lip), in cracks and joints in the cliff face, on ledges, and along the cliff base. Mosses, lichens, and liverworts are locally common on the exposed cliff face, typically above the wave-splashed zone. The upper edge of the cliff is typically backed by boreal forest and pockets of volcanic bedrock glade.

Characteristic herbaceous species (2-4%) include harebell (*Campanula rotundifolia*), hairy goldenrod (*Solidago hispida*), wormwood (*Artemisia campestris*), downy oatgrass (*Trisetum spicatum*, State Special Concern), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), wild strawberry (*Fragaria virginiana*), small pussytoes (*Antennaria howellii*), big-leaved aster (*Eurybia macrophylla*), lime-encrusted saxifrage (*Saxifraga paniculata*, State Threatened), yarrow (*Achillea millefolium*), poverty grass (*Danthonia spicata*), cow-wheat (*Melampyrum lineare*), and rusty woodsia (*Woodsia ilvensis*).

The low shrub layer is sparse (1-2%) but diverse and includes common juniper (*Juniperus communis*), creeping juniper (*J. horizontalis*), pin cherry (*Prunus pensylvanica*), soapberry (*Shepherdia canadensis*), round-leaved serviceberry (*Amelanchier sanguinea*), bearberry (*Arctostaphylos uva-ursi*), ninebark (*Physocarpus opulifolius*), wild rose (*Rosa acicularis*), Canada blueberry (*Vaccinium myrtilloides*), wild red raspberry (*Rubus strigosus*), mountain alder (*Alnus viridis*), Alpine bilberry (*Vaccinium uliginosum*, State Threatened), bush-honeysuckle (*Diervilla lonicera*), and seedling northern white-cedar, white spruce (*Picea glauca*), and paper birch (*Betula papyrifera*). Tall shrubs and tree saplings (<1%) include mountain alder, northern white-cedar, paper birch, white spruce, and quaking aspen (*Populus tremuloides*). Scattered trees (<1%) include northern white-cedar, white spruce, and quaking aspen.

The Mott Island volcanic lakeshore cliff was surveyed August 16, 2025. Forty-three plant species were documented with no non-native species. The total FQI was 40.7 and the total mean C value was 6.2.

Threats: Species composition and structure are patterned by natural processes. The non-native Canada bluegrass (*Poa compressa*) occurs locally. A trail passes through portions of the adjacent volcanic bedrock glade and boreal forest.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to maintain a natural buffer surrounding the lakeshore to prevent the increase of a weedy seed source. The volcanic lakeshore cliff should be periodically monitored for invasive species infestations. Non-native species should be controlled along the trail that circumnavigates Mott Island.



Mott Island volcanic lakeshore cliff. Photo by Joshua G. Cohen.



The Mott Island volcanic lakeshore cliff is primarily southeasterly facing but different aspects occur as the shoreline meanders and provide diverse climatic microhabitats for the diverse plants. Photos by Joshua G. Cohen.



58. North Shore
Natural Community Type: Volcanic Lakeshore Cliff
Rank: GU S1, uncertain globally and critically imperiled within the state
Element Occurrence Rank: A
Size: 16 acres (6.4 hectares)
Element Occurrence Identification Number: 28341

Site Description: Over three miles of north-facing volcanic lakeshore cliff occurs along the north shore of Isle Royale east and west of Huginnin Cove. Six polygons of volcanic lakeshore cliff occur intermixed with volcanic cobble shore and volcanic bedrock lakeshore. The majority of the shoreline is backed by boreal forest occurring on rugged topography. Pockets of volcanic cliff and volcanic bedrock glade occur nested within the boreal forest. The westernmost polygon of volcanic lakeshore cliff is topped by volcanic bedrock glade. The stretch of volcanic lakeshore cliff south of McGinty Cove is a stair-stepped escarpment backed by tall volcanic cliff. The volcanic lakeshore cliff consists of vertical or near-vertical exposures of Portage Lake Volcanics and include some of the westernmost exposures of the Minong Flow. The cliffs typically range in height from 7 to 15 meters but are locally taller south of McGinty Cove where they range from 20 to 35 meters tall and are backed by interior volcanic cliffs that are even taller (60 to 100 meters tall). There is little soil development on the steep rock face of the cliffs. Some organic soil development occurs in crevices in the rock face and on the upper lip of the cliffs. The soils are characterized by shallow (0-2 cm) organics and loams. Soils along the volcanic lakeshore cliff have variable soil chemistry depending on the local composition of decomposing plants and organic material. Recorded soil pH ranged widely from pH 5.5 to 7.8.

These cliffs are characterized by high site moisture due to the proximity to Lake Superior and a stressed and unstable environment because of severe waves, wind, and winter ice. The cliffs are exposed to almost continual wave action from



North Shore volcanic lakeshore cliff delineated in yellow on 2022 imagery.

Lake Superior. During winter, ice adds to the erosive environment along the shore. The wave-splashed and ice-scoured zone of the cliff is 2 to 7 meters up the cliff and is completely bare of vegetation. Near the water's edge, storm waves regularly scour the rock. Both wave splash and rain provide moisture for plants as well as the source for splash pools. Ice scours and abrades the bedrock shoreline during the winter. Freezing rain and mist coat both the rock and vegetation, and in combination with high winds, result in dwarf shrubs and stunted trees along the shore. Fog occurs frequently during the growing season, allowing plants more characteristic of cooler northern or high-elevation habitats to survive beyond their normal range. Conifers along the upper margin of the cliff were cored to gauge tree age: a 45 cm northern white-cedar (*Thuja occidentalis*) was cored along the top of the volcanic lakeshore cliff and was estimated to be over 300 years old (200 rings counted on a partial core); a 42 cm northern white-cedar was cored along the top of the volcanic lakeshore cliff and was estimated to be over 250 years old (84 rings counted on a partial core); and a 56 cm northern white-cedar was cored along the top of the volcanic lakeshore cliff and was estimated to be over 150 years old (140 rings counted on complete core).

Moose trails and scat occur throughout the adjacent boreal forest, and moose scat and browse were noted locally along the volcanic bedrock lakeshore. Moose droppings were additionally noted in a splash pool within an inclusion of volcanic bedrock lakeshore. Balsam fir (*Abies balsamea*) exhibited signs of moose browse along the upper margins of the cliffs. Vascular plant cover is sparse along the volcanic lakeshore cliff and is generally restricted to the flat, exposed bedrock at the upper edge of the cliff (the lip), in cracks and joints in the cliff face, on ledges, and along the cliff base. Mosses, lichens, and liverworts are locally common on the exposed cliff face, typically above the wave-splashed zone. The upper edge of the cliff is typically backed by boreal forest, with abundant windthrown trees resulting from strong lake winds.

Vegetation is primarily restricted to the upper portion of the cliff face. Characteristic herbaceous species (2-4%) include harebell (*Campanula rotundifolia*), hairy goldenrod (*Solidago hispida*), hair grass (*Deschampsia cespitosa*), Kalm's lobelia (*Lobelia kalmia*), bird's-eye primrose (*Primula mistassinica*), yarrow (*Achillea millefolium*), wild sarsaparilla (*Aralia nudicaulis*), twinflower (*Linnaea borealis*), geocaulon (*Geocaulon lividum*), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), fireweed (*Chamaenerion angustifolium*), wild strawberry (*Fragaria virginiana*), glaucous white lettuce (*Prenanthes racemosa*), common polypody (*Polypodium virginianum*), and blue-joint (*Calamagrostis canadensis*). In addition, several rare species occur along the cliff and include downy oatgrass (*Trisetum spicatum*, State Special Concern), butterwort (*Pinguicula vulgaris*, State Special Concern), lime-encrusted saxifrage (*Saxifraga paniculata*, State Threatened), black crowberry (*Empetrum nigrum*, State Threatened), and squashberry (*Viburnum edule*, State Threatened).

The low shrub layer (1-2%) includes bearberry (*Arctostaphylos uva-ursi*), Canada blueberry (*Vaccinium myrtilloides*), wild rose (*Rosa acicularis*), ninebark (*Physocarpus opulifolius*), shrubby cinquefoil (*Dasiphora fruticosa*), creeping juniper (*Juniperus horizontalis*), common juniper (*J. communis*), bush-honeysuckle (*Diervilla lonicera*), thimbleberry



The North Shore volcanic lakeshore cliff is back by boreal forest on steep terrain. Photo by Jesse M. Lincoln.

(*Rubus parviflorus*), wild red raspberry (*Rubus strigosus*), squashberry, yew (*Taxus canadensis*), and red-osier dogwood (*Cornus sericea*), and seedling northern white-cedar, white spruce (*Picea glauca*), paper birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*), and balsam poplar (*Populus balsamifera*). Tall shrubs and tree saplings (1-2%) include mountain alder (*Alnus viridis*), serviceberries (*Amelanchier arborea* and *A. interior*), mountain-ash (*Sorbus decora*), northern white-cedar, white spruce, balsam fir, and paper birch. Scattered trees (1-2%) include northern white-cedar, white spruce, paper birch, mountain-ash, balsam fir, quaking aspen (*Populus tremuloides*), and white pine (*Pinus strobus*).

The North Shore volcanic lakeshore cliff was surveyed August 7, August 8, and August 9, 2025. Sixty-three plant species were documented and no non-native species were recorded. The total FQI was 42.9 and the total mean C value was 5.4.

Threats: Species composition and structure are patterned by natural processes. No invasive species were documented during surveys of this stretch of shoreline.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to maintain a natural buffer surrounding the lakeshore to prevent the increase of a weedy seed source. The volcanic lakeshore cliff should be periodically monitored for invasive species infestations.



Over three miles of north-facing volcanic lakeshore cliff occurs along the north shore of Isle Royale east and west of Huginnin Cove. The majority of the shoreline is backed by boreal forest occurring on rugged topography. Photo by Joshua G. Cohen.

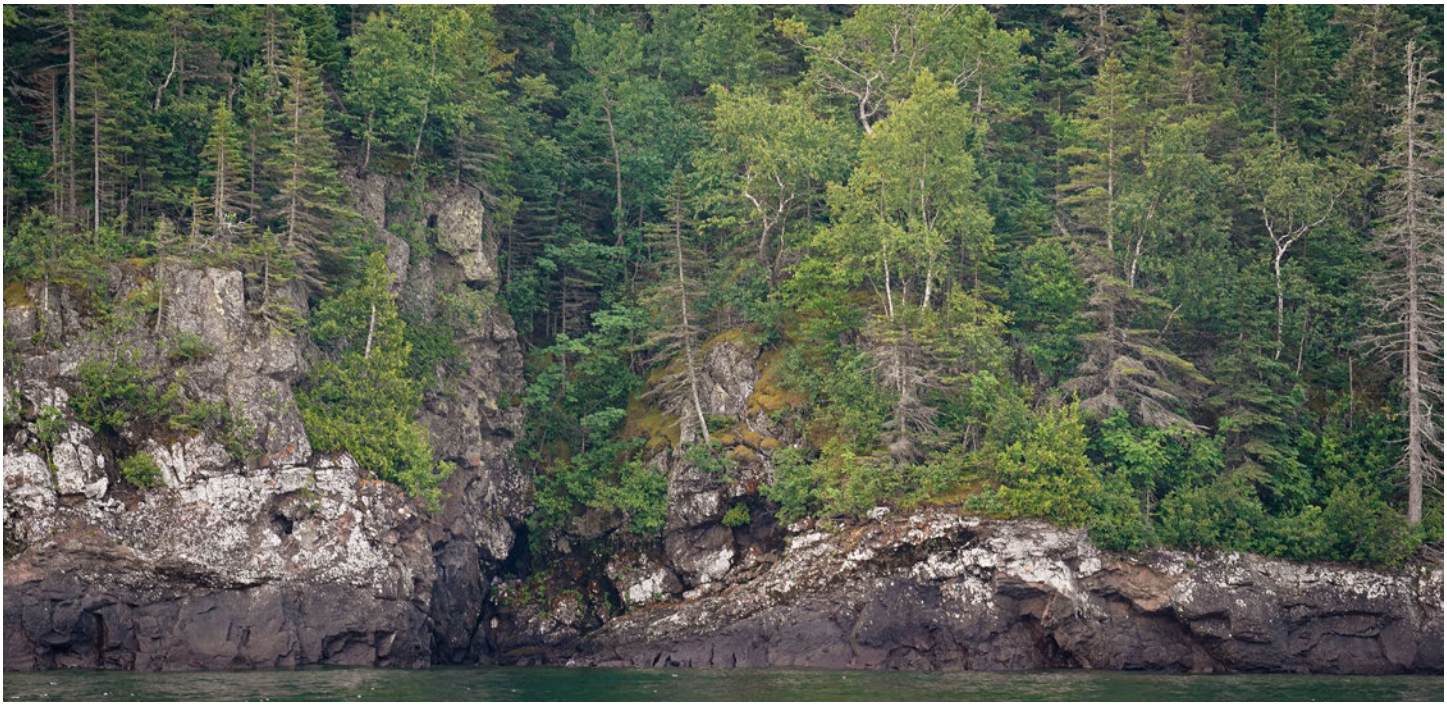


Plants growing along the North Shore volcanic lakeshore cliff are subject to a stressed and unstable environment because of severe waves, wind, winter ice, and shallow soils. Trees and shrubs exhibit contorted and stunted growth forms (e.g., twisted northern white-cedar above) and many plants along the cliffs senesce early in the growing season (e.g., dwarf raspberry turning red due to environemental stress below). Photos by Joshua G. Cohen.





The North Shore cliffs are exposed to continual wave action from Lake Superior. During winter, ice adds to the erosive environment along the shore. The wave-splashed and ice-scoured zone of the cliff is 2 to 7 meters up the cliff and is completely bare of vegetation (see the dark band just above the water's edge). Near the water's edge, storm waves regularly scour the rock. Both wave splash and rain provide moisture. Photos by Jesse M. Lincoln.



59. Scoville Point
Natural Community Type: Volcanic Lakeshore Cliff
Rank: GU S1, uncertain globally and critically imperiled within the state
Element Occurrence Rank: B
Size: 2.9 acres (1.1 hectares)
Element Occurrence Identification Number: 28365

Site Description: Approximately a quarter mile of southeast-facing volcanic lakeshore cliff occurs along the northeastern shore of Scoville Point. Four polygons of volcanic lakeshore cliff occur intermixed with volcanic bedrock lakeshore and volcanic cobble shore. The shoreline is backed by volcanic bedrock glade and boreal forest. The volcanic lakeshore cliff consists of vertical or near-vertical exposures of Portage Lake Volcanics. The cliffs typically range in height from 3 to 10 meters. The shoreline is primarily southeasterly facing but different aspects occur as the shoreline meanders and provide diverse climatic microhabitats for the high diversity of plants found along this stretch. There is little soil development on the steep rock face of the cliffs. Some organic soil development occurs in crevices in the rock face and on the upper lip of the cliffs. The soils are characterized by shallow (0-2 cm) organics and loams. Soils along the volcanic lakeshore cliff have variable soil chemistry depending on the local composition of decomposing plants and organic material. Soils sampled from the adjacent volcanic bedrock lakeshore are alkaline (pH 7.5-7.8).

These cliffs are characterized by high site moisture due to the proximity to Lake Superior and a stressed and unstable environment because of severe waves, wind, and winter ice. The cliffs are exposed to continual wave action from Lake Superior. During winter, ice adds to the erosive environment along the shore. The wave-splashed and ice-scoured zone of the cliff is 2 to 5 meters up the cliff and is completely bare of vegetation. Near the water's edge, storm waves regularly scour the rock. The shoreline was surveyed on a high wind day, and 2 to 4 meter waves were crashing along the shoreline and actively feeding the splash pools. Both wave splash and rain provide moisture for plants as well as the source for the



Scoville Point volcanic lakeshore cliff delineated in yellow on 2022 imagery.

splash pools. Ice scours and abrades the rock during the winter. Freezing rain and mist coat both the rock and vegetation, and in combination with high winds, result in dwarf shrubs and stunted trees along the shore. Fog occurs frequently in the summer, allowing plants more characteristic of cooler northern or high elevation habitats to survive beyond their normal range. A 7.5 cm northern white-cedar (*Thuja occidentalis*) was cored and estimated to be over 125 years old.

Vascular plant cover is sparse along the volcanic lakeshore cliff and is generally restricted to the flat, exposed bedrock at the upper edge of the cliff (the lip), in cracks and joints in the cliff face, on ledges, and along the cliff base. Mosses and lichens are locally common on the exposed cliff face, typically above the wave-splashed zone. Characteristic herbaceous species (1-2%) include harebell (*Campanula rotundifolia*), goldenrods (*Solidago hispida, S. ptarmicoides,* and *S. simplex*), yarrow (*Achillea millefolium*), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), downy oatgrass (*Trisetum spicatum,* State Special Concern), early saxifrage (*Micranthes virginiensis*), and common polypody (*Polypodium virginianum*). Numerous rare plants occur along this stretch of volcanic lakeshore cliff and include downy oatgrass, prickly saxifrage (*Saxifraga tricuspidata*, State Threatened), black crowberry (*Empetrum nigrum*, State Threatened), butterwort (*Pinguicula vulgaris*, State Special Concern), eyebright (*Euphrasia nemorosa*, State Threatened), mountain fir moss (*Huperzia appressa*, State Endangered), and Alpine bilberry (*Vaccinium uliginosum,* State Threatened).

The low shrub layer is sparse (1-2%) but diverse and includes common juniper (*Juniperus communis*), creeping juniper (*J. horizontalis*), ninebark (*Physocarpus opulifolius*), sweet gale (*Myrica gale*), black crowberry, alpine bilberry and seedling northern white-cedar, white spruce (*Picea glauca*), and paper birch (*Betula papyrifera*). Tall shrubs and tree saplings (<1%) include mountain alder (*Alnus viridis*), northern white-cedar, paper birch, white spruce, and balsam fir (*Abies balsamea*). Scattered trees (<1%) include northern white-cedar, white spruce, and paper birch.

The Scoville Point volcanic lakeshore cliff was surveyed August 17, 2025. Forty-seven plant species were documented with 46 native species and 1 non-native species. The total FQI was 45.2 and the total mean C value was 6.6.

Threats: Species composition and structure are patterned by natural processes. Canada bluegrass (*Poa compressa*) occurs infrequently along the cliff top. A trail passes through portions of the adjacent volcanic bedrock glade and boreal forest.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and to maintain a natural buffer surrounding the lakeshore to prevent the increase of a weedy seed source. The volcanic lakeshore cliff should be periodically monitored for invasive species infestations. Non-native species should be controlled along the trail that goes out to Scoville Point.



Scoville Point volcanic lakeshore cliff. Photo byJoshua G. Cohen.





A high concentration of rare plants occur along the Scoville Point volcanic lakeshore cliff and adjacent volcanic bedrock lakeshore including black crowberry (*Empetrum nigrum*, State Threatened) (top left), Alpine bilberry (*Vaccinium uliginosum*, State Threatened) (top right), and mountain fir moss (*Huperzia appressa*, State Endangered) (bottom). Photos by Joshua G. Cohen (above) and Jesse M. Lincoln (below).





Prickly saxifrage (*Saxifraga tricuspidata*, State Threatened). Photo by Joshua G. Cohen.



Black crowberry (*Empetrum nigrum*, State Threatened). Photo by Jesse M. Lincoln.



Spray from waves provides an important source of moisture for the stressed plants growing along the cliff face and lip. Photos by Joshua G. Cohen (above) and Jesse M. Lincoln (below).





Northern white-cedar (*Thuja occidentalis*) eeking out a stunted existence in a crevice in the vertical face of the Scoville Point volcanic lakeshore cliff. Photos by Joshua G. Cohen.

60. Stone's Point
Natural Community Type: Volcanic Lakeshore Cliff
Rank: GU S1, uncertain globally and critically imperiled within the state
Element Occurrence Rank: AB
Size: 7.5 acres (3.0 hectares)
Element Occurrence Identification Number: 28374

Site Description: Just over half a mile of north/northwest-facing volcanic lakeshore cliff occurs along an unnamed point in the northeastern portion of Isle Royale. Volcanic bedrock lakeshore occurs along the southwestern and northeastern margins of the volcanic lakeshore cliff, and the shoreline is backed by volcanic bedrock glade and boreal forest. The volcanic lakeshore cliff consists of vertical or near-vertical exposures of Portage Lake Volcanics. The cliffs typically range in height from 3 to 15 meters but reach 25 to 40 meters at their apex along the central portion of the point. The cliffs are locally terraced. The shoreline is north-northwest facing. There is little soil development on the steep rock face of the cliffs. Some organic soil development occurs in crevices in the rock face and on the upper lip of the cliffs. The soils are characterized by shallow (0-2 cm), acidic organics (pH 5.5-6.0). Soils along the volcanic lakeshore cliff have variable soil chemistry depending on the local composition of decomposing plants and organic material.

These cliffs are characterized by high site moisture due to the proximity to Lake Superior and a stressed and unstable environment because of severe waves, wind, and winter ice. The cliffs are exposed to continual wave action from Lake Superior. During winter, ice adds to the erosive environment along the shore. The wave splash and ice scour zone of the cliff is 2 to 7 meters up the cliff and is completely bare of vegetation. Near the water's edge, storm waves regularly scour the rock. Both wave splash and rain provide moisture for plants as well as the source for the splash pools. Ice scours and abrades the rock during the winter. Recently sheared-off volcanics provide talus along the base of the cliffs as well as exposed substrate devoid of vascular and non-vascular vegetation. Freezing rain and mist coat both the rock



Stone's Point volcanic lakeshore cliff delineated in yellow on 2022 imagery.

and vegetation, and in combination with high winds, result in dwarf shrubs and stunted trees along the shore. Fog occurs frequently in the growing season, allowing plants more characteristic of cooler northern or high elevation habitats to survive beyond their normal range. Conifers along the upper margin of the cliff were cored to gauge tree ages: a 12.2 cm northern white-cedar (*Thuja occidentalis*) was cored and estimated to be over 190 years old (180 ring count); and a 15.2 northern white-cedar was cored and estimated to be over 260 years old (250 ring count).

Vascular plant cover is sparse along the volcanic lakeshore cliff and is generally restricted to the flat, exposed bedrock at the upper edge of the cliff (the lip), in cracks and joints in the cliff face, on ledges, and along the cliff base. Mosses and lichens are locally common on the exposed cliff face, typically above the wave-splashed zone. The upper edge of the cliff is backed by boreal forest and volcanic bedrock glade. Characteristic herbaceous species (1-2%) include three-toothed cinquefoil (*Sibbaldiopsis tridentata*), goldenrods (*Solidago hispida* and *S. simplex*), rusty woodsia (*Woodsia ilvensis*), harebell (*Campanula rotundifolia*), fescue (*Festuca saximontana*), ticklegrass (*Agrostis scabra*), hair grass (*Avenella flexuosa*), common polypody (*Polypodium virginianum*), bird's-eye primrose (*Primula mistassinica*), prickly saxifrage (*Saxifraga tricuspidata*, State Threatened), Alpine bluegrass (*Poa alpina*, State Threatened), bluegrass (*Poa glauca*), poverty grass (*Danthonia spicata*), hair grass (*Deschampsia cespitosa*), geocaulon (*Geocaulon lividum*), Canada mayflower (*Maianthemum canadense*), rock whitlow-grass (*Draba arabisans*, State Special Concern), wild sarsaparilla (*Aralia nudicaulis*), downy oatgrass (*Trisetum spicatum*, State Special Concern), fragrant woodfern (*Dryopteris fragrans*, State Special Concern), glaucous white lettuce (*Prenanthes racemosa*), grass-leaved goldenrod (*Euthamia graminifolia*), fragile fern (*Cystopteris fragilis*), Kalm's lobelia (*Lobelia kalmia*), blue-joint (*Calamagrostis canadensis*), butterwort (*Pinguicula vulgaris*, State Special Concern), and fireweed (*Chamaenerion angustifolium*).

The low shrub layer is sparse (<1%) with ninebark (*Physocarpus opulifolius*), creeping juniper (*Juniperus horizontalis*), shrubby cinquefoil (*Dasiphora fruticosa*), squashberry (*Viburnum edule*, State Threatened), wild red raspberry (*Rubus strigosus*), thimbleberry (*Rubus parviflorus*), serviceberries (*Amelanchier* spp.), pin cherry (*Prunus pensylvanica*), Canada blueberry (*Vaccinium myrtilloides*), Alpine bilberry (*Vaccinium uliginosum*, State Threatened), and white spruce (*Picea glauca*). Tall shrubs and tree saplings (<1%) include mountain alder (*Alnus viridis*), white spruce, mountain-ash (*Sorbus decora*), and serviceberries (*Amelanchier* spp.). Scattered trees (<1%) include northern white-cedar, white spruce, quaking aspen (*Populus tremuloides*), paper birch (*Betula papyrifera*), balsam fir (*Abies balsamea*), and mountain-ash.



Stone's Point volcanic lakeshore cliff. Photo by Jesse M. Lincoln.

The Stone's Point volcanic lakeshore cliff was surveyed August 22, 2025. Fifty-two plant species were documented with no non-native species. The total FQI was 44.7 and the total mean C value was 6.2.

A potential peregrine falcon (*Falco peregrinus*, State Threatened) nest was documented along the cliffs

Threats: Species composition and structure are patterned by natural processes. No invasive plant species were recorded during the surveys.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to maintain a natural buffer surrounding the lakeshore cliff to prevent the increase of a weedy seed source. The volcanic lakeshore cliff should be periodically monitored for invasive species infestations. The cliffs should be surveyed for nesting peregrine falcons.



White wash along the Stone's Point volcanic lakeshore cliff suggests past nesting by peregrine falcon (*Falco peregrinus*, State Threatened) Photo by Joshua G. Cohen.



Stone’s Point volcanic lakeshore cliff. Photos by Jesse M. Lincoln.



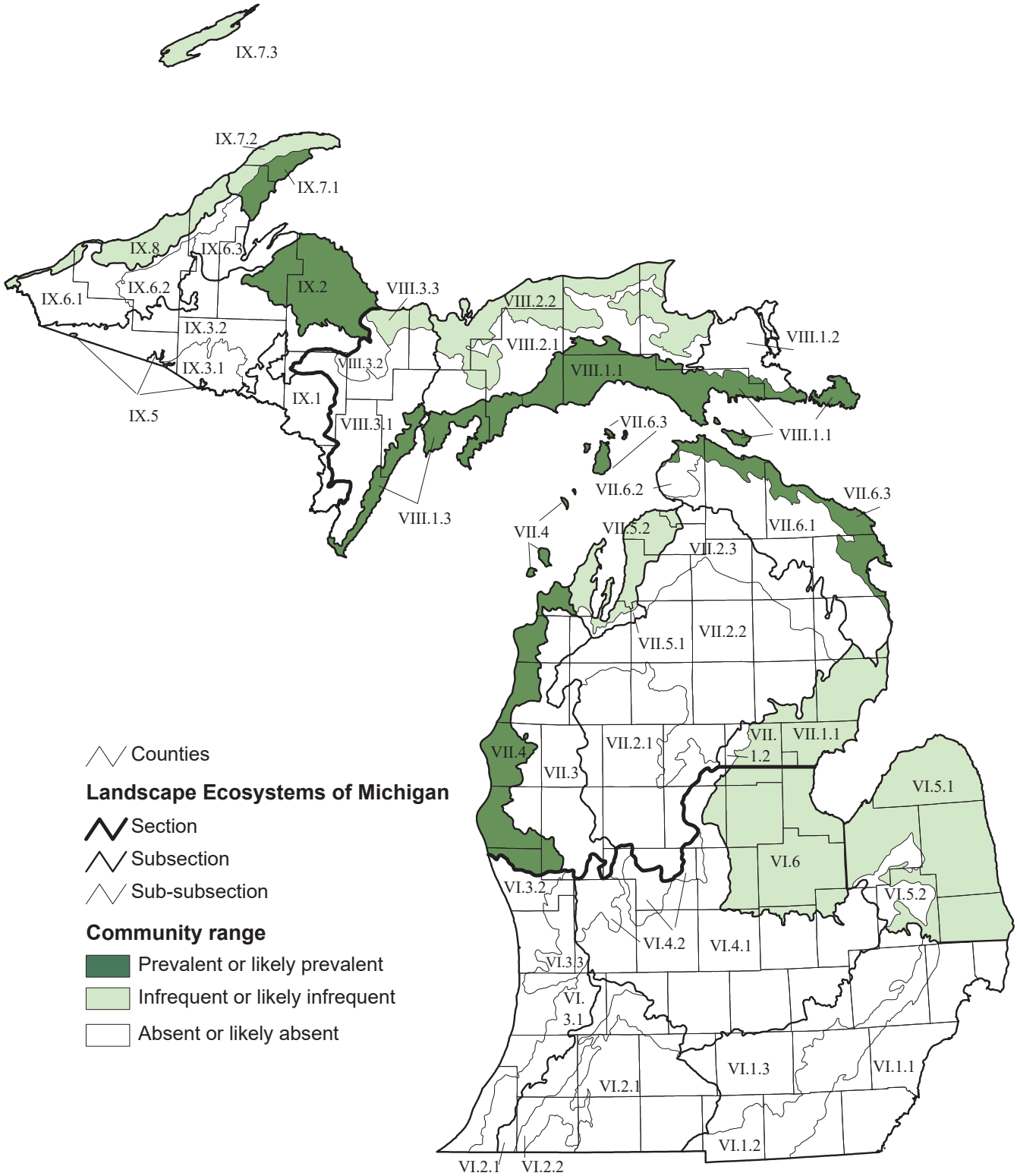


Numerous rare plants occur along this stretch of volcanic lakeshore cliff and adjacent volcanic bedrock lakeshore including Alpine bluegrass (*Poa alpina*, State Threatened) (above) and Alpine bilberry (*Vaccinium uliginosum,* State Threatened) (below). Photos by Jesse M. Lincoln (above) and Joshua G. Cohen (below).



WOODED DUNE AND SWALE COMPLEX

Overview: Wooded dune and swale complex is a large complex of parallel wetland swales and upland beach ridges (dunes) found in coastal embayments and on large sand spits along the shorelines of the Great Lakes. The upland dune ridges are typically forested, while the low swales support a variety of herbaceous or forested wetland types, with open wetlands more common near the shoreline and forested wetlands more prevalent further from the lake. Wooded dune and swale complexes occur primarily in the northern Lower and Upper Peninsulas and Thumb region (Kost et al. 2007, Cohen et al. 2015).



Map 18. Distribution of wooded dune and swale complex in Michigan (Cohen et al. 2025).

61. Siskiwit Bay
Natural Community Type: Wooded Dune and Swale Complex
Rank: G3 S3, vulnerable globally and within the state
Element Occurrence Rank: BC
Size: 116 acres (47 hectares)
Element Occurrence Identification Number: 27857

Site Description: This wooded dune and swale complex occurs along a 0.5 miles stretch of Lake Superior in a sandy embayment along Siskiwit Bay. This complex is unique in that the majority of the former embayment has been paludified. The swales are dominated by poor fen, and the low dune ridges are dominated by poor conifer swamp with scattered ridges supporting boreal forest closer to the shoreline. The dune and swales are oriented north to south and run parallel to the northernmost embayment of Siskiwit Bay, which spans approximately half a mile. The discernible patterning of alternating ridges and swales extends inland for just under half a mile. Siskiwit Bay is a relatively protected open embayment, occurring along the southwestern side of Isle Royale where prevailing winds come from the west. The position of the bay has allowed for the development of peatland throughout this dune and swale complex. Thousands of years of lacustrine processes have resulted in the development of this north to south-trending wooded dune and swale complex. At its widest, the dune and swale complex extends 0.45 miles inland. Just behind the narrow sandy shoreline and boreal forest-dominated inland ridge is an extensive poor fen swale that has been impacted by beaver flooding. Beaver flooding has likely increased the extent of the swales within this complex. The alternating ridges and swales are most prevalent 0.16 miles from the shoreline. The paludified dune ridges exhibit very mild topography (1-2 meters high).



Siskiwit Bay wooded dune and swale complex delineated in yellow on 2022 imagery.

Soils within the complex are variable. Dune ridges dominated by boreal forest are characterized by very shallow organics (5-10 cm, pH 4.5) over acidic, fine-textured, reddish sands (pH 5.0-5.5). Soils within one forested swale were characterized by 50 cm of acidic (pH 4.5-5.0), fibric peats over fine-textured sands (pH 6.0). Areas of poor fen are characterized by greater than a meter of saturated, acidic peats that range from fibric to hemic to sapric peats. The fibric peats on the top of the sphagnum hummock are more acidic (pH 4.5-5.0) than the underlying hemic and sapric peats (pH 6.5). Acidity decreases with increasing peat depth.

Proximity to Lake Superior moderates the local climate. The lake moderates the local climate with heavy snow loads, moderate temperatures in the winter and summer, and increased precipitation in the summer (fog and mist). The shoreline adjacent to the wooded dune and swale complex includes stretches of sand and gravel beach. Windthrow is prevalent within the boreal forest ridges, which are characterized by a high volume of early-successional coarse woody debris with balsam fir (*Abies balsamea*) and paper birch (*Betula papyrifera*).

Tree ages were estimated on both the ridges and swales: a 25 cm black spruce (*Picea mariana*) from a forested swale was cored and estimated to be over 220 years old (211 growth rings); a 25.1 cm black spruce from a boreal forest ridge was cored and estimated to be over 160 years old (150 growth rings); and a 17.2 cm black spruce from an open swale was estimated to be over 133 years old (123 ring count).

The forested swales are open canopied (40-65%) poor conifer swamp dominated by black spruce. The understory layer is sparse to patchy (10-20) with black spruce and tag alder (*Alnus incana*). The low shrub layer is patchy to dense (30-50%) with Labrador-tea (*Rhododendron groenlandicum*), leatherleaf (*Chamaedaphne calyculata*), and bog rosemary (*Andromeda glaucophylla*). The ground cover is diverse and dense (40-70%) with characteristic species including blue-joint (*Calamagrostis canadensis*), creeping snowberry (*Gaultheria hispidula*), bluebead-lily (*Clintonia borealis*), sedges (*Carex* spp.), small cranberry (*Vaccinium oxycoccos*), cow-wheat (*Melampyrum lineare*), cinnamon fern (*Osmundastrum cinnamomeum*), skunk-cabbage (*Symplocarpus foetidus*), dwarf raspberry (*Rubus pubescens*), marsh cinquefoil (*Comarum palustre*), wild blue flag (*Iris versicolor*), and false mayflower (*Maianthemum trifolium*). In areas of more open-canopied poor conifer swamp (20-45%), graminoids become more prevalent in the ground cover and include blue-joint and tussock sedge (*Carex stricta*) and tag alder increases in importance in the understory.



Siskiwit Bay wooded dune and swale complex. The open swales are characterized by poor fen and are diverse and dominated by graminoids. Photo by Joshua G. Cohen.

The low undulating dune ridges are predominantly paludified and dominated by poor conifer swamp. These dune ridges are similar in composition to the forested swales. The paludified dune ridges are dominated by black spruce in the overstory and Labrador-tea and low sweet blueberry (*Vaccinium angustifolium*) in the low shrub layer. Prevalent ground cover species include Sphagnum moss, feathermoss, bunchberry (*Cornus canadensis*), creeping snowberry, and false mayflower.

Closer to Siskiwit Bay, boreal forest dominates the low dune ridges. The overstory of the boreal forest ridges range from 40 to 65% with white spruce (*Picea glauca*), black spruce, and balsam fir. The understory is sparse to patchy (10 to 20%) with black spruce. The low shrub layer (15-30%) is dominated by low sweet blueberry. Characteristic ground cover (60-80%) species include bunchberry, creeping snowberry, bluebead-lily, feathermoss, big-leaved aster (*Eurybia macrophylla*), star-flower (*Trientalis borealis*), twinflower (*Linnaea borealis*), wild sarsaparilla (*Aralia nudicaulis*), and Canada mayflower (*Maianthemum canadense*).

Shrub-dominated swales are characterized by scattered overstory black spruce and a dense understory layer dominated by tag alder with red-osier dogwood (*Cornus sericea*) and a low shrub layer with leatherleaf and bog rosemary. Scattered sphagnum hummocks occur within the shrub and poor fen swales. Characteristic ground cover species within the shrub swales include tussock sedge, false mayflower, marsh cinquefoil, wild blue flag, star-flower, bluebead-lily, northern bog aster (*Symphyotrichum boreale*), and skunk cabbage.

The open swales are characterized by poor fen and are diverse and graminoid-dominated with 80 to 90% herbaceous ground cover. Prevalent graminoids include wiregrass sedge (*Carex lasiocarpa*), livid sedge (*C. livida*), white beak-rush (*Rhynchospora alba*), tufted bulrush (*Trichophorum cespitosum*), narrow-leaved cotton-grass (*Eriophorum angustifolium*), and sedge (*Carex michauxiana*). Characteristic ground cover species include pitcher-plant (*Sarracenia purpurea*), buckbean (*Menyanthes trifoliata*), bog goldenrod (*Solidago uliginosa*), dwarf raspberry, horned bladderwort (*Utricularia cornuta*), arrow-grass (*Scheuchzeria palustris*), and round-leaved sundew (*Drosera rotundifolia*). Scattered sphagnum hummocks contribute fine-scale structural diversity by providing small-scale gradients in soil moisture and soil chemistry. The conifers and shrubs are concentrated on the sphagnum hummocks. The poor fen is characterized by a scattered and stunted canopy of conifers (2-5%) with tamarack (*Larix laricina*), black spruce, and northern white-cedar (*Thuja occidentalis*). The tall shrub layer is sparse (5-10%) and is dominated by saplings of tamarack, black spruce, and northern



Shrub swale dominated by tag alder (*Alnus incana*). Photo by Joshua G. Cohen.

white-cedar as well as tag alder. The low shrub layer is diverse and patchy (10-25%) with leatherleaf, sweet gale (*Myrica gale*), bog rosemary, tag alder, and bog willow (*Salix pedicellaris*). Closer to the margins of the dune and swale complex and in areas of older fen, canopy cover increases to 5 to 15%, understory cover to 10 to 25%, and low shrub cover to 40 to 60%.

The Siskiwit Bay wooded dune and swale complex was surveyed August 19, 2024. Forty-four plant species were documented with no non-native species recorded. The total FQI was 43.1 and the total mean C value was 6.5.

Threats: Species composition and zonation are patterned by natural processes. No threats were documented during the survey.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to retain an intact buffer of natural communities surrounding the wooded dune and swale complex.



Closer to Siskiwit Bay, the low dune ridges of the wooded dune and swale complex are characterized by spruce-dominated boreal forest. Photo by Jesse M. Lincoln.

Appendix 3 - 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 61 natural community element occurrences surveyed, 64% had FQI values greater than 35 and 9.8% had FQI values greater than or equal to 50. Within the 61 natural community element occurrences, MNFI Ecologists documented 386 plant species with 362 native species and 24 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 Ojibwe names to scientific and common names in Appendix 4 for all plant species observed on Isle Royale that are listed in "Plants used by the Great Lakes Ojibwa" (Meeker et al. 1993).





Fragrant woodfern (*Dryopteris fragrans*, State Special Concern) occupying a small crevice in a vertical exposure of basalt along the Minong Shores volcanic bedrock lakeshore. In Michigan, fragrant woodfern is restricted to non-calcareous rock faces and talus beneath escarpments. Based on its strong fidelity to both specialized and undisturbed habitat, fragrant woodfern has a coefficient of conservatism value of 10. Photos by Jesse M. Lincoln.



MNFI ecologists recorded detailed plant lists for each natural community element occurrence. 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. Photos by Joshua G. Cohen (above) and Jesse M. Lincoln (below).



Appendix 3.1. Chippewa Harbor Boreal Forest FQA

Conservatism-Based Metrics:

Total Mean C:	5
Native Mean C:	5
Total FQI:	34.3
Native FQI:	34.3
Adjusted FQI:	50
% C value 0:	2.1
% C value 1-3:	23.4
% C value 4-6:	55.3
% C value 7-10:	19.1
Native Tree Mean C:	3.1
Native Shrub Mean C:	5.6
Native Herbaceous Mean C:	5.3

Species Richness:

Total Species:	47	
Native Species:	47	100.00%
Non-native Species:	0	0.00%

Species Wetness:

Mean Wetness:	1.4
Native Mean Wetness:	1.4

Physiognomy Metrics:

Tree:	8	17.00%
Shrub:	14	29.80%
Vine:	0	0.00%
Forb:	13	27.70%
Grass:	5	10.60%
Sedge:	1	2.10%
Rush:	0	0%
Fern:	6	12.80%
Bryophyte:	0	0%

Duration Metrics:

Annual:	1	2.10%
Perennial:	45	95.70%
Biennial:	1	2.10%
Native Annual:	1	2.10%
Native Perennial:	45	95.70%
Native Biennial:	1	2.10%

Appendix 3.1. Chippewa Harbor Boreal Forest FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Anaphalis margaritacea	pearly everlasting	ANAMAR	native	3	5
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Betula papyrifera	paper birch	BETPAP	native	2	3
Carex deweyana	sedge	CXDEWE	native	3	3
Chimaphila umbellata	pipsissewa	CHIUMB	native	8	5
Cinna latifolia	wood reedgrass	CINLAT	native	5	-3
Clintonia borealis	bluebead-lily; corn-lily	CLIBOR	native	5	0
Cornus canadensis	bunchberry	CORCAA	native	6	0
Cornus rugosa	round-leaved dogwood	CORRUG	native	6	5
Cypripedium acaule	pink lady-slipper; moccasin flower	CYPACA	native	5	-3
Diphasiastrum complanatum	ground-cedar	DIPCOM	native	5	3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Festuca occidentalis	western fescue	FESOCC	native	6	5
Gaultheria hispidula	creeping-snowberry	GAUHIS	native	8	-3
Gymnocarpium dryopteris	oak fern	GYMDRY	native	5	3
Lactuca biennis	tall blue lettuce	LACBIE	native	2	0
Linnaea borealis	twinflower	LINBOR	native	6	0
Lonicera canadensis	Canadian fly honeysuckle	LONCAN	native	5	3
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Milium effusum	wood millet	MILEFF	native	8	3
Mitella nuda	naked miterwort	MITNUD	native	8	-3
Neottia convallarioides	broad-leaved twayblade	NEOCON	native	10	-3
Phegopteris connectilis	northern beech-fern	PHECON	native	5	3
Picea glauca	white spruce	PICGLA	native	3	3
Pinus banksiana	jack pine	PINBAN	native	5	3
Poa glauca	bluegrass	POAGLA	native	10	5
Polypodium virginianum	common polypody	POLVIR	native	8	5
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3
Pteridium aquilinum	bracken fern	PTEAQU	native	0	3
Rhododendron groenlandicum	Labrador-tea	RHOGRO	native	8	-5
Ribes glandulosum	skunk currant	RIBGLA	native	5	-3
Rosa blanda	wild rose	ROSBLA	native	3	3
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Rubus pubescens	dwarf raspberry	RUBPUB	native	4	-3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Sambucus racemosa	red-berried elder	SAMRAC	native	3	3
Schizachne purpurascens	false melic	SCHPUP	native	5	3
Sorbus decora	mountain-ash	SORDEC	native	4	3
Spinulum annotinum	stiff clubmoss	SPIANN	native	5	0
Streptopus lanceolatus	rose twisted-stalk	STRLAN	native	5	3
Taxus canadensis	yew	TAXCAN	native	5	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trientalis borealis	star-flower	TRIBOR	native	5	0
Viburnum edule	squashberry	VIBEDU	native	10	-3

Appendix 3.2. Houghton Ridge Boreal Forest FQA

Conservatism-Based Metrics:

Total Mean C:	6.4
Native Mean C:	6.4
Total FQI:	54.3
Native FQI:	54.3
Adjusted FQI:	64
% C value 0:	1.4
% C value 1-3:	13.9
% C value 4-6:	38.9
% C value 7-10:	45.8
Native Tree Mean C:	4.2
Native Shrub Mean C:	6.9
Native Herbaceous Mean C:	6.4

Species Richness:

Total Species:	72	
Native Species:	72	100.00%
Non-native Species:	0	0.00%

Species Wetness:

Mean Wetness:	-4.1
Native Mean Wetness:	-4.1

Physiognomy Metrics:

Tree:	5	6.90%
Shrub:	13	18.10%
Vine:	0	0.00%
Forb:	30	41.70%
Grass:	4	5.60%
Sedge:	16	22.20%
Rush:	1	1%
Fern:	3	4.20%
Bryophyte:	0	0%

Duration Metrics:

Annual:	2	2.80%
Perennial:	70	97.20%
Biennial:	0	0.00%
Native Annual:	2	2.80%
Native Perennial:	70	97.20%
Native Biennial:	0	0.00%

Appendix 3.2. Houghton Ridge Boreal Forest FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Acer spicatum	mountain maple	ACESPI	native	3	5
Actaea pachypoda	doll's-eyes	ACTPAC	native	5	3
Amelanchier arborea	juneberry	AMEARB	native	2	3
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	3	3
Avenella flexuosa	hair grass	AVEFLE	native	8	5
Betula papyrifera	paper birch	BETPAP	native	5	-3
Carex deweyana	sedge	CXDEWE	native	5	0
Chimaphila umbellata	pipsissewa	CHIUMB	native	6	0
Cinna latifolia	wood reedgrass	CINLAT	native	6	5
Circaea alpina	small enchanter's-nightshade	CIRALP	native	5	-3
Clintonia borealis	bluebead-lily; corn-lily	CLIBOR	native	5	3
Cornus canadensis	bunchberry	CORCAA	native	4	5
Cornus rugosa	round-leaved dogwood	CORRUG	native	6	5
Dendrolycopodium dendroideum	tree clubmoss	DENDEN	native	8	-3
Diervilla lonicera	bush-honeysuckle	DIELON	native	5	3
Dryopteris carthusiana	spinulose woodfern	DRYCAR	native	2	0
Equisetum arvense	common horsetail	EQUARV	native	6	0
Equisetum scirpoides	dwarf scouring rush	EQUSCI	native	5	3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	3
Festuca occidentalis	western fescue	FESOCC	native	6	3
Galium triflorum	fragrant bedstraw	GALTRR	native	8	3
Goodyera repens	creeping rattlesnake plantain	GOOREP	native	8	-3
Gymnocarpium dryopteris	oak fern	GYMDRY	native	10	-3
Halenia deflexa	spurred gentian	HALDEF	native	5	3
Heracleum maximum	cow-parsnip	HERMAX	native	3	3
Lactuca canadensis	tall lettuce	LACCAN	native	5	3
Linnaea borealis	twinflower	LINBOR	native	10	5
Lonicera canadensis	Canadian fly honeysuckle	LONCAN	native	8	5
Lonicera involucrata	black twinberry	LONINV	native	1	0
Maianthemum canadense	Canada mayflower	MAICAN	native	3	3
Melampyrum lineare	cow-wheat	MELLIN	native	0	3
Milium effusum	wood millet	MILEFF	native	8	-5
Mitella nuda	naked miterwort	MITNUD	native	5	-3
Monotropa uniflora	Indian-pipe	MONOUN	native	3	3
Orthilia secunda	one-sided pyrola	ORTSEC	native	6	3
Osmorhiza berteroi	sweet-cicely	OSMBER	native	4	-3
Phegopteris connectilis	northern beech-fern	PHECON	native	2	0
Picea glauca	white spruce	PICGLA	native	3	3
Poa saltuensis	bluegrass	POASAL	native	5	3
Polygala paucifolia	gay-wings	POLPAU	native	4	3
Polypodium virginianum	common polypody	POLVIR	native	5	0
Populus tremuloides	quaking aspen	POPTRE	native	5	3
Prenanthes alba	white lettuce	PREALB	native	5	3
Pyrola elliptica	large-leaved shinleaf	PYRELL	native	4	-3
Pyrola minor	lesser pyrola	PYRMIN	native	5	0
Ribes lacustre	swamp black currant	RIBLAC	native	10	-3

Appendix 3.2. Houghton Ridge Boreal Forest FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Rosa acicularis	wild rose	ROSACI	native	4	3
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Rubus pubescens	dwarf raspberry	RUBPUB	native	4	-3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Sambucus racemosa	red-berried elder	SAMRAC	native	3	3
Sorbus decora	mountain-ash	SORDEC	native	4	3
Spinulum annotinum; lycopodium a.	stiff clubmoss	SPIANN	native	5	0
Streptopus lanceolatus; s. roseus	rose twisted-stalk	STRLAN	native	5	3
Taxus canadensis	yew	TAXCAN	native	5	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trientalis borealis	star-flower	TRIBOR	native	5	0
Viburnum edule	squashberry	VIBEDU	native	10	-3
Viola renifolia	kidney-leaved violet	VIOREN	native	6	-3

Appendix 3.3. Huginnin Cove Boreal Forest FQA

Conservatism-Based Metrics:

Total Mean C:	5.4
Native Mean C:	5.5
Total FQI:	41.8
Native FQI:	42.2
Adjusted FQI:	54.5
% C value 0:	1.7
% C value 1-3:	15
% C value 4-6:	58.3
% C value 7-10:	25
Native Tree Mean C:	3.6
Native Shrub Mean C:	5
Native Herbaceous Mean C:	6

Species Richness:

Total Species:	60	
Native Species:	59	98.30%
Non-native Species:	1	1.70%

Species Wetness:

Mean Wetness:	1
Native Mean Wetness:	1

Physiognomy Metrics:

Tree:	10	16.70%
Shrub:	5	8.30%
Vine:	0	0.00%
Forb:	29	48.30%
Grass:	5	8.30%
Sedge:	2	3.30%
Rush:	1	2%
Fern:	8	13.30%
Bryophyte:	0	0%

Duration Metrics:

Annual:	1	1.70%
Perennial:	59	98.30%
Biennial:	0	0.00%
Native Annual:	1	1.70%
Native Perennial:	58	96.70%
Native Biennial:	0	0.00%

Appendix 3.3. Huginnin Cove Boreal Forest FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Acer spicatum	mountain maple	ACESPI	native	5	3
Actaea pachypoda	doll's-eyes	ACTPAC	native	7	5
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Betula alleghaniensis	yellow birch	BETALL	native	7	0
Betula papyrifera	paper birch	BETPAP	native	2	3
Carex arctata	sedge	CXARTT	native	3	5
Carex intumescens	sedge	CXINTU	native	3	-3
Chelone glabra	turtlehead	CHEGLB	native	7	-5
Circaea alpina	small enchanter's-nightshade	CIRALP	native	4	-3
Clintonia borealis	bluebead-lily; corn-lily	CLIBOR	native	5	0
Coptis trifolia	goldthread	COPTRI	native	5	-3
Cornus canadensis	bunchberry	CORCAA	native	6	0
Cypripedium acaule	pink lady-slipper; moccasin flower	CYPACA	native	5	-3
Cystopteris fragilis	fragile fern	CYSFRA	native	4	3
Dryopteris carthusiana	spinulose woodfern	DRYCAR	native	5	-3
Dryopteris cristata	crested shield fern	DRYCRI	native	6	-5
Elymus wiegandii	wild-rye	ELYWIE	native	8	0
Equisetum sylvaticum	woodland horsetail	EQUSYL	native	5	-3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Festuca occidentalis	western fescue	FESOCC	native	6	5
Galium triflorum	fragrant bedstraw	GALTRR	native	4	3
Geocaulon lividum	geocaulon	GEOLIV	native	9	0
Goodyera repens	creeping rattlesnake plantain	GOOREP	native	9	0
Gymnocarpium dryopteris	oak fern	GYMDRY	native	5	3
Huperzia lucidula	shining clubmoss	HUPLUC	native	5	0
Linnaea borealis	twinflower	LINBOR	native	6	0
Lonicera canadensis	Canadian fly honeysuckle	LONCAN	native	5	3
Luzula parviflora	small-flowered wood rush	LUZPAR	native	10	0
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Milium effusum	wood millet	MILEFF	native	8	3
Mitchella repens	partridge-berry	MITREP	native	5	3
Mitella nuda	naked miterwort	MITNUD	native	8	-3
Moneses uniflora	one-flowered pyrola	MONEUN	native	8	0
Monotropa uniflora	Indian-pipe	MONOUN	native	5	3
Orthilia secunda	one-sided pyrola	ORTSEC	native	7	0
Osmorhiza berteroi	sweet-cicely	OSMBER	native	5	3
Phegopteris connectilis	northern beech-fern	PHECON	native	5	3
Picea glauca	white spruce	PICGLA	native	3	3
Pinus strobus	white pine	PINSTR	native	3	3
Platanthera orbiculata	round-leaved orchid	PLAORB	native	10	0
Poa glauca	bluegrass	POAGLA	native	10	5
Poa nemoralis	bluegrass	POANEM	non-native	0	3
Polygala paucifolia	gay-wings	POLPAU	native	7	3
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Prosartes trachycarpa	northern fairy-bells	PROTRA	native	10	5

Appendix 3.3. Huginnin Cove Boreal Forest FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Pyrola elliptica	large-leaved shinleaf	PYRELL	native	6	3
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Sambucus racemosa	red-berried elder	SAMRAC	native	3	3
Sorbus americana	American mountain-ash	SORAME	native	4	0
Sorbus decora	mountain-ash	SORDEC	native	4	3
Spinulum annotinum	stiff clubmoss	SPIANN	native	5	0
Streptopus lanceolatus	rose twisted-stalk	STRLAN	native	5	3
Symphyotrichum lanceolatum	panicled aster	SYMLAN	native	2	-3
Taxus canadensis	yew	TAXCAN	native	5	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trientalis borealis	star-flower	TRIBOR	native	5	0
Trillium cernuum	nodding trillium	TRICER	native	5	0
Viola renifolia	kidney-leaved violet	VIOREN	native	6	-3

Appendix 3.4. Starvation Point Boreal Forest FQA

Conservatism-Based Metrics:

Total Mean C:	5.1
Native Mean C:	5.2
Total FQI:	37.5
Native FQI:	37.9
Adjusted FQI:	51.5
% C value 0:	1.9
% C value 1-3:	13
% C value 4-6:	66.7
% C value 7-10:	18.5
Native Tree Mean C:	2.9
Native Shrub Mean C:	5.4
Native Herbaceous Mean C:	5.7

Species Richness:

Total Species:	54	
Native Species:	53	98.10%
Non-native Species:	1	1.90%

Species Wetness:

Mean Wetness:	1.4
Native Mean Wetness:	1.3

Physiognomy Metrics:

Tree:	8	14.80%
Shrub:	12	22.20%
Vine:	0	0.00%
Forb:	21	38.90%
Grass:	6	11.10%
Sedge:	2	3.70%
Rush:	0	0%
Fern:	5	9.30%
Bryophyte:	0	0%

Duration Metrics:

Annual:	1	1.90%
Perennial:	53	98.10%
Biennial:	0	0.00%
Native Annual:	1	1.90%
Native Perennial:	52	96.30%
Native Biennial:	0	0.00%

Appendix 3.4. Starvation Point 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	0
Acer spicatum	mountain maple	ACESPI	native	5	3
Actaea pachypoda	doll's-eyes	ACTPAC	native	7	5
Actaea rubra	red baneberry	ACTRUB	native	7	3
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Bromus ciliatus	fringed brome	BROCIL	native	6	-3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Carex gracillima	sedge	CXGRAA	native	4	3
Carex pedunculata	sedge	CXPEDU	native	5	3
Chimaphila umbellata	pipsissewa	CHIUMB	native	8	5
Cinna latifolia	wood reedgrass	CINLAT	native	5	-3
Clintonia borealis	bluebead-lily; corn-lily	CLIBOR	native	5	0
Corallorhiza maculata	spotted coral-root	CORMAC	native	5	3
Corallorhiza trifida	early coral-root	CORTRF	native	6	-3
Cornus canadensis	bunchberry	CORCAA	native	6	0
Cornus rugosa	round-leaved dogwood	CORRUG	native	6	5
Corylus cornuta	beaked hazelnut	CORCOR	native	5	3
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Doellingeria umbellata	flat-topped white aster	DOEUMB	native	5	-3
Dryopteris intermedia	evergreen woodfern	DRYINT	native	5	0
Equisetum sylvaticum	woodland horsetail	EQUSYL	native	5	-3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Festuca occidentalis	western fescue	FESOCC	native	6	5
Galium triflorum	fragrant bedstraw	GALTRR	native	4	3
Goodyera repens	creeping rattlesnake plantain	GOOREP	native	9	0
Gymnocarpium dryopteris	oak fern	GYMDRY	native	5	3
Hieracium piloselloides	**yellow hawkweed; king devil**	**HIEPIS**	**non-native**	**0**	**5**
Hieracium umbellatum	northern hawkweed	HIEUMB	native	7	5
Huperzia lucidula	shining clubmoss	HUPLUC	native	5	0
Linnaea borealis	twinflower	LINBOR	native	6	0
Lonicera canadensis	Canadian fly honeysuckle	LONCAN	native	5	3
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Milium effusum	wood millet	MILEFF	native	8	3
Mitella nuda	naked miterwort	MITNUD	native	8	-3
Picea glauca	white spruce	PICGLA	native	3	3
Polygala paucifolia	gay-wings	POLPAU	native	7	3
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Pyrola chlorantha	shinleaf	PYRCHL	native	8	3
Rosa acicularis	wild rose	ROSACI	native	4	3
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Rubus pubescens	dwarf raspberry	RUBPUB	native	4	-3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Sorbus decora	mountain-ash	SORDEC	native	4	3

Appendix 3.4. Starvation Point Boreal Forest FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Spinulum annotinum	stiff clubmoss	SPIANN	native	5	0
Streptopus lanceolatus	rose twisted-stalk	STRLAN	native	5	3
Taxus canadensis	yew	TAXCAN	native	5	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trientalis borealis	star-flower	TRIBOR	native	5	0
Viburnum edule	squashberry	VIBEDU	native	10	-3
Viola renifolia	kidney-leaved violet	VIOREN	native	6	-3

Appendix 3.5. Lake Harvey Dry-Mesic Northern Forest FQA

Conservatism-Based Metrics:

Total Mean C:	4.7
Native Mean C:	4.9
Total FQI:	36.7
Native FQI:	37.3
Adjusted FQI:	47.8
% C value 0:	6.6
% C value 1-3:	23
% C value 4-6:	49.2
% C value 7-10:	21.3
Native Tree Mean C:	3.3
Native Shrub Mean C:	5.3
Native Herbaceous Mean C:	5.2

Species Richness:

Total Species:	61	
Native Species:	58	95.10%
Non-native Species:	3	4.90%

Species Wetness:

Mean Wetness:	3.3
Native Mean Wetness:	3.3

Physiognomy Metrics:

Tree:	8	13.10%
Shrub:	14	23.00%
Vine:	2	3.30%
Forb:	26	42.60%
Grass:	9	14.80%
Sedge:	1	1.60%
Rush:	0	0%
Fern:	1	1.60%
Bryophyte:	0	0%

Duration Metrics:

Annual:	1	1.60%
Perennial:	60	98.40%
Biennial:	0	0.00%
Native Annual:	1	1.60%
Native Perennial:	57	93.40%
Native Biennial:	0	0.00%

Appendix 3.5. Lake Harvey Dry-Mesic Northern Forest FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Actaea pachypoda	doll's-eyes	ACTPAC	native	7	5
Amelanchier arborea	juneberry	AMEARB	native	4	3
Amelanchier sanguinea	round-leaved serviceberry	AMESAN	native	5	5
Anaphalis margaritacea	pearly everlasting	ANAMAR	native	3	5
Anemone virginiana	thimbleweed	ANEVIR	native	3	3
Antennaria parlinii	smooth pussytoes	ANTPAL	native	2	5
Apocynum androsaemifolium	spreading dogbane	APOAND	native	3	5
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Calystegia spithamaea	low bindweed	CALSPI	native	8	5
Carex arctata	sedge	CXARTT	native	3	5
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Chimaphila umbellata	pipsissewa	CHIUMB	native	8	5
Clinopodium vulgare	wild-basil	CLIVUL	native	3	5
Clintonia borealis	bluebead-lily; corn-lily	CLIBOR	native	5	0
Corallorhiza striata	striped coral-root	CORSTR	native	6	3
Cornus canadensis	bunchberry	CORCAA	native	6	0
Cornus rugosa	round-leaved dogwood	CORRUG	native	6	5
Corylus cornuta	beaked hazelnut	CORCOR	native	5	3
Cynoglossum boreale	northern wild comfrey	CYNBOR	native	7	5
Cypripedium parviflorum	yellow lady-slipper	CYPPAR	native	5	0
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Elymus trachycaulus	slender wheatgrass	ELYTRA	native	8	3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Festuca occidentalis	western fescue	FESOCC	native	6	5
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Hepatica americana	round-lobed hepatica	HEPAME	native	6	5
Hieracium caespitosum	**yellow hawkweed; king devil**	**HIECAE**	**non-native**	**0**	**5**
Hieracium umbellatum	northern hawkweed	HIEUMB	native	7	5
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Lathyrus ochroleucus	pale vetchling	LATOCH	native	8	5
Linnaea borealis	twinflower	LINBOR	native	6	0
Lonicera canadensis	Canadian fly honeysuckle	LONCAN	native	5	3
Lonicera hirsuta	hairy honeysuckle	LONHIR	native	6	0
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Milium effusum	wood millet	MILEFF	native	8	3
Orthilia secunda	one-sided pyrola	ORTSEC	native	7	0
Oryzopsis asperifolia	rough-leaved rice-grass	ORYASP	native	6	5
Picea glauca	white spruce	PICGLA	native	3	3
Pinus resinosa	red pine	PINRES	native	6	3
Pinus strobus	white pine	PINSTR	native	3	3
Piptatherum pungens	rice-grass	PIPPUN	native	9	5

Appendix 3.5. Lake Harvey Dry-Mesic Northern Forest FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Poa compressa	**Canada bluegrass**	**POACOM**	**non-native**	**0**	**3**
Polygala paucifolia	gay-wings	POLPAU	native	7	3
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Prunus virginiana	choke cherry	PRUVIR	native	2	3
Pteridium aquilinum	bracken fern	PTEAQU	native	0	3
Rosa acicularis	wild rose	ROSACI	native	4	3
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Salix humilis	prairie willow	SALHUM	native	4	3
Schizachne purpurascens	false melic	SCHPUP	native	5	3
Shepherdia canadensis	soapberry	SHECAN	native	7	5
Streptopus lanceolatus	rose twisted-stalk	STRLAN	native	5	3
Symphyotrichum ciliolatum	northern heart-leaved aster	SYMCIO	native	4	5
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trifolium pratense	**red clover**	**TRIPRA**	**non-native**	**0**	**3**

Appendix 3.6. Feldtmann Ridge Hardwood-Conifer Swamp FQA

Conservatism-Based Metrics:

Total Mean C:	4.4
Native Mean C:	4.4
Total FQI:	20.2
Native FQI:	20.2
Adjusted FQI:	44
% C value 0:	0
% C value 1-3:	28.6
% C value 4-6:	61.9
% C value 7-10:	9.5
Native Tree Mean C:	3.4
Native Shrub Mean C:	5.3
Native Herbaceous Mean C:	5

Species Richness:

Total Species:	21	
Native Species:	21	100.00%
Non-native Species:	0	0.00%

Species Wetness:

Mean Wetness:	-0.8
Native Mean Wetness:	-0.8

Physiognomy Metrics:

Tree:	8	38.10%
Shrub:	3	14.30%
Vine:	0	0.00%
Forb:	7	33.30%
Grass:	1	4.80%
Sedge:	0	0.00%
Rush:	0	0%
Fern:	2	9.50%
Bryophyte:	0	0%

Duration Metrics:

Annual:	1	4.80%
Perennial:	20	95.20%
Biennial:	0	0.00%
Native Annual:	1	4.80%
Native Perennial:	20	95.20%
Native Biennial:	0	0.00%

Appendix 3.6. Feldtmann Ridge Hardwood-Conifer Swamp FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Acer spicatum	mountain maple	ACESPI	native	5	3
Betula alleghaniensis	yellow birch	BETALL	native	7	0
Betula papyrifera	paper birch	BETPAP	native	2	3
Circaea alpina	small enchanter's-nightshade	CIRALP	native	4	-3
Cornus canadensis	bunchberry	CORCAA	native	6	0
Dryopteris carthusiana	spinulose woodfern	DRYCAR	native	5	-3
Glyceria striata	fowl manna grass	GLYSTR	native	4	-5
Gymnocarpium dryopteris	oak fern	GYMDRY	native	5	3
Impatiens capensis	spotted touch-me-not	IMPCAP	native	2	-3
Linnaea borealis	twinflower	LINBOR	native	6	0
Mitella nuda	naked miterwort	MITNUD	native	8	-3
Picea glauca	white spruce	PICGLA	native	3	3
Populus balsamifera	balsam poplar	POPBAL	native	2	-3
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Rubus pubescens	dwarf raspberry	RUBPUB	native	4	-3
Symplocarpus foetidus	skunk-cabbage	SYMFOE	native	6	-5
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trientalis borealis	star-flower	TRIBOR	native	5	0
Trillium cernuum	nodding trillium	TRICER	native	5	0

Appendix 3.7. Feldtmann Ridge Mesic Northern Forest FQA

Conservatism-Based Metrics:

Total Mean C:	4.8
Native Mean C:	4.8
Total FQI:	38.4
Native FQI:	38.1
Adjusted FQI:	47.6
% C value 0:	3.1
% C value 1-3:	20.3
% C value 4-6:	59.4
% C value 7-10:	17.2
Native Tree Mean C:	3.8
Native Shrub Mean C:	4.6
Native Herbaceous Mean C:	5.1

Species Richness:

Total Species:	64	
Native Species:	63	98.40%
Non-native Species:	1	1.60%

Species Wetness:

Mean Wetness:	1.3
Native Mean Wetness:	1.3

Physiognomy Metrics:

Tree:	10	15.60%
Shrub:	10	15.60%
Vine:	1	1.60%
Forb:	27	42.20%
Grass:	6	9.40%
Sedge:	3	4.70%
Rush:	0	0%
Fern:	7	10.90%
Bryophyte:	0	0%

Duration Metrics:

Annual:	2	3.10%
Perennial:	61	95.30%
Biennial:	1	1.60%
Native Annual:	2	3.10%
Native Perennial:	60	93.80%
Native Biennial:	1	1.60%

Appendix 3.7. Feldtmann Ridge Mesic Northern 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	0
Acer spicatum	mountain maple	ACESPI	native	5	3
Actaea pachypoda	doll's-eyes	ACTPAC	native	7	5
Actaea rubra	red baneberry	ACTRUB	native	7	3
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Athyrium angustum	lady fern	ATHFIL	native	4	0
Betula alleghaniensis	yellow birch	BETALL	native	7	0
Betula papyrifera	paper birch	BETPAP	native	2	3
Carex arctata	sedge	CXARTT	native	3	5
Carex intumescens	sedge	CXINTU	native	3	-3
Carex pedunculata	sedge	CXPEDU	native	5	3
Cinna latifolia	wood reedgrass	CINLAT	native	5	-3
Circaea alpina	small enchanter's-nightshade	CIRALP	native	4	-3
Clintonia borealis	bluebead-lily; corn-lily	CLIBOR	native	5	0
Corallorhiza striata	striped coral-root	CORSTR	native	6	3
Corallorhiza trifida	early coral-root	CORTRF	native	6	-3
Cornus canadensis	bunchberry	CORCAA	native	6	0
Cornus rugosa	round-leaved dogwood	CORRUG	native	6	5
Corylus cornuta	beaked hazelnut	CORCOR	native	5	3
Danthonia compressa	flat oatgrass	DANCOM	native	7	3
Dendrolycopodium dendroideum	tree clubmoss	DENDEN	native	5	3
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Dryopteris carthusiana	spinulose woodfern	DRYCAR	native	5	-3
Equisetum arvense	common horsetail	EQUARV	native	0	0
Equisetum scirpoides	dwarf scouring rush	EQUSCI	native	7	0
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Fallopia cilinodis	fringed false buckwheat	FALCIL	native	3	5
Fraxinus nigra	black ash	FRANIG	native	6	-3
Galium triflorum	fragrant bedstraw	GALTRR	native	4	3
Geum aleppicum	yellow avens	GEUALE	native	3	0
Goodyera repens	creeping rattlesnake plantain	GOOREP	native	9	0
Gymnocarpium dryopteris	oak fern	GYMDRY	native	5	3
Huperzia lucidula	shining clubmoss	HUPLUC	native	5	0
Hypopitys monotropa	pinesap	HYPMON	native	6	5
Impatiens capensis	spotted touch-me-not	IMPCAP	native	2	-3
Lactuca biennis	tall blue lettuce	LACBIE	native	2	0
Linnaea borealis	twinflower	LINBOR	native	6	0
Lonicera canadensis	Canadian fly honeysuckle	LONCAN	native	5	3
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Milium effusum	wood millet	MILEFF	native	8	3
Mitella nuda	naked miterwort	MITNUD	native	8	-3
Orthilia secunda	one-sided pyrola	ORTSEC	native	7	0
Osmorhiza claytonii	hairy sweet-cicely	OSMCLI	native	4	3
Oxalis acetosella	northern wood-sorrel	OXAACE	native	7	3
Picea glauca	white spruce	PICGLA	native	3	3

Appendix 3.7. Feldtmann Ridge Mesic Northern Forest FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Poa alsodes	bluegrass	POAALS	native	9	0
Poa nemoralis	**bluegrass**	**POANEM**	**non-native**	**0**	**3**
Poa saltuensis	bluegrass	POASAL	native	5	5
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3
Ranunculus recurvatus	hooked crowfoot	RANREC	native	5	-3
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Rubus pubescens	dwarf raspberry	RUBPUB	native	4	-3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Sambucus racemosa	red-berried elder	SAMRAC	native	3	3
Sorbus decora	mountain-ash	SORDEC	native	4	3
Streptopus lanceolatus	rose twisted-stalk	STRLAN	native	5	3
Symphyotrichum ciliolatum	northern heart-leaved aster	SYMCIO	native	4	5
Symplocarpus foetidus	skunk-cabbage	SYMFOE	native	6	-5
Taxus canadensis	yew	TAXCAN	native	5	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trientalis borealis	star-flower	TRIBOR	native	5	0
Trillium cernuum	nodding trillium	TRICER	native	5	0

Appendix 3.8. Lake Desor Mesic Northern Forest FQA

Conservatism-Based Metrics:

Total Mean C:	4.3
Native Mean C:	4.4
Total FQI:	34.9
Native FQI:	35.2
Adjusted FQI:	43.3
% C value 0:	7.6
% C value 1-3:	25.8
% C value 4-6:	54.5
% C value 7-10:	12.1
Native Tree Mean C:	4
Native Shrub Mean C:	4.5
Native Herbaceous Mean C:	4.5

Species Richness:

Total Species:	66	
Native Species:	64	97.00%
Non-native Species:	2	3.00%

Species Wetness:

Mean Wetness:	1.3
Native Mean Wetness:	1.3

Physiognomy Metrics:

Tree:	14	21.20%
Shrub:	8	12.10%
Vine:	1	1.50%
Forb:	25	37.90%
Grass:	4	6.10%
Sedge:	6	9.10%
Rush:	0	0%
Fern:	8	12.10%
Bryophyte:	0	0%

Duration Metrics:

Annual:	1	1.50%
Perennial:	64	97.00%
Biennial:	1	1.50%
Native Annual:	1	1.50%
Native Perennial:	62	93.90%
Native Biennial:	1	1.50%

Appendix 3.8. Lake Desor Mesic Northern 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	0
Acer saccharum	sugar maple	ACESAU	native	5	3
Acer spicatum	mountain maple	ACESPI	native	5	3
Actaea pachypoda	doll's-eyes	ACTPAC	native	7	5
Actaea rubra	red baneberry	ACTRUB	native	7	3
Amelanchier arborea	juneberry	AMEARB	native	4	3
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Aralia racemosa	spikenard	ARARAC	native	8	3
Arisaema triphyllum	Jack-in-the-pulpit	ARITRI	native	5	0
Betula alleghaniensis	yellow birch	BETALL	native	7	0
Carex arctata	sedge	CXARTT	native	3	5
Carex crinita	sedge	CXCRIN	native	4	-5
Carex deweyana	sedge	CXDEWE	native	3	3
Carex intumescens	sedge	CXINTU	native	3	-3
Carex pedunculata	sedge	CXPEDU	native	5	3
Carex projecta	sedge	CXPROJ	native	3	-3
Chimaphila umbellata	pipsissewa	CHIUMB	native	8	5
Cinna latifolia	wood reedgrass	CINLAT	native	5	-3
Clintonia borealis	bluebead-lily; corn-lily	CLIBOR	native	5	0
Corallorhiza striata	striped coral-root	CORSTR	native	6	3
Cornus alternifolia	alternate-leaved dogwood	CORALT	native	5	3
Corylus cornuta	beaked hazelnut	CORCOR	native	5	3
Dendrolycopodium dendroideum	tree clubmoss	DENDEN	native	5	3
Dryopteris carthusiana	spinulose woodfern	DRYCAR	native	5	-3
Dryopteris marginalis	marginal woodfern	DRYMAR	native	5	3
Epilobium ciliatum	willow-herb	EPICIL	native	3	-3
Epipactis helleborine	**helleborine**	**EPIHEL**	**non-native**	**0**	**0**
Equisetum arvense	common horsetail	EQUARV	native	0	0
Fallopia cilinodis	fringed false buckwheat	FALCIL	native	3	5
Fraxinus nigra	black ash	FRANIG	native	6	-3
Galium triflorum	fragrant bedstraw	GALTRR	native	4	3
Glyceria striata	fowl manna grass	GLYSTR	native	4	-5
Goodyera repens	creeping rattlesnake plantain	GOOREP	native	9	0
Gymnocarpium dryopteris	oak fern	GYMDRY	native	5	3
Huperzia lucidula	shining clubmoss	HUPLUC	native	5	0
Impatiens capensis	spotted touch-me-not	IMPCAP	native	2	-3
Lactuca canadensis	tall lettuce	LACCAN	native	2	3
Lonicera canadensis	Canadian fly honeysuckle	LONCAN	native	5	3
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Milium effusum	wood millet	MILEFF	native	8	3
Monotropa uniflora	Indian-pipe	MONOUN	native	5	3
Osmorhiza berteroi	sweet-cicely	OSMBER	native	5	3
Picea glauca	white spruce	PICGLA	native	3	3
Poa pratensis	**Kentucky bluegrass**	**POAPRA**	**non-native**	**0**	**3**
Polygonatum pubescens	downy Solomon seal	POLPUB	native	5	5
Polypodium virginianum	common polypody	POLVIR	native	8	5

Appendix 3.8. Lake Desor Mesic Northern Forest FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3
Prunus virginiana	choke cherry	PRUVIR	native	2	3
Pteridium aquilinum	bracken fern	PTEAQU	native	0	3
Quercus rubra	red oak	QUERUB	native	5	3
Ranunculus abortivus	small-flowered buttercup	RANABO	native	0	0
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Sambucus racemosa	red-berried elder	SAMRAC	native	3	3
Sorbus decora	mountain-ash	SORDEC	native	4	3
Streptopus lanceolatus	rose twisted-stalk	STRLAN	native	5	3
Symphyotrichum ciliolatum	northern heart-leaved aster	SYMCIO	native	4	5
Symplocarpus foetidus	skunk-cabbage	SYMFOE	native	6	-5
Taxus canadensis	yew	TAXCAN	native	5	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trientalis borealis	star-flower	TRIBOR	native	5	0
Trillium cernuum	nodding trillium	TRICER	native	5	0
Viola blanda	sweet white violet	VIOBLA	native	5	-3
Viola labradorica	dog violet	VIOLAB	native	3	0

Appendix 3.9. Lake Desor Muskeg FQA

Conservatism-Based Metrics:

Total Mean C:	6.7
Native Mean C:	6.7
Total FQI:	35.5
Native FQI:	35.5
Adjusted FQI:	67
% C value 0:	0
% C value 1-3:	7.1
% C value 4-6:	50
% C value 7-10:	42.9
Native Tree Mean C:	4.7
Native Shrub Mean C:	7.1
Native Herbaceous Mean C:	6.8

Physiognomy Metrics:

Tree:	3	10.70%
Shrub:	10	35.70%
Vine:	0	0.00%
Forb:	7	25.00%
Grass:	1	3.60%
Sedge:	5	17.90%
Rush:	0	0%
Fern:	2	7.10%
Bryophyte:	0	0%

Species Richness:

Total Species:	28	
Native Species:	28	100.00%
Non-native Species:	0	0.00%

Duration Metrics:

Annual:	0	0.00%
Perennial:	28	100.00%
Biennial:	0	0.00%
Native Annual:	0	0.00%
Native Perennial:	28	100.00%
Native Biennial:	0	0.00%

Species Wetness:

Mean Wetness:	-3.7
Native Mean Wetness:	-3.7

Appendix 3.9. Lake Desor Muskeg FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Alnus incana	speckled alder	ALNINC	native	5	-3
Andromeda glaucophylla	bog-rosemary	ANDGLA	native	10	-5
Aronia prunifolia	chokeberry	AROPRU	native	5	-3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Carex magellanica	sedge	CXMAGE	native	8	-5
Carex pauciflora	sedge	CXPAUC	native	10	-5
Carex stricta	sedge	CXSTRI	native	4	-5
Chamaedaphne calyculata	leatherleaf	CHACAL	native	8	-5
Coptis trifolia	goldthread	COPTRI	native	5	-3
Cypripedium acaule	pink lady-slipper; moccasin flower	CYPACA	native	5	-3
Eriophorum angustifolium	narrow-leaved cotton-grass	ERIANG	native	10	-5
Eriophorum vaginatum	cotton-grass	ERIVAG	native	10	-5
Gaultheria hispidula	creeping-snowberry	GAUHIS	native	8	-3
Gaultheria procumbens	wintergreen	GAUPRO	native	5	3
Iris versicolor	wild blue flag	IRIVER	native	5	-5
Kalmia polifolia	bog-laurel	KALPOL	native	10	-5
Larix laricina	tamarack	LARLAR	native	5	-3
Maianthemum trifolium	false mayflower	MAITRI	native	10	-5
Osmundastrum cinnamomeum	cinnamon fern	OSMCIN	native	5	-3
Osmunda spectabilis	royal fern	OSMREG	native	5	-5
Picea mariana	black spruce	PICMAR	native	6	-3
Pinus strobus	white pine	PINSTR	native	3	3
Platanthera clavellata	small green wood orchid	PLACLA	native	6	-3
Rhododendron groenlandicum	Labrador-tea	RHOGRO	native	8	-5
Sarracenia purpurea	pitcher-plant	SARPUR	native	10	-5
Symplocarpus foetidus	skunk-cabbage	SYMFOE	native	6	-5
Vaccinium myrtilloides	Canada blueberry	VACMYR	native	4	-3
Vaccinium oxycoccos	small cranberry	VACOXY	native	8	-5

Appendix 3.10. Feldtmann Fen Patterned Fen FQA

Conservatism-Based Metrics:

Total Mean C:	7.4
Native Mean C:	7.4
Total FQI:	59.2
Native FQI:	59.2
Adjusted FQI:	74
% C value 0:	0
% C value 1-3:	3.1
% C value 4-6:	32.8
% C value 7-10:	64.1
Native Tree Mean C:	4.5
Native Shrub Mean C:	7.5
Native Herbaceous Mean C:	7.7

Physiognomy Metrics:

Tree:	4	6.30%
Shrub:	17	26.60%
Vine:	0	0.00%
Forb:	24	37.50%
Grass:	2	3.10%
Sedge:	13	20.30%
Rush:	2	3%
Fern:	2	3.10%
Bryophyte:	0	0%

Species Richness:

Total Species:	64	
Native Species:	64	100.00%
Non-native Species:	0	0.00%

Duration Metrics:

Annual:	0	0.00%
Perennial:	64	100.00%
Biennial:	0	0.00%
Native Annual:	0	0.00%
Native Perennial:	64	100.00%
Native Biennial:	0	0.00%

Species Wetness:

Mean Wetness:	-3.6
Native Mean Wetness:	-3.6

Appendix 3.10. Feldtmann Fen Patterned Fen FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Alnus incana	speckled alder	ALNINC	native	5	-3
Andromeda glaucophylla	bog-rosemary	ANDGLA	native	10	-5
Betula pumila	bog birch	BETPUM	native	8	-5
Carex buxbaumii	sedge	CXBUXB	native	10	-5
Carex exilis	sedge	CXEXIL	native	10	-5
Carex flava	sedge	CXFLAV	native	4	-5
Carex lasiocarpa	sedge	CXLASI	native	8	-5
Carex livida	sedge	CXLIVI	native	10	-5
Carex magellanica	sedge	CXMAGE	native	8	-5
Carex michauxiana	sedge	CXMICH	native	10	-5
Chamaedaphne calyculata	leatherleaf	CHACAL	native	8	-5
Cladium mariscoides	twig-rush	CLAMAR	native	10	-5
Cornus canadensis	bunchberry	CORCAA	native	6	0
Dasiphora fruticosa	shrubby cinquefoil	DASFRU	native	8	-3
Doellingeria umbellata	flat-topped white aster	DOEUMB	native	5	-3
Drosera intermedia	spatulate-leaved sundew	DROINT	native	8	-5
Drosera rotundifolia	round-leaved sundew	DROROT	native	6	-5
Equisetum palustre	marsh horsetail	EQUPAL	native	8	-3
Eriophorum angustifolium	narrow-leaved cotton-grass	ERIANG	native	10	-5
Geocaulon lividum	geocaulon	GEOLIV	native	9	0
Iris versicolor	wild blue flag	IRIVER	native	5	-5
Juncus brevicaudatus	rush	JUNBRE	native	8	-5
Juncus pelocarpus	brown-fruited rush	JUNPEL	native	8	-5
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Kalmia polifolia	bog-laurel	KALPOL	native	10	-5
Larix laricina	tamarack	LARLAR	native	5	-3
Linnaea borealis	twinflower	LINBOR	native	6	0
Liparis loeselii	Loesel's twayblade	LIPLOE	native	5	-3
Lonicera villosa	mountain fly honeysuckle	LONVIL	native	8	-3
Menyanthes trifoliata	buckbean	MENTRI	native	8	-5
Muhlenbergia glomerata	marsh wild-Timothy	MUHGLO	native	10	-5
Muhlenbergia uniflora	muhly grass	MUHUNI	native	8	-5
Myrica gale	sweet gale	MYRGAL	native	6	-5
Osmunda spectabilis	royal fern	OSMREG	native	5	-5
Packera paupercula	balsam ragwort	PACPAU	native	3	0
Parnassia palustris	marsh grass-of-Parnassus	PARPAL	native	10	-5
Picea mariana	black spruce	PICMAR	native	6	-3
Platanthera dilatata	tall white bog orchid	PLADIL	native	10	-5
Platanthera huronensis	Lake Huron green orchid	PLAHUR	native	5	-3
Prenanthes alba	white lettuce	PREALB	native	5	3
Prenanthes racemosa	glaucous white lettuce	PRERAC	native	8	-3
Prunus pumila	sand cherry	PRUPUM	native	8	5
Pyrola asarifolia	pink pyrola	PYRASA	native	8	-3
Pyrola chlorantha	shinleaf	PYRCHL	native	8	3
Rhamnus alnifolia	alder-leaved buckthorn	RHAALN	native	8	-5
Rhododendron groenlandicum	Labrador-tea	RHOGRO	native	8	-5

Appendix 3.10. Feldtmann Fen Patterned Fen FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Rhynchospora alba	beak-rush	RHYALB	native	6	-5
Rhynchospora fusca	beak-rush	RHYFUS	native	7	-5
Rubus pubescens	dwarf raspberry	RUBPUB	native	4	-3
Sarracenia purpurea	pitcher-plant	SARPUR	native	10	-5
Solidago uliginosa	bog goldenrod	SOLULI	native	4	-5
Spiranthes romanzoffiana	hooded ladies'-tresses	SPIROM	native	8	-5
Symplocarpus foetidus	skunk-cabbage	SYMFOE	native	6	-5
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Triantha glutinosa	false asphodel	TRIGLU	native	10	-5
Trichophorum alpinum	bulrush	TRIALP	native	10	-5
Trichophorum cespitosum	bulrush	TRICES	native	10	-5
Trientalis borealis	star-flower	TRIBOR	native	5	0
Triglochin maritima	common bog arrow-grass	TRIMAR	native	8	-5
Utricularia cornuta	horned bladderwort	UTRCOR	native	10	-5
Vaccinium macrocarpon	large cranberry	VACMAC	native	8	-5
Vaccinium myrtilloides	Canada blueberry	VACMYR	native	4	-3
Vaccinium oxycoccos	small cranberry	VACOXY	native	8	-5

Appendix 3.11. Siskiwit Bay Poor Fen FQA

Conservatism-Based Metrics:

Total Mean C:	6.5
Native Mean C:	6.5
Total FQI:	56.3
Native FQI:	56.3
Adjusted FQI:	65
% C value 0:	0
% C value 1-3:	9.3
% C value 4-6:	44
% C value 7-10:	46.7
Native Tree Mean C:	4.3
Native Shrub Mean C:	6.1
Native Herbaceous Mean C:	6.8

Species Richness:

Total Species:	75	
Native Species:	75	100.00%
Non-native Species:	0	0.00%

Species Wetness:

Mean Wetness:	-3.3
Native Mean Wetness:	-3.3

Physiognomy Metrics:

Tree:	4	5.30%
Shrub:	24	32.00%
Vine:	0	0.00%
Forb:	25	33.30%
Grass:	5	6.70%
Sedge:	13	17.30%
Rush:	0	0%
Fern:	4	5.30%
Bryophyte:	0	0%

Duration Metrics:

Annual:	0	0.00%
Perennial:	75	100.00%
Biennial:	0	0.00%
Native Annual:	0	0.00%
Native Perennial:	75	100.00%
Native Biennial:	0	0.00%

Appendix 3.11. Siskiwit Bay Poor Fen FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Alnus incana	speckled alder	ALNINC	native	5	-3
Amelanchier interior	serviceberry	AMEINT	native	4	5
Andromeda glaucophylla	bog-rosemary	ANDGLA	native	10	-5
Betula papyrifera	paper birch	BETPAP	native	2	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Campanula aparinoides	marsh bellflower	CAMAPA	native	7	-5
Carex buxbaumii	sedge	CXBUXB	native	10	-5
Carex castanea	sedge	CXCAST	native	6	-3
Carex exilis	sedge	CXEXIL	native	10	-5
Carex flava	sedge	CXFLAV	native	4	-5
Carex lasiocarpa	sedge	CXLASI	native	8	-5
Carex livida	sedge	CXLIVI	native	10	-5
Carex stricta	sedge	CXSTRI	native	4	-5
Chamaedaphne calyculata	leatherleaf	CHACAL	native	8	-5
Cladium mariscoides	twig-rush	CLAMAR	native	10	-5
Comarum palustre	marsh cinquefoil	COMPAL	native	7	-5
Cornus canadensis	bunchberry	CORCAA	native	6	0
Cornus sericea	red-osier dogwood	CORSER	native	2	-3
Cypripedium reginae	showy or queen's lady-slipper	CYPREG	native	9	-3
Dasiphora fruticosa	shrubby cinquefoil	DASFRU	native	8	-3
Doellingeria umbellata	flat-topped white aster	DOEUMB	native	5	-3
Drosera rotundifolia	round-leaved sundew	DROROT	native	6	-5
Dryopteris cristata	crested shield fern	DRYCRI	native	6	-5
Dulichium arundinaceum	three-way sedge	DULARU	native	8	-5
Equisetum palustre	marsh horsetail	EQUPAL	native	8	-3
Equisetum variegatum	variegated scouring rush	EQUVAR	native	6	-3
Eriophorum angustifolium	narrow-leaved cotton-grass	ERIANG	native	10	-5
Eriophorum vaginatum	cotton-grass	ERIVAG	native	10	-5
Eutrochium maculatum	Joe-pye-weed	EUTMAC	native	4	-5
Gaultheria hispidula	creeping-snowberry	GAUHIS	native	8	-3
Geocaulon lividum	geocaulon	GEOLIV	native	9	0
Glyceria striata	fowl manna grass	GLYSTR	native	4	-5
Iris versicolor	wild blue flag	IRIVER	native	5	-5
Larix laricina	tamarack	LARLAR	native	5	-3
Linnaea borealis	twinflower	LINBOR	native	6	0
Lonicera villosa	mountain fly honeysuckle	LONVIL	native	8	-3
Lycopus uniflorus	northern bugle weed	LYCUNI	native	2	-5
Maianthemum trifolium	false mayflower	MAITRI	native	10	-5
Menyanthes trifoliata	buckbean	MENTRI	native	8	-5
Mitella nuda	naked miterwort	MITNUD	native	8	-3
Muhlenbergia glomerata	marsh wild-Timothy	MUHGLO	native	10	-5
Myrica gale	sweet gale	MYRGAL	native	6	-5
Physocarpus opulifolius	ninebark	PHYOPU	native	4	-3
Picea mariana	black spruce	PICMAR	native	6	-3
Platanthera clavellata	small green wood orchid	PLACLA	native	6	-3
Platanthera dilatata	tall white bog orchid	PLADIL	native	10	-5

Appendix 3.11. Siskiwit Bay Poor Fen FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Platanthera huronensis	Lake Huron green orchid	PLAHUR	native	5	-3
Poa palustris	fowl meadow grass	POAPAS	native	3	-3
Prenanthes alba	white lettuce	PREALB	native	5	3
Prenanthes racemosa	glaucous white lettuce	PRERAC	native	8	-3
Pyrola americana	round-leaved pyrola	PYRAME	native	7	0
Rhamnus alnifolia	alder-leaved buckthorn	RHAALN	native	8	-5
Rhododendron groenlandicum	Labrador-tea	RHOGRO	native	8	-5
Rosa acicularis	wild rose	ROSACI	native	4	3
Rosa palustris	swamp rose	ROSPAL	native	5	-5
Rubus hispidus	swamp dewberry	RUBHIS	native	4	-3
Rubus pubescens	dwarf raspberry	RUBPUB	native	4	-3
Salix bebbiana	Bebb's willow	SALBEB	native	1	-3
Salix pedicellaris	bog willow	SALPED	native	8	-5
Sarracenia purpurea	pitcher-plant	SARPUR	native	10	-5
Solidago uliginosa	bog goldenrod	SOLULI	native	4	-5
Spiranthes romanzoffiana	hooded ladies'-tresses	SPIROM	native	8	-5
Symphyotrichum puniceum	swamp aster	SYMPUN	native	5	-5
Symplocarpus foetidus	skunk-cabbage	SYMFOE	native	6	-5
Taxus canadensis	yew	TAXCAN	native	5	3
Thelypteris palustris	marsh fern	THEPAL	native	2	-3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trichophorum alpinum	bulrush	TRIALP	native	10	-5
Trichophorum cespitosum	bulrush	TRICES	native	10	-5
Trientalis borealis	star-flower	TRIBOR	native	5	0
Vaccinium macrocarpon	large cranberry	VACMAC	native	8	-5
Vaccinium myrtilloides	Canada blueberry	VACMYR	native	4	-3
Vaccinium oxycoccos	small cranberry	VACOXY	native	8	-5
Vaccinium vitis-idaea	lingonberry	VACVIT	native	10	0

Appendix 3.12. Sumner Lake and Newt Lake Poor Fen FQA

Conservatism-Based Metrics:

Total Mean C:	6.4
Native Mean C:	6.4
Total FQI:	50
Native FQI:	50
Adjusted FQI:	64
% C value 0:	0
% C value 1-3:	16.4
% C value 4-6:	37.7
% C value 7-10:	45.9
Native Tree Mean C:	3.8
Native Shrub Mean C:	7.9
Native Herbaceous Mean C:	6.5

Physiognomy Metrics:

Tree:	6	9.80%
Shrub:	9	14.80%
Vine:	0	0.00%
Forb:	27	44.30%
Grass:	4	6.60%
Sedge:	11	18.00%
Rush:	0	0%
Fern:	4	6.60%
Bryophyte:	0	0%

Species Richness:

Total Species:	61	
Native Species:	61	100.00%
Non-native Species:	0	0.00%

Duration Metrics:

Annual:	0	0.00%
Perennial:	61	100.00%
Biennial:	0	0.00%
Native Annual:	0	0.00%
Native Perennial:	61	100.00%
Native Biennial:	0	0.00%

Species Wetness:

Mean Wetness:	-4.1
Native Mean Wetness:	-4.1

Appendix 3.12. Sumner Lake and Newt Lake Poor Fen FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Alnus incana	speckled alder	ALNINC	native	5	-3
Andromeda glaucophylla	bog-rosemary	ANDGLA	native	10	-5
Betula papyrifera	paper birch	BETPAP	native	2	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Calla palustris	wild calla	CALPAU	native	10	-5
Calopogon tuberosus	grass-pink	CALTUB	native	9	-5
Campanula aparinoides	marsh bellflower	CAMAPA	native	7	-5
Carex aurea	sedge	CXAURE	native	3	-3
Carex bebbii	sedge	CXBEBB	native	4	-5
Carex exilis	sedge	CXEXIL	native	10	-5
Carex flava	sedge	CXFLAV	native	4	-5
Carex lasiocarpa	sedge	CXLASI	native	8	-5
Carex livida	sedge	CXLIVI	native	10	-5
Chamaedaphne calyculata	leatherleaf	CHACAL	native	8	-5
Comarum palustre	marsh cinquefoil	COMPAL	native	7	-5
Doellingeria umbellata	flat-topped white aster	DOEUMB	native	5	-3
Drosera rotundifolia	round-leaved sundew	DROROT	native	6	-5
Dryopteris cristata	crested shield fern	DRYCRI	native	6	-5
Dulichium arundinaceum	three-way sedge	DULARU	native	8	-5
Epilobium ciliatum	willow-herb	EPICIL	native	3	-3
Epilobium leptophyllum	fen willow-herb	EPILEP	native	6	-5
Equisetum variegatum	variegated scouring rush	EQUVAR	native	6	-3
Eriophorum viridi-carinatum	green-keeled cotton-grass	ERIVID	native	8	-5
Eutrochium maculatum	Joe-pye-weed	EUTMAC	native	4	-5
Glyceria canadensis	rattlesnake grass	GLYCAN	native	8	-5
Hippuris vulgaris	mare's-tail	HIPVUL	native	10	-5
Iris versicolor	wild blue flag	IRIVER	native	5	-5
Kalmia polifolia	bog-laurel	KALPOL	native	10	-5
Larix laricina	tamarack	LARLAR	native	5	-3
Lobelia kalmii	Kalm's lobelia	LOBKAL	native	10	-5
Lysimachia terrestris	swamp-candles	LYSTER	native	6	-5
Lysimachia thyrsiflora	tufted loosestrife	LYSTHY	native	6	-5
Menyanthes trifoliata	buckbean	MENTRI	native	8	-5
Myrica gale	sweet gale	MYRGAL	native	6	-5
Osmunda spectabilis	royal fern	OSMREG	native	5	-5
Parnassia palustris	marsh grass-of-Parnassus	PARPAL	native	10	-5
Picea glauca	white spruce	PICGLA	native	3	3
Picea mariana	black spruce	PICMAR	native	6	-3
Pinus strobus	white pine	PINSTR	native	3	3
Platanthera dilatata	tall white bog orchid	PLADIL	native	10	-5
Poa palustris	fowl meadow grass	POAPAS	native	3	-3
Rhododendron groenlandicum	Labrador-tea	RHOGRO	native	8	-5
Rhynchospora alba	beak-rush	RHYALB	native	6	-5
Rhynchospora fusca	beak-rush	RHYFUS	native	7	-5
Salix pedicellaris	bog willow	SALPED	native	8	-5
Sarracenia purpurea	pitcher-plant	SARPUR	native	10	-5

Appendix 3.12. Sumner Lake and Newt Lake Poor Fen FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Scheuchzeria palustris	arrow-grass	SCHPAL	native	10	-5
Solidago canadensis	Canada goldenrod	SOLCAN	native	1	3
Solidago uliginosa	bog goldenrod	SOLULI	native	4	-5
Spiranthes romanzoffiana	hooded ladies'-tresses	SPIROM	native	8	-5
Symphyotrichum puniceum	swamp aster	SYMPUN	native	5	-5
Symplocarpus foetidus	skunk-cabbage	SYMFOE	native	6	-5
Thelypteris palustris	marsh fern	THEPAL	native	2	-3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Triadenum fraseri	marsh St. John's-wort	TRIFRA	native	6	-5
Trichophorum alpinum	bulrush	TRIALP	native	10	-5
Typha latifolia	broad-leaved cat-tail	TYPLAT	native	1	-5
Utricularia intermedia	flat-leaved bladderwort	UTRINT	native	10	-5
Vaccinium macrocarpon	large cranberry	VACMAC	native	8	-5
Vaccinium oxycoccos	small cranberry	VACOXY	native	8	-5

Appendix 3.13. Tobin Creek Poor Fen FQA

Conservatism-Based Metrics:

Total Mean C:	6.9
Native Mean C:	6.9
Total FQI:	49.3
Native FQI:	49.3
Adjusted FQI:	69
% C value 0:	0
% C value 1-3:	11.8
% C value 4-6:	33.3
% C value 7-10:	54.9
Native Tree Mean C:	4
Native Shrub Mean C:	6.8
Native Herbaceous Mean C:	7.4

Species Richness:

Total Species:	51	
Native Species:	51	100.00%
Non-native Species:	0	0.00%

Species Wetness:

Mean Wetness:	-3.6
Native Mean Wetness:	-3.6

Physiognomy Metrics:

Tree:	6	11.80%
Shrub:	12	23.50%
Vine:	0	0.00%
Forb:	19	37.30%
Grass:	1	2.00%
Sedge:	11	21.60%
Rush:	0	0%
Fern:	2	3.90%
Bryophyte:	0	0%

Duration Metrics:

Annual:	0	0.00%
Perennial:	51	100.00%
Biennial:	0	0.00%
Native Annual:	0	0.00%
Native Perennial:	51	100.00%
Native Biennial:	0	0.00%

Appendix 3.13. Tobin Creek Poor Fen FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Alnus incana	speckled alder	ALNINC	native	5	-3
Amelanchier arborea	juneberry	AMEARB	native	4	3
Amelanchier interior	serviceberry	AMEINT	native	4	5
Andromeda glaucophylla	bog-rosemary	ANDGLA	native	10	-5
Betula papyrifera	paper birch	BETPAP	native	2	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Carex exilis	sedge	CXEXIL	native	10	-5
Carex lasiocarpa	sedge	CXLASI	native	8	-5
Carex livida	sedge	CXLIVI	native	10	-5
Carex magellanica	sedge	CXMAGE	native	8	-5
Carex michauxiana	sedge	CXMICH	native	10	-5
Chamaedaphne calyculata	leatherleaf	CHACAL	native	8	-5
Cladium mariscoides	twig-rush	CLAMAR	native	10	-5
Comarum palustre	marsh cinquefoil	COMPAL	native	7	-5
Cornus canadensis	bunchberry	CORCAA	native	6	0
Cornus sericea	red-osier dogwood	CORSER	native	2	-3
Doellingeria umbellata	flat-topped white aster	DOEUMB	native	5	-3
Drosera rotundifolia	round-leaved sundew	DROROT	native	6	-5
Equisetum palustre	marsh horsetail	EQUPAL	native	8	-3
Eriophorum angustifolium	narrow-leaved cotton-grass	ERIANG	native	10	-5
Eutrochium maculatum	Joe-pye-weed	EUTMAC	native	4	-5
Geocaulon lividum	geocaulon	GEOLIV	native	9	0
Kalmia polifolia	bog-laurel	KALPOL	native	10	-5
Larix laricina	tamarack	LARLAR	native	5	-3
Linnaea borealis	twinflower	LINBOR	native	6	0
Lycopus uniflorus	northern bugle weed	LYCUNI	native	2	-5
Menyanthes trifoliata	buckbean	MENTRI	native	8	-5
Picea mariana	black spruce	PICMAR	native	6	-3
Platanthera clavellata	small green wood orchid	PLACLA	native	6	-3
Platanthera dilatata	tall white bog orchid	PLADIL	native	10	-5
Pyrola asarifolia	pink pyrola	PYRASA	native	8	-3
Rhamnus alnifolia	alder-leaved buckthorn	RHAALN	native	8	-5
Rhododendron groenlandicum	Labrador-tea	RHOGRO	native	8	-5
Rhynchospora alba	beak-rush	RHYALB	native	6	-5
Rhynchospora fusca	beak-rush	RHYFUS	native	7	-5
Rubus pubescens	dwarf raspberry	RUBPUB	native	4	-3
Salix pedicellaris	bog willow	SALPED	native	8	-5
Sarracenia purpurea	pitcher-plant	SARPUR	native	10	-5
Scheuchzeria palustris	arrow-grass	SCHPAL	native	10	-5
Solidago uliginosa	bog goldenrod	SOLULI	native	4	-5
Spiranthes romanzoffiana	hooded ladies'-tresses	SPIROM	native	8	-5
Symphyotrichum boreale	northern bog aster	SYMBOR	native	9	-5
Symplocarpus foetidus	skunk-cabbage	SYMFOE	native	6	-5
Thelypteris palustris	marsh fern	THEPAL	native	2	-3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trichophorum alpinum	bulrush	TRIALP	native	10	-5
Trichophorum cespitosum	bulrush	TRICES	native	10	-5
Trientalis borealis	star-flower	TRIBOR	native	5	0
Utricularia cornuta	horned bladderwort	UTRCOR	native	10	-5
Vaccinium oxycoccos	small cranberry	VACOXY	native	8	-5

Appendix 3.14. Houghton Point Sandstone Bedrock Glade FQA

Conservatism-Based Metrics:

Total Mean C:	5.2
Native Mean C:	5.5
Total FQI:	44.4
Native FQI:	45.7
Adjusted FQI:	53.5
% C value 0:	5.5
% C value 1-3:	21.9
% C value 4-6:	43.8
% C value 7-10:	28.8
Native Tree Mean C:	3
Native Shrub Mean C:	5.6
Native Herbaceous Mean C:	5.8

Species Richness:

Total Species:	73	
Native Species:	69	94.50%
Non-native Species:	4	5.50%

Species Wetness:

Mean Wetness:	2.8
Native Mean Wetness:	2.7

Physiognomy Metrics:

Tree:	7	9.60%
Shrub:	17	23.30%
Vine:	2	2.70%
Forb:	28	38.40%
Grass:	14	19.20%
Sedge:	1	1.40%
Rush:	0	0%
Fern:	4	5.50%
Bryophyte:	0	0%

Duration Metrics:

Annual:	1	1.40%
Perennial:	71	97.30%
Biennial:	1	1.40%
Native Annual:	1	1.40%
Native Perennial:	67	91.80%
Native Biennial:	1	1.40%

Appendix 3.14. Houghton Point Sandstone Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Achillea millefolium	yarrow	ACHMIL	native	1	3
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Alnus viridis	mountain alder	ALNVIR	native	8	0
Amelanchier bartramiana	northern juneberry	AMEBAR	native	8	0
Amelanchier sanguinea	round-leaved serviceberry	AMESAN	native	5	5
Anaphalis margaritacea	pearly everlasting	ANAMAR	native	3	5
Antennaria howellii	small pussytoes	ANTHOW	native	2	5
Aquilegia canadensis	wild columbine	AQUCAN	native	5	3
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Artemisia campestris	wormwood	ARTCAM	native	5	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Carex umbellata	sedge	CXUMBE	native	5	5
Castilleja septentrionalis	northern paintbrush	CASSEP	native	10	0
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Chimaphila umbellata	pipsissewa	CHIUMB	native	8	5
Comandra umbellata	bastard-toadflax	COMUMB	native	5	3
Cornus sericea	red-osier dogwood	CORSER	native	2	-3
Cystopteris fragilis	fragile fern	CYSFRA	native	4	3
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Drymocallis arguta	tall or prairie cinquefoil	DRYARG	native	8	3
Elymus trachycaulus	slender wheatgrass	ELYTRA	native	8	3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Festuca saximontana	fescue	FESSAX	native	6	5
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Galium triflorum	fragrant bedstraw	GALTRR	native	4	3
Geocaulon lividum	geocaulon	GEOLIV	native	9	0
Hepatica americana	round-lobed hepatica	HEPAME	native	6	5
Hieracium aurantiacum	**orange hawkweed**	**HIEAUR**	**non-native**	**0**	**5**
Hieracium caespitosum	**yellow hawkweed; king devil**	**HIECAE**	**non-native**	**0**	**5**
Hieracium kalmii	Kalm's hawkweed	HIEKAL	native	3	5
Hieracium umbellatum	northern hawkweed	HIEUMB	native	7	5
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Lathyrus ochroleucus	pale vetchling	LATOCH	native	8	5
Lonicera hirsuta	hairy honeysuckle	LONHIR	native	6	0
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Micranthes virginiensis	early saxifrage	MICVIR	native	10	3
Oryzopsis asperifolia	rough-leaved rice-grass	ORYASP	native	6	5
Physocarpus opulifolius	ninebark	PHYOPU	native	4	-3
Picea glauca	white spruce	PICGLA	native	3	3
Pinus banksiana	jack pine	PINBAN	native	5	3

Appendix 3.14. Houghton Point Sandstone Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Pinus strobus	white pine	PINSTR	native	3	3
Piptatherum pungens	rice-grass	PIPPUN	native	9	5
Poa compressa	**Canada bluegrass**	**POACOM**	**non-native**	**0**	**3**
Poa glauca	bluegrass	POAGLA	native	10	5
Poa interior	bluegrass	POAINT	native	10	0
Poa pratensis	**Kentucky bluegrass**	**POAPRA**	**non-native**	**0**	**3**
Polypodium virginianum	common polypody	POLVIR	native	8	5
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3
Rosa acicularis	wild rose	ROSACI	native	4	3
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Salix humilis	prairie willow	SALHUM	native	4	3
Schizachne purpurascens	false melic	SCHPUP	native	5	3
Selaginella rupestris	sand club moss	SELRUP	native	8	5
Solidago hispida	hairy goldenrod	SOLHIS	native	3	5
Solidago juncea	early goldenrod	SOLJUN	native	3	5
Solidago simplex	Gillman's goldenrod	SOLSIM	native	10	3
Symphoricarpos albus var. albus	snowberry	SYMALA	native	5	3
Symphyotrichum ciliolatum	northern heart-leaved aster	SYMCIO	native	4	5
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trisetum spicatum	downy oatgrass	TRISPI	native	10	0
Vaccinium myrtilloides	Canada blueberry	VACMYR	native	4	-3
Viburnum edule	squashberry	VIBEDU	native	10	-3
Viola adunca	sand violet	VIOADU	native	4	3
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.15. Houghton Ridge Sandstone Bedrock Glade FQA

Conservatism-Based Metrics:

Total Mean C:	4.4
Native Mean C:	5.2
Total FQI:	42.9
Native FQI:	46.8
Adjusted FQI:	48
% C value 0:	16.8
% C value 1-3:	20
% C value 4-6:	43.2
% C value 7-10:	20
Native Tree Mean C:	3.3
Native Shrub Mean C:	5.3
Native Herbaceous Mean C:	5.4

Species Richness:

Total Species:	95	
Native Species:	81	85.30%
Non-native Species:	14	14.70%

Species Wetness:

Mean Wetness:	3.1
Native Mean Wetness:	3

Physiognomy Metrics:

Tree:	7	7.40%
Shrub:	20	21.10%
Vine:	3	3.20%
Forb:	47	49.50%
Grass:	13	13.70%
Sedge:	1	1.10%
Rush:	0	0%
Fern:	4	4.20%
Bryophyte:	0	0%

Duration Metrics:

Annual:	3	3.20%
Perennial:	85	89.50%
Biennial:	7	7.40%
Native Annual:	2	2.10%
Native Perennial:	74	77.90%
Native Biennial:	5	5.30%

Appendix 3.15. Houghton Ridge Sandstone Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Achillea millefolium	yarrow	ACHMIL	native	1	3
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Amelanchier interior	serviceberry	AMEINT	native	4	5
Amelanchier sanguinea	round-leaved serviceberry	AMESAN	native	5	5
Amelanchier spicata	shadbush serviceberry	AMESPI	native	4	3
Anaphalis margaritacea	pearly everlasting	ANAMAR	native	3	5
Antennaria howellii	small pussytoes	ANTHOW	native	2	5
Aquilegia canadensis	wild columbine	AQUCAN	native	5	3
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Artemisia campestris	wormwood	ARTCAM	native	5	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Boechera grahamii	rock cress	BOEGRA	native	6	3
Campanula rotundifolia	harebell	CAMROT	native	6	3
Capnoides sempervirens	pink or pale corydalis	CAPSEM	native	5	5
Carex umbellata	sedge	CXUMBE	native	5	5
Castilleja septentrionalis	northern paintbrush	CASSEP	native	10	0
Cerastium fontanum	**mouse-ear chickweed**	**CERFON**	**non-native**	**0**	**3**
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Clinopodium vulgare	wild-basil	CLIVUL	native	3	5
Comandra umbellata	bastard-toadflax	COMUMB	native	5	3
Cornus canadensis	bunchberry	CORCAA	native	6	0
Corylus cornuta	beaked hazelnut	CORCOR	native	5	3
Cypripedium arietinum	ram's head lady-slipper	CYPARI	native	10	-3
Cystopteris fragilis	fragile fern	CYSFRA	native	4	3
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Drymocallis arguta	tall or prairie cinquefoil	DRYARG	native	8	3
Elymus trachycaulus	slender wheatgrass	ELYTRA	native	8	3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Festuca occidentalis	western fescue	FESOCC	native	6	5
Festuca saximontana	fescue	FESSAX	native	6	5
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Galeopsis tetrahit	**hemp-nettle**	**GALTET**	**non-native**	**0**	**3**
Geocaulon lividum	geocaulon	GEOLIV	native	9	0
Geum aleppicum	yellow avens	GEUALE	native	3	0
Geum fragarioides	barren-strawberry	GEUFRA	native	6	5
Hieracium aurantiacum	**orange hawkweed**	**HIEAUR**	**non-native**	**0**	**5**
Hieracium caespitosum	**yellow hawkweed; king devil**	**HIECAE**	**non-native**	**0**	**5**
Hieracium kalmii	Kalm's hawkweed	HIEKAL	native	3	5
Hieracium piloselloides	**yellow hawkweed; king devil**	**HIEPIS**	**non-native**	**0**	**5**
Hieracium umbellatum	northern hawkweed	HIEUMB	native	7	5
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Lactuca biennis	tall blue lettuce	LACBIE	native	2	0
Lactuca canadensis	tall lettuce	LACCAN	native	2	3
Lathyrus ochroleucus	pale vetchling	LATOCH	native	8	5

Appendix 3.15. Houghton Ridge Sandstone Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Lonicera hirsuta	hairy honeysuckle	LONHIR	native	6	0
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Micranthes virginiensis	early saxifrage	MICVIR	native	10	3
Oryzopsis asperifolia	rough-leaved rice-grass	ORYASP	native	6	5
Phleum pratense	**Timothy**	**PHLPRA**	**non-native**	**0**	**3**
Picea glauca	white spruce	PICGLA	native	3	3
Pinus banksiana	jack pine	PINBAN	native	5	3
Pinus strobus	white pine	PINSTR	native	3	3
Piptatherum pungens	rice-grass	PIPPUN	native	9	5
Poa compressa	**Canada bluegrass**	**POACOM**	**non-native**	**0**	**3**
Poa glauca	bluegrass	POAGLA	native	10	5
Poa pratensis	**Kentucky bluegrass**	**POAPRA**	**non-native**	**0**	**3**
Polypodium virginianum	common polypody	POLVIR	native	8	5
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Potentilla recta	**rough-fruited cinquefoil**	**POTREC**	**non-native**	**0**	**5**
Prunella vulgaris	self-heal	PRUVUL	native	0	0
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3
Pteridium aquilinum	bracken fern	PTEAQU	native	0	3
Ranunculus acris	**tall or common buttercup**	**RANACR**	**non-native**	**0**	**0**
Ranunculus rhomboideus	prairie buttercup	RANRHO	native	9	5
Rhus typhina	staghorn sumac	RHUTYP	native	2	3
Ribes oxyacanthoides	northern gooseberry	RIBOXY	native	9	3
Rosa acicularis	wild rose	ROSACI	native	4	3
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Rumex crispus	**curly dock**	**RUMCRI**	**non-native**	**0**	**0**
Salix humilis	prairie willow	SALHUM	native	4	3
Schizachne purpurascens	false melic	SCHPUP	native	5	3
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Silene antirrhina	sleepy catchfly	SILANT	native	2	5
Solidago hispida	hairy goldenrod	SOLHIS	native	3	5
Solidago juncea	early goldenrod	SOLJUN	native	3	5
Solidago simplex	Gillman's goldenrod	SOLSIM	native	10	3
Sorbus decora	mountain-ash	SORDEC	native	4	3
Symphoricarpos albus var. albus	snowberry	SYMALA	native	5	3
Symphyotrichum ciliolatum	northern heart-leaved aster	SYMCIO	native	4	5
Taxus canadensis	yew	TAXCAN	native	5	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Tragopogon pratensis	**common goat's beard**	**TRAPRA**	**non-native**	**0**	**5**
Trifolium pratense	**red clover**	**TRIPRA**	**non-native**	**0**	**3**
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Vaccinium myrtilloides	Canada blueberry	VACMYR	native	4	-3
Verbascum thapsus	**common mullein**	**VERTHA**	**non-native**	**0**	**5**
Viburnum edule	squashberry	VIBEDU	native	10	-3
Vicia americana	american vetch	VICAME	native	5	3
Viola adunca	sand violet	VIOADU	native	4	3
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.16. Houghton Point Sandstone Bedrock Lakeshore FQA

Conservatism-Based Metrics:

Total Mean C:	5
Native Mean C:	5.2
Total FQI:	38.4
Native FQI:	39.3
Adjusted FQI:	51.1
% C value 0:	6.8
% C value 1-3:	28.8
% C value 4-6:	30.5
% C value 7-10:	33.9
Native Tree Mean C:	3.1
Native Shrub Mean C:	5.4
Native Herbaceous Mean C:	5.5

Species Richness:

Total Species:	59	
Native Species:	57	96.60%
Non-native Species:	2	3.40%

Species Wetness:

Mean Wetness:	0.8
Native Mean Wetness:	0.7

Physiognomy Metrics:

Tree:	8	13.60%
Shrub:	13	22.00%
Vine:	1	1.70%
Forb:	25	42.40%
Grass:	9	15.30%
Sedge:	0	0.00%
Rush:	0	0%
Fern:	3	5.10%
Bryophyte:	0	0%

Duration Metrics:

Annual:	2	3.40%
Perennial:	57	96.60%
Biennial:	0	0.00%
Native Annual:	2	3.40%
Native Perennial:	55	93.20%
Native Biennial:	0	0.00%

Appendix 3.16. Houghton Point Sandstone Bedrock Lakeshore FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Acer spicatum	mountain maple	ACESPI	native	5	3
Achillea millefolium	yarrow	ACHMIL	native	1	3
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Alnus viridis	mountain alder	ALNVIR	native	8	0
Amelanchier sanguinea	round-leaved serviceberry	AMESAN	native	5	5
Antennaria howellii	small pussytoes	ANTHOW	native	2	5
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Castilleja septentrionalis	northern paintbrush	CASSEP	native	10	0
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Comandra umbellata	bastard-toadflax	COMUMB	native	5	3
Cornus sericea	red-osier dogwood	CORSER	native	2	-3
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Dasiphora fruticosa	shrubby cinquefoil	DASFRU	native	8	-3
Deschampsia cespitosa	hair grass	DESCES	native	9	-3
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Doellingeria umbellata	flat-topped white aster	DOEUMB	native	5	-3
Drymocallis arguta	tall or prairie cinquefoil	DRYARG	native	8	3
Elymus trachycaulus	slender wheatgrass	ELYTRA	native	8	3
Euphrasia hudsoniana	eyebright	EUPHUD	native	8	3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Euthamia graminifolia	grass-leaved goldenrod	EUTGRA	native	3	0
Festuca saximontana	fescue	FESSAX	native	6	5
Fragaria vesca	woodland strawberry	FRAVES	native	2	3
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Hieracium caespitosum	**yellow hawkweed; king devil**	**HIECAE**	**non-native**	**0**	**5**
Hieracium umbellatum	northern hawkweed	HIEUMB	native	7	5
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Lathyrus japonicus	beach pea	LATJAP	native	10	3
Lobelia kalmii	Kalm's lobelia	LOBKAL	native	10	-5
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Onoclea sensibilis	sensitive fern	ONOSEN	native	2	-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**
Poa palustris	fowl meadow grass	POAPAS	native	3	-3
Polypodium virginianum	common polypody	POLVIR	native	8	5
Populus balsamifera	balsam poplar	POPBAL	native	2	-3
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Potentilla norvegica	rough cinquefoil	POTNOR	native	0	0
Prenanthes racemosa	glaucous white lettuce	PRERAC	native	8	-3
Primula mistassinica	bird's-eye primrose	PRIMIS	native	10	-3
Prunella vulgaris	self-heal	PRUVUL	native	0	0
Rosa acicularis	wild rose	ROSACI	native	4	3
Rubus pubescens	dwarf raspberry	RUBPUB	native	4	-3

Appendix 3.16. Houghton Point Sandstone Bedrock Lakeshore FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Salix bebbiana	Bebb's willow	SALBEB	native	1	-3
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Sisyrinchium montanum	mountain blue-eyed-grass	SISMON	native	4	0
Solidago simplex	Gillman's goldenrod	SOLSIM	native	10	3
Sorbus americana	American mountain-ash	SORAME	native	4	0
Sorbus decora	mountain-ash	SORDEC	native	4	3
Thelypteris palustris	marsh fern	THEPAL	native	2	-3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trisetum spicatum	downy oatgrass	TRISPI	native	10	0
Viburnum edule	squashberry	VIBEDU	native	10	-3
Viola nephrophylla	northern bog violet	VIONEP	native	8	-3

Appendix 3.17. Houghton Ridge Sandstone Bedrock Lakeshore FQA

Conservatism-Based Metrics:

Total Mean C:	5.1
Native Mean C:	5.3
Total FQI:	38.8
Native FQI:	39.7
Adjusted FQI:	52.1
% C value 0:	6.9
% C value 1-3:	27.6
% C value 4-6:	31
% C value 7-10:	34.5
Native Tree Mean C:	2.8
Native Shrub Mean C:	5.6
Native Herbaceous Mean C:	5.5

Physiognomy Metrics:

Tree:	5	8.60%
Shrub:	14	24.10%
Vine:	1	1.70%
Forb:	26	44.80%
Grass:	9	15.50%
Sedge:	0	0.00%
Rush:	0	0%
Fern:	3	5.20%
Bryophyte:	0	0%

Species Richness:

Total Species:	58	
Native Species:	56	96.60%
Non-native Species:	2	3.40%

Duration Metrics:

Annual:	2	3.40%
Perennial:	56	96.60%
Biennial:	0	0.00%
Native Annual:	2	3.40%
Native Perennial:	54	93.10%
Native Biennial:	0	0.00%

Species Wetness:

Mean Wetness:	0.7
Native Mean Wetness:	0.6

Appendix 3.17. Houghton Ridge Sandstone Bedrock Lakeshore FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Achillea millefolium	yarrow	ACHMIL	native	1	3
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Alnus viridis	mountain alder	ALNVIR	native	8	0
Amelanchier sanguinea	round-leaved serviceberry	AMESAN	native	5	5
Antennaria howellii	small pussytoes	ANTHOW	native	2	5
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Castilleja septentrionalis	northern paintbrush	CASSEP	native	10	0
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Comandra umbellata	bastard-toadflax	COMUMB	native	5	3
Cornus canadensis	bunchberry	CORCAA	native	6	0
Cornus sericea	red-osier dogwood	CORSER	native	2	-3
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Dasiphora fruticosa	shrubby cinquefoil	DASFRU	native	8	-3
Deschampsia cespitosa	hair grass	DESCES	native	9	-3
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Doellingeria umbellata	flat-topped white aster	DOEUMB	native	5	-3
Drymocallis arguta	tall or prairie cinquefoil	DRYARG	native	8	3
Elymus trachycaulus	slender wheatgrass	ELYTRA	native	8	3
Euphrasia hudsoniana	eyebright	EUPHUD	native	8	3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Euthamia graminifolia	grass-leaved goldenrod	EUTGRA	native	3	0
Festuca saximontana	fescue	FESSAX	native	6	5
Fragaria vesca	woodland strawberry	FRAVES	native	2	3
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Hieracium caespitosum	**yellow hawkweed; king devil**	**HIECAE**	**non-native**	**0**	**5**
Hieracium umbellatum	northern hawkweed	HIEUMB	native	7	5
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Lathyrus japonicus	beach pea	LATJAP	native	10	3
Lobelia kalmii	Kalm's lobelia	LOBKAL	native	10	-5
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Onoclea sensibilis	sensitive fern	ONOSEN	native	2	-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**
Poa palustris	fowl meadow grass	POAPAS	native	3	-3
Polypodium virginianum	common polypody	POLVIR	native	8	5
Populus balsamifera	balsam poplar	POPBAL	native	2	-3
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Potentilla norvegica	rough cinquefoil	POTNOR	native	0	0
Prenanthes racemosa	glaucous white lettuce	PRERAC	native	8	-3
Primula mistassinica	bird's-eye primrose	PRIMIS	native	10	-3
Prunella vulgaris	self-heal	PRUVUL	native	0	0
Rosa acicularis	wild rose	ROSACI	native	4	3
Rubus pubescens	dwarf raspberry	RUBPUB	native	4	-3

Appendix 3.17. Houghton Ridge Sandstone Bedrock Lakeshore FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Salix bebbiana	Bebb's willow	SALBEB	native	1	-3
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Sisyrinchium montanum	mountain blue-eyed-grass	SISMON	native	4	0
Solidago simplex	Gillman's goldenrod	SOLSIM	native	10	3
Sorbus americana	American mountain-ash	SORAME	native	4	0
Thelypteris palustris	marsh fern	THEPAL	native	2	-3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trisetum spicatum	downy oatgrass	TRISPI	native	10	0
Viburnum edule	squashberry	VIBEDU	native	10	-3
Viola labradorica	dog violet	VIOLAB	native	3	0
Viola nephrophylla	northern bog violet	VIONEP	native	8	-3

Appendix 3.18. Malone Bay Sandstone Bedrock Lakeshore FQA

Conservatism-Based Metrics:

Total Mean C:	5.1
Native Mean C:	5.4
Total FQI:	42.7
Native FQI:	43.5
Adjusted FQI:	52
% C value 0:	8.6
% C value 1-3:	24.3
% C value 4-6:	37.1
% C value 7-10:	30
Native Tree Mean C:	3
Native Shrub Mean C:	5.2
Native Herbaceous Mean C:	6.1

Species Richness:

Total Species:	70	
Native Species:	65	92.90%
Non-native Species:	5	7.10%

Species Wetness:

Mean Wetness:	1.4
Native Mean Wetness:	1.2

Physiognomy Metrics:

Tree:	8	11.40%
Shrub:	20	28.60%
Vine:	1	1.40%
Forb:	31	44.30%
Grass:	9	12.90%
Sedge:	0	0.00%
Rush:	0	0%
Fern:	1	1.40%
Bryophyte:	0	0%

Duration Metrics:

Annual:	4	5.70%
Perennial:	65	92.90%
Biennial:	1	1.40%
Native Annual:	3	4.30%
Native Perennial:	61	87.10%
Native Biennial:	1	1.40%

Appendix 3.18. Malone Bay Sandstone Bedrock Lakeshore FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Acer spicatum	mountain maple	ACESPI	native	5	3
Achillea millefolium	yarrow	ACHMIL	native	1	3
Alnus viridis	mountain alder	ALNVIR	native	8	0
Amelanchier interior	serviceberry	AMEINT	native	4	5
Amelanchier sanguinea	round-leaved serviceberry	AMESAN	native	5	5
Anaphalis margaritacea	pearly everlasting	ANAMAR	native	3	5
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Artemisia campestris	wormwood	ARTCAM	native	5	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Cerastium fontanum	**mouse-ear chickweed**	**CERFON**	**non-native**	**0**	**3**
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Clintonia borealis	bluebead-lily; corn-lily	CLIBOR	native	5	0
Cornus canadensis	bunchberry	CORCAA	native	6	0
Cornus sericea; c. stolonifera	red-osier dogwood	CORSER	native	2	-3
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Dasiphora fruticosa	shrubby cinquefoil	DASFRU	native	8	-3
Deschampsia cespitosa	hair grass	DESCES	native	9	-3
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Drymocallis arguta	tall or prairie cinquefoil	DRYARG	native	8	3
Elymus trachycaulus	slender wheatgrass	ELYTRA	native	8	3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Euthamia graminifolia	grass-leaved goldenrod	EUTGRA	native	3	0
Festuca saximontana	fescue	FESSAX	native	6	5
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Galeopsis tetrahit	**hemp-nettle**	**GALTET**	**non-native**	**0**	**3**
Geocaulon lividum	geocaulon	GEOLIV	native	9	0
Halenia deflexa	spurred gentian	HALDEF	native	7	0
Hieracium caespitosum	**yellow hawkweed; king devil**	**HIECAE**	**non-native**	**0**	**5**
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Lobelia kalmii	Kalm's lobelia	LOBKAL	native	10	-5
Lonicera hirsuta	hairy honeysuckle	LONHIR	native	6	0
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Packera paupercula	balsam ragwort	PACPAU	native	3	0
Phleum pratense	**Timothy**	**PHLPRA**	**non-native**	**0**	**3**
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**
Poa glauca	bluegrass	POAGLA	native	10	5
Populus balsamifera	balsam poplar	POPBAL	native	2	-3
Populus tremuloides	quaking aspen	POPTRE	native	1	0

Appendix 3.18. Malone Bay Sandstone Bedrock Lakeshore FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Potentilla litoralis	prairie cinquefoil	POTLIT	native	9	3
Potentilla norvegica	rough cinquefoil	POTNOR	native	0	0
Primula mistassinica	bird's-eye primrose	PRIMIS	native	10	-3
Rosa acicularis	wild rose	ROSACI	native	4	3
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Rubus pubescens	dwarf raspberry	RUBPUB	native	4	-3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Salix discolor	pussy willow	SALDIS	native	1	-3
Sambucus racemosa	red-berried elder	SAMRAC	native	3	3
Saxifraga paniculata	lime-encrusted saxifrage	SAXPAN	native	10	0
Selaginella selaginoides	spikemoss	SELSEL	native	10	-3
Shepherdia canadensis	soapberry	SHECAN	native	7	5
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Sisyrinchium montanum	mountain blue-eyed-grass	SISMON	native	4	0
Solidago hispida	hairy goldenrod	SOLHIS	native	3	5
Solidago ptarmicoides	upland white goldenrod	SOLPTA	native	6	3
Solidago simplex	Gillman's goldenrod	SOLSIM	native	10	3
Sorbus decora	mountain-ash	SORDEC	native	4	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trisetum spicatum	downy oatgrass	TRISPI	native	10	0
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Viburnum edule	squashberry	VIBEDU	native	10	-3
Viola adunca	sand violet	VIOADU	native	4	3

Appendix 3.19. Wright Island Sandstone Bedrock Lakeshore FQA

Conservatism-Based Metrics:

Total Mean C:	4.3
Native Mean C:	4.7
Total FQI:	27.9
Native FQI:	29.4
Adjusted FQI:	45.3
% C value 0:	11.9
% C value 1-3:	31
% C value 4-6:	38.1
% C value 7-10:	19
Native Tree Mean C:	2.9
Native Shrub Mean C:	4.9
Native Herbaceous Mean C:	5.1

Physiognomy Metrics:

Tree:	7	16.70%
Shrub:	9	21.40%
Vine:	0	0.00%
Forb:	22	52.40%
Grass:	4	9.50%
Sedge:	0	0.00%
Rush:	0	0%
Fern:	0	0.00%
Bryophyte:	0	0%

Species Richness:

Total Species:	42	
Native Species:	39	92.90%
Non-native Species:	3	7.10%

Duration Metrics:

Annual:	2	4.80%
Perennial:	39	92.90%
Biennial:	1	2.40%
Native Annual:	1	2.40%
Native Perennial:	37	88.10%
Native Biennial:	1	2.40%

Species Wetness:

Mean Wetness:	1.1
Native Mean Wetness:	0.9

Appendix 3.19. Wright Island Sandstone Bedrock Lakeshore FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Achillea millefolium	yarrow	ACHMIL	native	1	3
Alnus viridis	mountain alder	ALNVIR	native	8	0
Amelanchier interior	serviceberry	AMEINT	native	4	5
Amelanchier sanguinea	round-leaved serviceberry	AMESAN	native	5	5
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Artemisia campestris	wormwood	ARTCAM	native	5	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Cornus sericea	red-osier dogwood	CORSER	native	2	-3
Deschampsia cespitosa	hair grass	DESCES	native	9	-3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Euthamia graminifolia	grass-leaved goldenrod	EUTGRA	native	3	0
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Galeopsis tetrahit	**hemp-nettle**	**GALTET**	**non-native**	**0**	**3**
Hieracium caespitosum	**yellow hawkweed; king devil**	**HIECAE**	**non-native**	**0**	**5**
Linnaea borealis	twinflower	LINBOR	native	6	0
Lobelia kalmii	Kalm's lobelia	LOBKAL	native	10	-5
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Physocarpus opulifolius	ninebark	PHYOPU	native	4	-3
Picea glauca	white spruce	PICGLA	native	3	3
Pinguicula vulgaris	butterwort	PINVUL	native	10	-5
Pinus strobus	white pine	PINSTR	native	3	3
Poa compressa	**Canada bluegrass**	**POACOM**	**non-native**	**0**	**3**
Poa glauca	bluegrass	POAGLA	native	10	5
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Potentilla norvegica	rough cinquefoil	POTNOR	native	0	0
Primula mistassinica	bird's-eye primrose	PRIMIS	native	10	-3
Prunella vulgaris	self-heal	PRUVUL	native	0	0
Rosa acicularis	wild rose	ROSACI	native	4	3
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Salix discolor	pussy willow	SALDIS	native	1	-3
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Sisyrinchium montanum	mountain blue-eyed-grass	SISMON	native	4	0
Solidago hispida	hairy goldenrod	SOLHIS	native	3	5
Solidago ptarmicoides	upland white goldenrod	SOLPTA	native	6	3
Sorbus decora	mountain-ash	SORDEC	native	4	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Viburnum edule	squashberry	VIBEDU	native	10	-3
Viola adunca	sand violet	VIOADU	native	4	3

Appendix 3.20. Houghton Ridge Sandstone Cliff FQA

Conservatism-Based Metrics:

Total Mean C:	4.8
Native Mean C:	4.9
Total FQI:	25.8
Native FQI:	25.9
Adjusted FQI:	48.1
% C value 0:	3.4
% C value 1-3:	24.1
% C value 4-6:	58.6
% C value 7-10:	13.8
Native Tree Mean C:	3.3
Native Shrub Mean C:	4.9
Native Herbaceous Mean C:	5.8

Species Richness:

Total Species:	29	
Native Species:	28	96.60%
Non-native Species:	1	3.40%

Species Wetness:

Mean Wetness:	2.9
Native Mean Wetness:	2.9

Physiognomy Metrics:

Tree:	7	24.10%
Shrub:	8	27.60%
Vine:	1	3.40%
Forb:	6	20.70%
Grass:	4	13.80%
Sedge:	0	0.00%
Rush:	0	0%
Fern:	3	10.30%
Bryophyte:	0	0%

Duration Metrics:

Annual:	0	0.00%
Perennial:	28	96.60%
Biennial:	1	3.40%
Native Annual:	0	0.00%
Native Perennial:	28	96.60%
Native Biennial:	0	0.00%

Appendix 3.20. Houghton Ridge Sandstone Cliff FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Acer spicatum	mountain maple	ACESPI	native	5	3
Amelanchier interior	serviceberry	AMEINT	native	4	5
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Avenella flexuosa; deschampsia f.	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Cystopteris fragilis	fragile fern	CYSFRA	native	4	3
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Festuca saximontana	fescue	FESSAX	native	6	5
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Linnaea borealis	twinflower	LINBOR	native	6	0
Lonicera hirsuta	hairy honeysuckle	LONHIR	native	6	0
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Melilotus albus	**white sweet-clover**	**MELALB**	**non-native**	**0**	**3**
Oryzopsis asperifolia	rough-leaved rice-grass	ORYASP	native	6	5
Picea glauca	white spruce	PICGLA	native	3	3
Pinus banksiana	jack pine	PINBAN	native	5	3
Poa glauca	bluegrass	POAGLA	native	10	5
Polypodium virginianum	common polypody	POLVIR	native	8	5
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3
Ribes lacustre	swamp black currant	RIBLAC	native	6	-3
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Solidago hispida	hairy goldenrod	SOLHIS	native	3	5
Symphoricarpos albus var. albus	snowberry	SYMALA	native	5	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.21. Wright Island Sandstone Cobble Shore FQA

Conservatism-Based Metrics:

Total Mean C:	4.9
Native Mean C:	4.9
Total FQI:	15.5
Native FQI:	15.5
Adjusted FQI:	49
% C value 0:	0
% C value 1-3:	20
% C value 4-6:	60
% C value 7-10:	20
Native Tree Mean C:	3.7
Native Shrub Mean C:	6
Native Herbaceous Mean C:	4

Species Richness:

Total Species:	10	
Native Species:	10	100.00%
Non-native Species:	0	0.00%

Species Wetness:

Mean Wetness:	0.8
Native Mean Wetness:	0.8

Physiognomy Metrics:

Tree:	3	30.00%
Shrub:	5	50.00%
Vine:	0	0.00%
Forb:	2	20.00%
Grass:	0	0.00%
Sedge:	0	0.00%
Rush:	0	0%
Fern:	0	0.00%
Bryophyte:	0	0%

Duration Metrics:

Annual:	0	0.00%
Perennial:	10	100.00%
Biennial:	0	0.00%
Native Annual:	0	0.00%
Native Perennial:	10	100.00%
Native Biennial:	0	0.00%

Appendix 3.21. Wright Island Sandstone Cobble Shore FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Alnus viridis	mountain alder	ALNVIR	native	8	0
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Physocarpus opulifolius	ninebark	PHYOPU	native	4	-3
Picea glauca	white spruce	PICGLA	native	3	3
Rosa acicularis	wild rose	ROSACI	native	4	3
Sorbus decora	mountain-ash	SORDEC	native	4	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Viburnum edule	squashberry	VIBEDU	native	10	-3

Appendix 3.22. Houghton Point Sandstone Lakeshore Cliff FQA

Conservatism-Based Metrics:

Total Mean C:	6
Native Mean C:	6
Total FQI:	25.5
Native FQI:	25.5
Adjusted FQI:	60
% C value 0:	5.6
% C value 1-3:	11.1
% C value 4-6:	44.4
% C value 7-10:	38.9
Native Tree Mean C:	3.5
Native Shrub Mean C:	5.5
Native Herbaceous Mean C:	6.8

Species Richness:

Total Species:	18	
Native Species:	18	100.00%
Non-native Species:	0	0.00%

Species Wetness:

Mean Wetness:	1.1
Native Mean Wetness:	1.1

Physiognomy Metrics:

Tree:	2	11.10%
Shrub:	6	33.30%
Vine:	0	0.00%
Forb:	6	33.30%
Grass:	2	11.10%
Sedge:	0	0.00%
Rush:	0	0%
Fern:	2	11.10%
Bryophyte:	0	0%

Duration Metrics:

Annual:	1	5.60%
Perennial:	17	94.40%
Biennial:	0	0.00%
Native Annual:	1	5.60%
Native Perennial:	17	94.40%
Native Biennial:	0	0.00%

Appendix 3.22. Houghton Point Sandstone Lakeshore Cliff FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Alnus viridis	mountain alder	ALNVIR	native	8	0
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Campanula rotundifolia	harebell	CAMROT	native	6	3
Clintonia borealis	bluebead-lily; corn-lily	CLIBOR	native	5	0
Dasiphora fruticosa	shrubby cinquefoil	DASFRU	native	8	-3
Deschampsia cespitosa	hair grass	DESCES	native	9	-3
Lonicera canadensis	Canadian fly honeysuckle	LONCAN	native	5	3
Picea glauca	white spruce	PICGLA	native	3	3
Polypodium virginianum	common polypody	POLVIR	native	8	5
Potentilla norvegica	rough cinquefoil	POTNOR	native	0	0
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Rubus pubescens	dwarf raspberry	RUBPUB	native	4	-3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Solidago simplex	Gillman's goldenrod	SOLSIM	native	10	3
Streptopus lanceolatus	rose twisted-stalk	STRLAN	native	5	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trisetum spicatum	downy oatgrass	TRISPI	native	10	0
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.23. Malone Bay Sandstone Lakeshore Cliff FQA

Conservatism-Based Metrics:

Total Mean C:	5.4
Native Mean C:	5.7
Total FQI:	25.9
Native FQI:	26.7
Adjusted FQI:	55.7
% C value 0:	4.3
% C value 1-3:	26.1
% C value 4-6:	34.8
% C value 7-10:	34.8
Native Tree Mean C:	3.3
Native Shrub Mean C:	5.2
Native Herbaceous Mean C:	6.6

Species Richness:

Total Species:	23	
Native Species:	22	95.70%
Non-native Species:	1	4.30%

Species Wetness:

Mean Wetness:	1.9
Native Mean Wetness:	1.8

Physiognomy Metrics:

Tree:	4	17.40%
Shrub:	5	21.70%
Vine:	0	0.00%
Forb:	10	43.50%
Grass:	3	13.00%
Sedge:	0	0.00%
Rush:	0	0%
Fern:	1	4.30%
Bryophyte:	0	0%

Duration Metrics:

Annual:	1	4.30%
Perennial:	22	95.70%
Biennial:	0	0.00%
Native Annual:	1	4.30%
Native Perennial:	21	91.30%
Native Biennial:	0	0.00%

Appendix 3.23. Malone Bay Sandstone Lakeshore Cliff FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Amelanchier interior	serviceberry	AMEINT	native	4	5
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Campanula rotundifolia	harebell	CAMROT	native	6	3
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Dasiphora fruticosa	shrubby cinquefoil	DASFRU	native	8	-3
Deschampsia cespitosa	hair grass	DESCES	native	9	-3
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Geocaulon lividum	geocaulon	GEOLIV	native	9	0
Melampyrum lineare	cow-wheat	MELLIN	native	6	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**
Poa glauca	bluegrass	POAGLA	native	10	5
Polypodium virginianum	common polypody	POLVIR	native	8	5
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Saxifraga paniculata	lime-encrusted saxifrage	SAXPAN	native	10	0
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Solidago hispida	hairy goldenrod	SOLHIS	native	3	5
Solidago ptarmicoides	upland white goldenrod	SOLPTA	native	6	3
Sorbus decora	mountain-ash	SORDEC	native	4	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Viola adunca	sand violet	VIOADU	native	4	3

Appendix 3.24. Amygdaloid Island Volcanic Bedrock Glade FQA

Conservatism-Based Metrics:

Total Mean C:	4.8
Native Mean C:	5.2
Total FQI:	47.3
Native FQI:	49.3
Adjusted FQI:	50.1
% C value 0:	9.3
% C value 1-3:	24.7
% C value 4-6:	42.3
% C value 7-10:	23.7
Native Tree Mean C:	3.6
Native Shrub Mean C:	5.1
Native Herbaceous Mean C:	5.5

Species Richness:

Total Species:	97	
Native Species:	90	92.80%
Non-native Species:	7	7.20%

Species Wetness:

Mean Wetness:	2.7
Native Mean Wetness:	2.6

Physiognomy Metrics:

Tree:	10	10.30%
Shrub:	25	25.80%
Vine:	2	2.10%
Forb:	39	40.20%
Grass:	15	15.50%
Sedge:	1	1.00%
Rush:	0	0%
Fern:	5	5.20%
Bryophyte:	0	0%

Duration Metrics:

Annual:	6	6.20%
Perennial:	83	85.60%
Biennial:	8	8.20%
Native Annual:	5	5.20%
Native Perennial:	78	80.40%
Native Biennial:	7	7.20%

Appendix 3.24. Amygdaloid Island Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Acer spicatum	mountain maple	ACESPI	native	5	3
Achillea millefolium	yarrow	ACHMIL	native	1	3
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Alnus viridis	mountain alder	ALNVIR	native	8	0
Amelanchier bartramiana	northern juneberry	AMEBAR	native	8	0
Amelanchier sanguinea	round-leaved serviceberry	AMESAN	native	5	5
Amelanchier spicata	shadbush serviceberry	AMESPI	native	4	3
Anaphalis margaritacea	pearly everlasting	ANAMAR	native	3	5
Antennaria howellii	small pussytoes	ANTHOW	native	2	5
Aquilegia canadensis	wild columbine	AQUCAN	native	5	3
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Artemisia campestris	wormwood	ARTCAM	native	5	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Boechera grahamii	rock cress	BOEGRA	native	6	3
Boechera retrofracta	rock cress	BOERET	native	10	5
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Capnoides sempervirens	pink or pale corydalis	CAPSEM	native	5	5
Carex umbellata	sedge	CXUMBE	native	5	5
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Chimaphila umbellata	pipsissewa	CHIUMB	native	8	5
Clematis virginiana	virgin's bower	CLEVIR	native	4	0
Clinopodium vulgare	wild-basil	CLIVUL	native	3	5
Cornus canadensis	bunchberry	CORCAA	native	6	0
Cornus sericea	red-osier dogwood	CORSER	native	2	-3
Cryptogramma acrostichoides	American rock-brake	CRYACR	native	10	5
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Drymocallis arguta	tall or prairie cinquefoil	DRYARG	native	8	3
Dryopteris fragrans	fragrant woodfern	DRYFRA	native	10	5
Elymus trachycaulus	slender wheatgrass	ELYTRA	native	8	3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Festuca saximontana	fescue	FESSAX	native	6	5
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Galeopsis tetrahit	**hemp-nettle**	**GALTET**	**non-native**	**0**	**3**
Geocaulon lividum	geocaulon	GEOLIV	native	9	0
Geranium bicknellii	northern crane's-bill	GERBIC	native	4	5
Hieracium aurantiacum	**orange hawkweed**	**HIEAUR**	**non-native**	**0**	**5**
Hieracium caespitosum	**yellow hawkweed; king devil**	**HIECAE**	**non-native**	**0**	**5**
Hieracium umbellatum	northern hawkweed	HIEUMB	native	7	5
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Lactuca biennis	tall blue lettuce	LACBIE	native	2	0
Lactuca canadensis	tall lettuce	LACCAN	native	2	3

Appendix 3.24. Amygdaloid Island Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Linnaea borealis	twinflower	LINBOR	native	6	0
Lonicera hirsuta	hairy honeysuckle	LONHIR	native	6	0
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Micranthes virginiensis	early saxifrage	MICVIR	native	10	3
Oryzopsis asperifolia	rough-leaved rice-grass	ORYASP	native	6	5
Phleum pratense	Timothy	PHLPRA	non-native	0	3
Picea glauca	white spruce	PICGLA	native	3	3
Pinus banksiana	jack pine	PINBAN	native	5	3
Pinus resinosa	red pine	PINRES	native	6	3
Piptatherum pungens	rice-grass	PIPPUN	native	9	5
Poa compressa	Canada bluegrass	POACOM	non-native	0	3
Poa glauca	bluegrass	POAGLA	native	10	5
Poa interior	bluegrass	POAINT	native	10	0
Poa pratensis	Kentucky bluegrass	POAPRA	non-native	0	3
Polygonum douglasii	western smartweed	POLDOU	native	5	3
Polypodium virginianum	common polypody	POLVIR	native	8	5
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Potentilla norvegica	rough cinquefoil	POTNOR	native	0	0
Prunella vulgaris	self-heal	PRUVUL	native	0	0
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3
Prunus virginiana	choke cherry	PRUVIR	native	2	3
Rhus typhina	staghorn sumac	RHUTYP	native	2	3
Ribes lacustre	swamp black currant	RIBLAC	native	6	-3
Rosa acicularis	wild rose	ROSACI	native	4	3
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Rubus pubescens	dwarf raspberry	RUBPUB	native	4	-3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Salix humilis	prairie willow	SALHUM	native	4	3
Sambucus racemosa	red-berried elder	SAMRAC	native	3	3
Schizachne purpurascens	false melic	SCHPUP	native	5	3
Selaginella rupestris	sand club moss	SELRUP	native	8	5
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Silene antirrhina	sleepy catchfly	SILANT	native	2	5
Solidago hispida	hairy goldenrod	SOLHIS	native	3	5
Solidago juncea	early goldenrod	SOLJUN	native	3	5
Solidago nemoralis	old-field goldenrod	SOLNEM	native	2	5
Solidago simplex	Gillman's goldenrod	SOLSIM	native	10	3
Sorbus decora	mountain-ash	SORDEC	native	4	3
Symphoricarpos albus var. albus	snowberry	SYMALA	native	5	3
Taxus canadensis	yew	TAXCAN	native	5	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Tragopogon pratensis	common goat's beard	TRAPRA	non-native	0	5
Trisetum spicatum	downy oatgrass	TRISPI	native	10	0
Turritis glabra	tower mustard	TURGLA	native	3	5
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Vaccinium myrtilloides	Canada blueberry	VACMYR	native	4	-3
Viburnum edule	squashberry	VIBEDU	native	10	-3
Viola adunca	sand violet	VIOADU	native	4	3
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.25. Banksi Glade Volcanic Bedrock Glade FQA

Conservatism-Based Metrics:

Total Mean C:	5.2
Native Mean C:	5.4
Total FQI:	49.3
Native FQI:	50.1
Adjusted FQI:	52.8
% C value 0:	5.6
% C value 1-3:	22.2
% C value 4-6:	44.4
% C value 7-10:	27.8
Native Tree Mean C:	3.4
Native Shrub Mean C:	5.4
Native Herbaceous Mean C:	5.8

Physiognomy Metrics:

Tree:	10	11.10%
Shrub:	18	20.00%
Vine:	2	2.20%
Forb:	43	47.80%
Grass:	11	12.20%
Sedge:	0	0.00%
Rush:	0	0%
Fern:	6	6.70%
Bryophyte:	0	0%

Species Richness:

Total Species:	90	
Native Species:	86	95.60%
Non-native Species:	4	4.40%

Duration Metrics:

Annual:	2	2.20%
Perennial:	83	92.20%
Biennial:	5	5.60%
Native Annual:	2	2.20%
Native Perennial:	80	88.90%
Native Biennial:	4	4.40%

Species Wetness:

Mean Wetness:	2.8
Native Mean Wetness:	2.7

Appendix 3.25. Banksi Glade Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Amelanchier bartramiana	northern juneberry	AMEBAR	native	8	0
Amelanchier interior	serviceberry	AMEINT	native	4	5
Amelanchier sanguinea	round-leaved serviceberry	AMESAN	native	5	5
Anaphalis margaritacea	pearly everlasting	ANAMAR	native	3	5
Antennaria howellii	small pussytoes	ANTHOW	native	2	5
Apocynum androsaemifolium	spreading dogbane	APOAND	native	3	5
Aquilegia canadensis	wild columbine	AQUCAN	native	5	3
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Boechera stricta	Drummond rock cress	BOESTR	native	6	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Calystegia spithamaea	low bindweed	CALSPI	native	8	5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Capnoides sempervirens	pink or pale corydalis	CAPSEM	native	5	5
Castilleja septentrionalis	northern paintbrush	CASSEP	native	10	0
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Clinopodium vulgare	wild-basil	CLIVUL	native	3	5
Clintonia borealis	bluebead-lily; corn-lily	CLIBOR	native	5	0
Comandra umbellata	bastard-toadflax	COMUMB	native	5	3
Cornus canadensis	bunchberry	CORCAA	native	6	0
Corylus cornuta	beaked hazelnut	CORCOR	native	5	3
Cryptogramma acrostichoides	American rock-brake	CRYACR	native	10	5
Cynoglossum boreale	northern wild comfrey	CYNBOR	native	7	5
Cypripedium arietinum	ram's head lady-slipper	CYPARI	native	10	-3
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Dichanthelium depauperatum	panic grass	DICDEP	native	4	5
Dichanthelium xanthophysum	panic grass	DICXAN	native	6	5
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Dryopteris fragrans	fragrant woodfern	DRYFRA	native	10	5
Elymus trachycaulus	slender wheatgrass	ELYTRA	native	8	3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Geocaulon lividum	geocaulon	GEOLIV	native	9	0
Hepatica americana	round-lobed hepatica	HEPAME	native	6	5
Hieracium piloselloides	**yellow hawkweed; king devil**	**HIEPIS**	**non-native**	**0**	**5**
Hieracium scabrum	rough hawkweed	HIESCA	native	3	5
Hieracium umbellatum	northern hawkweed	HIEUMB	native	7	5
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Lactuca biennis	tall blue lettuce	LACBIE	native	2	0
Lactuca canadensis	tall lettuce	LACCAN	native	2	3
Linnaea borealis	twinflower	LINBOR	native	6	0
Lonicera dioica	red honeysuckle	LONDIO	native	5	3

Appendix 3.25. Banksi Glade Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Lonicera hirsuta	hairy honeysuckle	LONHIR	native	6	0
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Micranthes virginiensis	early saxifrage	MICVIR	native	10	3
Orthilia secunda	one-sided pyrola	ORTSEC	native	7	0
Oryzopsis asperifolia	rough-leaved rice-grass	ORYASP	native	6	5
Picea glauca	white spruce	PICGLA	native	3	3
Pinus banksiana	jack pine	PINBAN	native	5	3
Pinus resinosa	red pine	PINRES	native	6	3
Pinus strobus	white pine	PINSTR	native	3	3
Piptatherum pungens	rice-grass	PIPPUN	native	9	5
Platanthera clavellata	small green wood orchid	PLACLA	native	6	-3
Platanthera hookeri	Hooker's orchid	PLAHOO	native	8	0
Platanthera huronensis	Lake Huron green orchid	PLAHUR	native	5	-3
Poa compressa	**Canada bluegrass**	**POACOM**	**non-native**	**0**	**3**
Poa glauca	bluegrass	POAGLA	native	10	5
Polygala paucifolia	gay-wings	POLPAU	native	7	3
Polygonum douglasii	western smartweed	POLDOU	native	5	3
Polypodium virginianum	common polypody	POLVIR	native	8	5
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Prenanthes alba	white lettuce	PREALB	native	5	3
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3
Prunus virginiana	choke cherry	PRUVIR	native	2	3
Pteridium aquilinum	bracken fern	PTEAQU	native	0	3
Rosa blanda	wild rose	ROSBLA	native	3	3
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Rumex acetosella	**sheep sorrel**	**RUMACL**	**non-native**	**0**	**3**
Salix humilis	prairie willow	SALHUM	native	4	3
Selaginella rupestris	sand club moss	SELRUP	native	8	5
Shepherdia canadensis	soapberry	SHECAN	native	7	5
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Solidago juncea	early goldenrod	SOLJUN	native	3	5
Solidago nemoralis	old-field goldenrod	SOLNEM	native	2	5
Sorbus decora	mountain-ash	SORDEC	native	4	3
Spiranthes lacera	slender ladies'-tresses	SPILAC	native	8	0
Symphoricarpos albus var. albus	snowberry	SYMALA	native	5	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Vaccinium cespitosum	dwarf bilberry	VACCES	native	9	3
Vaccinium myrtilloides	Canada blueberry	VACMYR	native	4	-3
Verbascum thapsus	**common mullein**	**VERTHA**	**non-native**	**0**	**5**
Viola adunca	sand violet	VIOADU	native	4	3
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.26. The Glade Coast Volcanic Bedrock Glade FQA

Conservatism-Based Metrics:

Total Mean C:	4.8
Native Mean C:	5.1
Total FQI:	46.3
Native FQI:	47.6
Adjusted FQI:	49.3
% C value 0:	8.6
% C value 1-3:	23.7
% C value 4-6:	44.1
% C value 7-10:	23.7
Native Tree Mean C:	3.1
Native Shrub Mean C:	5.4
Native Herbaceous Mean C:	5.3

Species Richness:

Total Species:	93	
Native Species:	87	93.50%
Non-native Species:	6	6.50%

Species Wetness:

Mean Wetness:	2.9
Native Mean Wetness:	2.8

Physiognomy Metrics:

Tree:	8	8.60%
Shrub:	22	23.70%
Vine:	2	2.20%
Forb:	45	48.40%
Grass:	11	11.80%
Sedge:	0	0.00%
Rush:	0	0%
Fern:	5	5.40%
Bryophyte:	0	0%

Duration Metrics:

Annual:	5	5.40%
Perennial:	84	90.30%
Biennial:	4	4.30%
Native Annual:	4	4.30%
Native Perennial:	79	84.90%
Native Biennial:	4	4.30%

Appendix 3.26. The Glade Coast Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Achillea millefolium	yarrow	ACHMIL	native	1	3
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Alnus viridis	mountain alder	ALNVIR	native	8	0
Amelanchier interior	serviceberry	AMEINT	native	4	5
Amelanchier spicata	shadbush serviceberry	AMESPI	native	4	3
Anaphalis margaritacea	pearly everlasting	ANAMAR	native	3	5
Antennaria howellii	small pussytoes	ANTHOW	native	2	5
Apocynum androsaemifolium	spreading dogbane	APOAND	native	3	5
Aquilegia canadensis	wild columbine	AQUCAN	native	5	3
Aralia hispida	bristly sarsaparilla	ARAHIS	native	3	5
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Boechera grahamii	rock cress	BOEGRA	native	6	3
Boechera stricta	Drummond rock cress	BOESTR	native	6	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Capnoides sempervirens	pink or pale corydalis	CAPSEM	native	5	5
Castilleja septentrionalis	northern paintbrush	CASSEP	native	10	0
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Chimaphila umbellata	pipsissewa	CHIUMB	native	8	5
Clinopodium vulgare	wild-basil	CLIVUL	native	3	5
Clintonia borealis	bluebead-lily; corn-lily	CLIBOR	native	5	0
Comandra umbellata	bastard-toadflax	COMUMB	native	5	3
Cornus canadensis	bunchberry	CORCAA	native	6	0
Cryptogramma acrostichoides	American rock-brake	CRYACR	native	10	5
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Dichanthelium depauperatum	panic grass	DICDEP	native	4	5
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Drymocallis arguta	tall or prairie cinquefoil	DRYARG	native	8	3
Elymus trachycaulus	slender wheatgrass	ELYTRA	native	8	3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Festuca occidentalis	western fescue	FESOCC	native	6	5
Festuca saximontana	fescue	FESSAX	native	6	5
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Geranium bicknellii	northern crane's-bill	GERBIC	native	4	5
Geum fragarioides	barren-strawberry	GEUFRA	native	6	5
Hieracium aurantiacum	**orange hawkweed**	**HIEAUR**	**non-native**	**0**	**5**
Hieracium caespitosum	**yellow hawkweed; king devil**	**HIECAE**	**non-native**	**0**	**5**
Hieracium piloselloides	**yellow hawkweed; king devil**	**HIEPIS**	**non-native**	**0**	**5**
Hieracium scabrum	rough hawkweed	HIESCA	native	3	5
Hieracium umbellatum	northern hawkweed	HIEUMB	native	7	5
Hypericum perforatum	**common St. John's-wort**	**HYPPER**	**non-native**	**0**	**5**
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3

Appendix 3.26. The Glade Coast Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Lactuca biennis	tall blue lettuce	LACBIE	native	2	0
Lilium philadelphicum	wood lily	LILPHI	native	7	0
Lonicera dioica	red honeysuckle	LONDIO	native	5	3
Lonicera hirsuta	hairy honeysuckle	LONHIR	native	6	0
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Micranthes virginiensis	early saxifrage	MICVIR	native	10	3
Oryzopsis asperifolia	rough-leaved rice-grass	ORYASP	native	6	5
Physocarpus opulifolius	ninebark	PHYOPU	native	4	-3
Picea glauca	white spruce	PICGLA	native	3	3
Pinus banksiana	jack pine	PINBAN	native	5	3
Piptatherum pungens	rice-grass	PIPPUN	native	9	5
Polygonum douglasii	western smartweed	POLDOU	native	5	3
Polypodium virginianum	common polypody	POLVIR	native	8	5
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Potentilla norvegica	rough cinquefoil	POTNOR	native	0	0
Prenanthes alba	white lettuce	PREALB	native	5	3
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3
Prunus pumila	sand cherry	PRUPUM	native	8	5
Pteridium aquilinum	bracken fern	PTEAQU	native	0	3
Ranunculus rhomboideus	prairie buttercup	RANRHO	native	9	5
Rhus typhina	staghorn sumac	RHUTYP	native	2	3
Ribes glandulosum	skunk currant	RIBGLA	native	5	-3
Rosa acicularis	wild rose	ROSACI	native	4	3
Rosa blanda	wild rose	ROSBLA	native	3	3
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Salix humilis	prairie willow	SALHUM	native	4	3
Schizachne purpurascens	false melic	SCHPUP	native	5	3
Selaginella rupestris	sand club moss	SELRUP	native	8	5
Shepherdia canadensis	soapberry	SHECAN	native	7	5
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Solidago juncea	early goldenrod	SOLJUN	native	3	5
Solidago nemoralis	old-field goldenrod	SOLNEM	native	2	5
Sorbus decora	mountain-ash	SORDEC	native	4	3
Spiranthes lacera	slender ladies'-tresses	SPILAC	native	8	0
Spiranthes romanzoffiana	hooded ladies'-tresses	SPIROM	native	8	-5
Symphyotrichum ciliolatum	northern heart-leaved aster	SYMCIO	native	4	5
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trifolium aureum	**hop clover**	**TRIAUM**	**non-native**	**0**	**5**
Trifolium pratense	**red clover**	**TRIPRA**	**non-native**	**0**	**3**
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Viburnum edule	squashberry	VIBEDU	native	10	-3
Viola adunca	sand violet	VIOADU	native	4	3
Viola labradorica	dog violet	VIOLAB	native	3	0
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.27. Glade of Ages Volcanic Bedrock Glade FQA

Conservatism-Based Metrics:

Total Mean C:	5.3
Native Mean C:	5.3
Total FQI:	34.3
Native FQI:	34.3
Adjusted FQI:	53
% C value 0:	0
% C value 1-3:	23.8
% C value 4-6:	50
% C value 7-10:	26.2
Native Tree Mean C:	3.2
Native Shrub Mean C:	5.6
Native Herbaceous Mean C:	5.7

Physiognomy Metrics:

Tree:	6	14.30%
Shrub:	12	28.60%
Vine:	0	0.00%
Forb:	16	38.10%
Grass:	6	14.30%
Sedge:	0	0.00%
Rush:	0	0%
Fern:	2	4.80%
Bryophyte:	0	0%

Species Richness:

Total Species:	42	
Native Species:	42	100.00%
Non-native Species:	0	0.00%

Duration Metrics:

Annual:	2	4.80%
Perennial:	39	92.90%
Biennial:	1	2.40%
Native Annual:	2	4.80%
Native Perennial:	39	92.90%
Native Biennial:	1	2.40%

Species Wetness:

Mean Wetness:	2
Native Mean Wetness:	2

Appendix 3.27. Glade of Ages Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Achillea millefolium	yarrow	ACHMIL	native	1	3
Amelanchier bartramiana	northern juneberry	AMEBAR	native	8	0
Amelanchier sanguinea	round-leaved serviceberry	AMESAN	native	5	5
Antennaria howellii	small pussytoes	ANTHOW	native	2	5
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Capnoides sempervirens	pink or pale corydalis	CAPSEM	native	5	5
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Coptis trifolia	goldthread	COPTRI	native	5	-3
Cornus canadensis	bunchberry	CORCAA	native	6	0
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Deschampsia cespitosa	hair grass	DESCES	native	9	-3
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Geocaulon lividum	geocaulon	GEOLIV	native	9	0
Hieracium umbellatum	northern hawkweed	HIEUMB	native	7	5
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Linnaea borealis	twinflower	LINBOR	native	6	0
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Oryzopsis asperifolia	rough-leaved rice-grass	ORYASP	native	6	5
Picea glauca	white spruce	PICGLA	native	3	3
Polygonum douglasii	western smartweed	POLDOU	native	5	3
Polypodium virginianum	common polypody	POLVIR	native	8	5
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3
Rhododendron groenlandicum	Labrador-tea	RHOGRO	native	8	-5
Rosa acicularis	wild rose	ROSACI	native	4	3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Sorbus decora	mountain-ash	SORDEC	native	4	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trisetum spicatum	downy oatgrass	TRISPI	native	10	0
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Vaccinium myrtilloides	Canada blueberry	VACMYR	native	4	-3
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.28. Lake Whittlesey Volcanic Bedrock Glade FQA

Conservatism-Based Metrics:

Total Mean C:	4.9
Native Mean C:	5.1
Total FQI:	50.7
Native FQI:	51.5
Adjusted FQI:	49.8
% C value 0:	6.5
% C value 1-3:	22.4
% C value 4-6:	46.7
% C value 7-10:	24.3
Native Tree Mean C:	3.5
Native Shrub Mean C:	5.3
Native Herbaceous Mean C:	5.3

Species Richness:

Total Species:	107	
Native Species:	102	95.30%
Non-native Species:	5	4.70%

Species Wetness:

Mean Wetness:	2.9
Native Mean Wetness:	2.8

Physiognomy Metrics:

Tree:	11	10.30%
Shrub:	25	23.40%
Vine:	3	2.80%
Forb:	48	44.90%
Grass:	12	11.20%
Sedge:	1	0.90%
Rush:	0	0%
Fern:	7	6.50%
Bryophyte:	0	0%

Duration Metrics:

Annual:	5	4.70%
Perennial:	98	91.60%
Biennial:	4	3.70%
Native Annual:	4	3.70%
Native Perennial:	95	88.80%
Native Biennial:	3	2.80%

Appendix 3.28. Lake Whittlesey Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Alnus viridis	mountain alder	ALNVIR	native	8	0
Amelanchier arborea	juneberry	AMEARB	native	4	3
Amelanchier sanguinea	round-leaved serviceberry	AMESAN	native	5	5
Anaphalis margaritacea	pearly everlasting	ANAMAR	native	3	5
Antennaria parlinii	smooth pussytoes	ANTPAL	native	2	5
Apocynum androsaemifolium	spreading dogbane	APOAND	native	3	5
Aquilegia canadensis	wild columbine	AQUCAN	native	5	3
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Boechera stricta	Drummond rock cress	BOESTR	native	6	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Calystegia spithamaea	low bindweed	CALSPI	native	8	5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Capnoides sempervirens	pink or pale corydalis	CAPSEM	native	5	5
Carex umbellata	sedge	CXUMBE	native	5	5
Castilleja septentrionalis	northern paintbrush	CASSEP	native	10	0
Chamaedaphne calyculata	leatherleaf	CHACAL	native	8	-5
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Chimaphila umbellata	pipsissewa	CHIUMB	native	8	5
Clinopodium vulgare	wild-basil	CLIVUL	native	3	5
Clintonia borealis	bluebead-lily; corn-lily	CLIBOR	native	5	0
Comandra umbellata	bastard-toadflax	COMUMB	native	5	3
Corallorhiza maculata	spotted coral-root	CORMAC	native	5	3
Cornus canadensis	bunchberry	CORCAA	native	6	0
Corylus cornuta	beaked hazelnut	CORCOR	native	5	3
Cryptogramma acrostichoides	American rock-brake	CRYACR	native	10	5
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Dichanthelium depauperatum	panic grass	DICDEP	native	4	5
Dichanthelium xanthophysum	panic grass	DICXAN	native	6	5
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Diphasiastrum complanatum	ground-cedar	DIPCOM	native	5	3
Drymocallis arguta	tall or prairie cinquefoil	DRYARG	native	8	3
Elymus trachycaulus	slender wheatgrass	ELYTRA	native	8	3
Erigeron strigosus	daisy fleabane	ERISTR	native	4	3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Festuca occidentalis	western fescue	FESOCC	native	6	5
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Galium triflorum	fragrant bedstraw	GALTRR	native	4	3
Geocaulon lividum	geocaulon	GEOLIV	native	9	0
Goodyera oblongifolia	Menzies' rattlesnake plantain	GOOOBL	native	8	3
Gymnocarpium dryopteris	oak fern	GYMDRY	native	5	3
Hieracium aurantiacum	**orange hawkweed**	**HIEAUR**	**non-native**	**0**	**5**
Hieracium kalmii	Kalm's hawkweed	HIEKAL	native	3	5

Appendix 3.28. Lake Whittlesey Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Hieracium piloselloides	**yellow hawkweed; king devil**	**HIEPIS**	**non-native**	**0**	**5**
Hieracium scabrum	rough hawkweed	HIESCA	native	3	5
Hieracium umbellatum	northern hawkweed	HIEUMB	native	7	5
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Lactuca canadensis	tall lettuce	LACCAN	native	2	3
Lathyrus ochroleucus	pale vetchling	LATOCH	native	8	5
Lilium philadelphicum	wood lily	LILPHI	native	7	0
Linnaea borealis	twinflower	LINBOR	native	6	0
Lonicera canadensis	Canadian fly honeysuckle	LONCAN	native	5	3
Lonicera dioica	red honeysuckle	LONDIO	native	5	3
Lonicera hirsuta	hairy honeysuckle	LONHIR	native	6	0
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Micranthes virginiensis	early saxifrage	MICVIR	native	10	3
Myrica gale	sweet gale	MYRGAL	native	6	-5
Oryzopsis asperifolia	rough-leaved rice-grass	ORYASP	native	6	5
Picea glauca	white spruce	PICGLA	native	3	3
Pinus banksiana	jack pine	PINBAN	native	5	3
Pinus resinosa	red pine	PINRES	native	6	3
Pinus strobus	white pine	PINSTR	native	3	3
Piptatherum pungens	rice-grass	PIPPUN	native	9	5
Platanthera hookeri	Hooker's orchid	PLAHOO	native	8	0
Poa compressa	**Canada bluegrass**	**POACOM**	**non-native**	**0**	**3**
Polygala paucifolia	gay-wings	POLPAU	native	7	3
Polygonum douglasii	western smartweed	POLDOU	native	5	3
Polypodium virginianum	common polypody	POLVIR	native	8	5
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Potentilla norvegica	rough cinquefoil	POTNOR	native	0	0
Prenanthes alba	white lettuce	PREALB	native	5	3
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3
Prunus virginiana	choke cherry	PRUVIR	native	2	3
Pteridium aquilinum	bracken fern	PTEAQU	native	0	3
Rhus typhina	staghorn sumac	RHUTYP	native	2	3
Ribes oxyacanthoides	northern gooseberry	RIBOXY	native	9	3
Rosa acicularis	wild rose	ROSACI	native	4	3
Rosa blanda	wild rose	ROSBLA	native	3	3
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Rubus pubescens	dwarf raspberry	RUBPUB	native	4	-3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Salix humilis	prairie willow	SALHUM	native	4	3
Schizachne purpurascens	false melic	SCHPUP	native	5	3
Selaginella rupestris	sand club moss	SELRUP	native	8	5
Shepherdia canadensis	soapberry	SHECAN	native	7	5
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Silene antirrhina	sleepy catchfly	SILANT	native	2	5
Solidago hispida	hairy goldenrod	SOLHIS	native	3	5

Appendix 3.28. Lake Whittlesey Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Solidago juncea	early goldenrod	SOLJUN	native	3	5
Solidago nemoralis	old-field goldenrod	SOLNEM	native	2	5
Sorbus decora	mountain-ash	SORDEC	native	4	3
Spiranthes lacera	slender ladies'-tresses	SPILAC	native	8	0
Symphoricarpos albus var. albus	snowberry	SYMALA	native	5	3
Symphyotrichum ciliolatum	northern heart-leaved aster	SYMCIO	native	4	5
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Tragopogon pratensis	**common goat's beard**	**TRAPRA**	**non-native**	**0**	**5**
Trifolium aureum	**hop clover**	**TRIAUM**	**non-native**	**0**	**5**
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Vaccinium myrtilloides	Canada blueberry	VACMYR	native	4	-3
Viola adunca	sand violet	VIOADU	native	4	3
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.29. Lane Cove Volcanic Bedrock Glade FQA

Conservatism-Based Metrics:

Total Mean C:	4.9
Native Mean C:	5.3
Total FQI:	41
Native FQI:	42.7
Adjusted FQI:	51.1
% C value 0:	8.6
% C value 1-3:	20
% C value 4-6:	45.7
% C value 7-10:	25.7
Native Tree Mean C:	3.7
Native Shrub Mean C:	5.3
Native Herbaceous Mean C:	5.8

Species Richness:

Total Species:	70	
Native Species:	65	92.90%
Non-native Species:	5	7.10%

Species Wetness:

Mean Wetness:	2.8
Native Mean Wetness:	2.6

Physiognomy Metrics:

Tree:	11	15.70%
Shrub:	21	30.00%
Vine:	2	2.90%
Forb:	26	37.10%
Grass:	6	8.60%
Sedge:	0	0.00%
Rush:	0	0%
Fern:	4	5.70%
Bryophyte:	0	0%

Duration Metrics:

Annual:	3	4.30%
Perennial:	63	90.00%
Biennial:	4	5.70%
Native Annual:	2	2.90%
Native Perennial:	61	87.10%
Native Biennial:	2	2.90%

Appendix 3.29. Lane Cove Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Amelanchier sanguinea	round-leaved serviceberry	AMESAN	native	5	5
Amelanchier spicata	shadbush serviceberry	AMESPI	native	4	3
Anaphalis margaritacea	pearly everlasting	ANAMAR	native	3	5
Antennaria howellii	small pussytoes	ANTHOW	native	2	5
Apocynum androsaemifolium	spreading dogbane	APOAND	native	3	5
Aquilegia canadensis	wild columbine	AQUCAN	native	5	3
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Artemisia campestris	wormwood	ARTCAM	native	5	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Capnoides sempervirens	pink or pale corydalis	CAPSEM	native	5	5
Ceanothus herbaceus	New Jersey tea	CEAHER	native	9	5
Chimaphila umbellata	pipsissewa	CHIUMB	native	8	5
Clematis virginiana	virgin's bower	CLEVIR	native	4	0
Comandra umbellata	bastard-toadflax	COMUMB	native	5	3
Cornus canadensis	bunchberry	CORCAA	native	6	0
Corylus cornuta	beaked hazelnut	CORCOR	native	5	3
Crataegus douglasii	black hawthorn	CRADOU	native	7	0
Cryptogramma acrostichoides	American rock-brake	CRYACR	native	10	5
Cypripedium arietinum	ram's head lady-slipper	CYPARI	native	10	-3
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Deschampsia cespitosa	hair grass	DESCES	native	9	-3
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Drymocallis arguta; potentilla a.	tall or prairie cinquefoil	DRYARG	native	8	3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Galeopsis tetrahit	**hemp-nettle**	**GALTET**	**non-native**	**0**	**3**
Geranium bicknellii	northern crane's-bill	GERBIC	native	4	5
Hypericum perforatum	**common St. John's-wort**	**HYPPER**	**non-native**	**0**	**5**
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Linnaea borealis	twinflower	LINBOR	native	6	0
Lonicera hirsuta	hairy honeysuckle	LONHIR	native	6	0
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Micranthes virginiensis	early saxifrage	MICVIR	native	10	3
Oryzopsis asperifolia	rough-leaved rice-grass	ORYASP	native	6	5
Picea glauca	white spruce	PICGLA	native	3	3
Pinus banksiana	jack pine	PINBAN	native	5	3
Pinus resinosa	red pine	PINRES	native	6	3
Pinus strobus	white pine	PINSTR	native	3	3
Poa compressa	**Canada bluegrass**	**POACOM**	**non-native**	**0**	**3**
Polygala paucifolia	gay-wings	POLPAU	native	7	3
Polypodium virginianum	common polypody	POLVIR	native	8	5

Appendix 3.29. Lane Cove Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Potentilla norvegica	rough cinquefoil	POTNOR	native	0	0
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3
Prunus virginiana	choke cherry	PRUVIR	native	2	3
Ranunculus rhomboideus	prairie buttercup	RANRHO	native	9	5
Rhus typhina	staghorn sumac	RHUTYP	native	2	3
Rosa acicularis	wild rose	ROSACI	native	4	3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Salix humilis	prairie willow	SALHUM	native	4	3
Selaginella rupestris	sand club moss	SELRUP	native	8	5
Shepherdia canadensis	soapberry	SHECAN	native	7	5
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Sorbus decora	mountain-ash	SORDEC	native	4	3
Symphoricarpos albus var. albus	snowberry	SYMALA	native	5	3
Taxus canadensis	yew	TAXCAN	native	5	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Tragopogon pratensis	**common goat's beard**	**TRAPRA**	**non-native**	**0**	**5**
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Vaccinium myrtilloides	Canada blueberry	VACMYR	native	4	-3
Verbascum thapsus	**common mullein**	**VERTHA**	**non-native**	**0**	**5**
Viburnum edule	squashberry	VIBEDU	native	10	-3
Viola adunca	sand violet	VIOADU	native	4	3
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.30. Malone Bay Volcanic Bedrock Glade FQA

Conservatism-Based Metrics:

Total Mean C:	4.5
Native Mean C:	5
Total FQI:	40
Native FQI:	42.1
Adjusted FQI:	47.4
% C value 0:	12.7
% C value 1-3:	20.3
% C value 4-6:	46.8
% C value 7-10:	20.3
Native Tree Mean C:	2.8
Native Shrub Mean C:	4.8
Native Herbaceous Mean C:	5.4

Species Richness:

Total Species:	79	
Native Species:	71	89.90%
Non-native Species:	8	10.10%

Species Wetness:

Mean Wetness:	2.6
Native Mean Wetness:	2.5

Physiognomy Metrics:

Tree:	6	7.60%
Shrub:	19	24.10%
Vine:	2	2.50%
Forb:	36	45.60%
Grass:	13	16.50%
Sedge:	0	0.00%
Rush:	0	0%
Fern:	3	3.80%
Bryophyte:	0	0%

Duration Metrics:

Annual:	3	3.80%
Perennial:	72	91.10%
Biennial:	4	5.10%
Native Annual:	3	3.80%
Native Perennial:	66	83.50%
Native Biennial:	2	2.50%

Appendix 3.30. Malone Bay Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Achillea millefolium	yarrow	ACHMIL	native	1	3
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Alnus viridis	mountain alder	ALNVIR	native	8	0
Amelanchier interior	serviceberry	AMEINT	native	4	5
Amelanchier sanguinea	round-leaved serviceberry	AMESAN	native	5	5
Amelanchier spicata	shadbush serviceberry	AMESPI	native	4	3
Anaphalis margaritacea	pearly everlasting	ANAMAR	native	3	5
Antennaria howellii	small pussytoes	ANTHOW	native	2	5
Aquilegia canadensis	wild columbine	AQUCAN	native	5	3
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Boechera grahamii	rock cress	BOEGRA	native	6	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Capnoides sempervirens	pink or pale corydalis	CAPSEM	native	5	5
Cerastium fontanum	**mouse-ear chickweed**	**CERFON**	**non-native**	**0**	**3**
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Cirsium vulgare	**bull thistle**	**CIRVUL**	**non-native**	**0**	**3**
Clinopodium vulgare	wild-basil	CLIVUL	native	3	5
Clintonia borealis	bluebead-lily; corn-lily	CLIBOR	native	5	0
Comandra umbellata	bastard-toadflax	COMUMB	native	5	3
Cornus canadensis	bunchberry	CORCAA	native	6	0
Cryptogramma acrostichoides	American rock-brake	CRYACR	native	10	5
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Drymocallis arguta	tall or prairie cinquefoil	DRYARG	native	8	3
Elymus trachycaulus	slender wheatgrass	ELYTRA	native	8	3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Festuca occidentalis	western fescue	FESOCC	native	6	5
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Geocaulon lividum	geocaulon	GEOLIV	native	9	0
Geranium bicknellii	northern crane's-bill	GERBIC	native	4	5
Hieracium caespitosum	**yellow hawkweed; king devil**	**HIECAE**	**non-native**	**0**	**5**
Hieracium umbellatum	northern hawkweed	HIEUMB	native	7	5
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Linnaea borealis	twinflower	LINBOR	native	6	0
Lonicera dioica	red honeysuckle	LONDIO	native	5	3
Lonicera hirsuta	hairy honeysuckle	LONHIR	native	6	0
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Micranthes virginiensis	early saxifrage	MICVIR	native	10	3
Milium effusum	wood millet	MILEFF	native	8	3
Oryzopsis asperifolia	rough-leaved rice-grass	ORYASP	native	6	5
Phleum pratense	**Timothy**	**PHLPRA**	**non-native**	**0**	**3**
Picea glauca	white spruce	PICGLA	native	3	3

Appendix 3.30. Malone Bay Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Poa compressa	**Canada bluegrass**	**POACOM**	**non-native**	**0**	**3**
Poa pratensis	**Kentucky bluegrass**	**POAPRA**	**non-native**	**0**	**3**
Poa saltuensis	bluegrass	POASAL	native	5	5
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Potentilla norvegica	rough cinquefoil	POTNOR	native	0	0
Prunella vulgaris	self-heal	PRUVUL	native	0	0
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3
Ranunculus rhomboideus	prairie buttercup	RANRHO	native	9	5
Rhus typhina	staghorn sumac	RHUTYP	native	2	3
Rosa acicularis	wild rose	ROSACI	native	4	3
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Rubus pubescens	dwarf raspberry	RUBPUB	native	4	-3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Salix humilis	prairie willow	SALHUM	native	4	3
Sambucus racemosa	red-berried elder	SAMRAC	native	3	3
Schizachne purpurascens	false melic	SCHPUP	native	5	3
Selaginella rupestris	sand club moss	SELRUP	native	8	5
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Solidago juncea	early goldenrod	SOLJUN	native	3	5
Solidago nemoralis	old-field goldenrod	SOLNEM	native	2	5
Sorbus decora	mountain-ash	SORDEC	native	4	3
Spiranthes lacera	slender ladies'-tresses	SPILAC	native	8	0
Spiranthes romanzoffiana	hooded ladies'-tresses	SPIROM	native	8	-5
Taxus canadensis	yew	TAXCAN	native	5	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trifolium pratense	**red clover**	**TRIPRA**	**non-native**	**0**	**3**
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Vaccinium myrtilloides	Canada blueberry	VACMYR	native	4	-3
Verbascum thapsus	**common mullein**	**VERTHA**	**non-native**	**0**	**5**
Viburnum edule	squashberry	VIBEDU	native	10	-3
Viola adunca	sand violet	VIOADU	native	4	3
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.31. Moose Lake Volcanic Bedrock Glade FQA

Conservatism-Based Metrics:

Total Mean C:	4.6
Native Mean C:	5
Total FQI:	41.1
Native FQI:	42.7
Adjusted FQI:	47.8
% C value 0:	11.3
% C value 1-3:	23.8
% C value 4-6:	43.8
% C value 7-10:	21.3
Native Tree Mean C:	3.4
Native Shrub Mean C:	4.6
Native Herbaceous Mean C:	5.4

Species Richness:

Total Species:	80	
Native Species:	73	91.30%
Non-native Species:	7	8.80%

Species Wetness:

Mean Wetness:	3
Native Mean Wetness:	2.9

Physiognomy Metrics:

Tree:	8	10.00%
Shrub:	14	17.50%
Vine:	1	1.30%
Forb:	40	50.00%
Grass:	11	13.80%
Sedge:	2	2.50%
Rush:	0	0%
Fern:	4	5.00%
Bryophyte:	0	0%

Duration Metrics:

Annual:	4	5.00%
Perennial:	72	90.00%
Biennial:	4	5.00%
Native Annual:	4	5.00%
Native Perennial:	66	82.50%
Native Biennial:	3	3.80%

Appendix 3.31. Moose Lake Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Achillea millefolium	yarrow	ACHMIL	native	1	3
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Amelanchier sanguinea	round-leaved serviceberry	AMESAN	native	5	5
Amelanchier spicata	shadbush serviceberry	AMESPI	native	4	3
Anaphalis margaritacea	pearly everlasting	ANAMAR	native	3	5
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Capnoides sempervirens	pink or pale corydalis	CAPSEM	native	5	5
Carex merritt-fernaldii	sedge	CXMERR	native	4	5
Carex umbellata	sedge	CXUMBE	native	5	5
Cerastium arvense	field chickweed	CERARV	native	6	3
Cerastium fontanum	**mouse-ear chickweed**	**CERFON**	**non-native**	**0**	**3**
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Clinopodium vulgare	wild-basil	CLIVUL	native	3	5
Comandra umbellata	bastard-toadflax	COMUMB	native	5	3
Cryptogramma acrostichoides	American rock-brake	CRYACR	native	10	5
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Drymocallis arguta	tall or prairie cinquefoil	DRYARG	native	8	3
Elymus trachycaulus	slender wheatgrass	ELYTRA	native	8	3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Festuca saximontana	fescue	FESSAX	native	6	5
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Gaultheria hispidula	creeping-snowberry	GAUHIS	native	8	-3
Geocaulon lividum	geocaulon	GEOLIV	native	9	0
Geranium bicknellii	northern crane's-bill	GERBIC	native	4	5
Geum fragarioides	barren-strawberry	GEUFRA	native	6	5
Hieracium aurantiacum	**orange hawkweed**	**HIEAUR**	**non-native**	**0**	**5**
Hieracium caespitosum	**yellow hawkweed; king devil**	**HIECAE**	**non-native**	**0**	**5**
Hieracium kalmii	Kalm's hawkweed	HIEKAL	native	3	5
Hieracium umbellatum	northern hawkweed	HIEUMB	native	7	5
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Lactuca biennis	tall blue lettuce	LACBIE	native	2	0
Lactuca canadensis	tall lettuce	LACCAN	native	2	3
Linnaea borealis	twinflower	LINBOR	native	6	0
Lonicera hirsuta	hairy honeysuckle	LONHIR	native	6	0
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Micranthes virginiensis	early saxifrage	MICVIR	native	10	3
Oryzopsis asperifolia	rough-leaved rice-grass	ORYASP	native	6	5
Picea glauca	white spruce	PICGLA	native	3	3
Pinus banksiana	jack pine	PINBAN	native	5	3

Appendix 3.31. Moose Lake Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Pinus strobus	white pine	PINSTR	native	3	3
Piptatherum pungens	rice-grass	PIPPUN	native	9	5
Poa compressa	**Canada bluegrass**	**POACOM**	**non-native**	**0**	**3**
Poa glauca	bluegrass	POAGLA	native	10	5
Poa pratensis	**Kentucky bluegrass**	**POAPRA**	**non-native**	**0**	**3**
Polygonum douglasii	western smartweed	POLDOU	native	5	3
Polypodium virginianum	common polypody	POLVIR	native	8	5
Potentilla norvegica	rough cinquefoil	POTNOR	native	0	0
Prenanthes racemosa	glaucous white lettuce	PRERAC	native	8	-3
Prunella vulgaris	self-heal	PRUVUL	native	0	0
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3
Ranunculus rhomboideus	prairie buttercup	RANRHO	native	9	5
Rhus typhina	staghorn sumac	RHUTYP	native	2	3
Rosa acicularis	wild rose	ROSACI	native	4	3
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Rumex acetosella	**sheep sorrel**	**RUMACL**	**non-native**	**0**	**3**
Salix humilis	prairie willow	SALHUM	native	4	3
Selaginella rupestris	sand club moss	SELRUP	native	8	5
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Solidago juncea	early goldenrod	SOLJUN	native	3	5
Solidago nemoralis	old-field goldenrod	SOLNEM	native	2	5
Solidago simplex	Gillman's goldenrod	SOLSIM	native	10	3
Sorbus decora	mountain-ash	SORDEC	native	4	3
Symphoricarpos albus var. albus	snowberry	SYMALA	native	5	3
Symphyotrichum ciliolatum	northern heart-leaved aster	SYMCIO	native	4	5
Taxus canadensis	yew	TAXCAN	native	5	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Verbascum thapsus	**common mullein**	**VERTHA**	**non-native**	**0**	**5**
Viola adunca	sand violet	VIOADU	native	4	3
Viola labradorica	dog violet	VIOLAB	native	3	0

Appendix 3.32. Moose Lightning Volcanic Bedrock Glade FQA

Conservatism-Based Metrics:

Total Mean C:	4.5
Native Mean C:	4.7
Total FQI:	34
Native FQI:	34.5
Adjusted FQI:	45.7
% C value 0:	7
% C value 1-3:	24.6
% C value 4-6:	54.4
% C value 7-10:	14
Native Tree Mean C:	2.8
Native Shrub Mean C:	4.3
Native Herbaceous Mean C:	5.2

Species Richness:

Total Species:	57	
Native Species:	54	94.70%
Non-native Species:	3	5.30%

Species Wetness:

Mean Wetness:	2.3
Native Mean Wetness:	2.3

Physiognomy Metrics:

Tree:	6	10.50%
Shrub:	14	24.60%
Vine:	1	1.80%
Forb:	19	33.30%
Grass:	11	19.30%
Sedge:	3	5.30%
Rush:	0	0%
Fern:	3	5.30%
Bryophyte:	0	0%

Duration Metrics:

Annual:	3	5.30%
Perennial:	53	93.00%
Biennial:	1	1.80%
Native Annual:	3	5.30%
Native Perennial:	50	87.70%
Native Biennial:	1	1.80%

Appendix 3.32. Moose Lightning Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Agrostis gigantea	**redtop**	**AGRGIG**	**non-native**	**0**	**-3**
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Amelanchier interior	serviceberry	AMEINT	native	4	5
Amelanchier spicata	shadbush serviceberry	AMESPI	native	4	3
Anaphalis margaritacea	pearly everlasting	ANAMAR	native	3	5
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Athyrium angustum	lady fern	ATHFIL	native	4	0
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Capnoides sempervirens	pink or pale corydalis	CAPSEM	native	5	5
Carex arctata	sedge	CXARTT	native	3	5
Carex bebbii	sedge	CXBEBB	native	4	-5
Carex merritt-fernaldii	sedge	CXMERR	native	4	5
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Clintonia borealis	bluebead-lily; corn-lily	CLIBOR	native	5	0
Cornus canadensis	bunchberry	CORCAA	native	6	0
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Doellingeria umbellata	flat-topped white aster	DOEUMB	native	5	-3
Dryopteris marginalis	marginal woodfern	DRYMAR	native	5	3
Elymus trachycaulus	slender wheatgrass	ELYTRA	native	8	3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Fallopia cilinodis	fringed false buckwheat	FALCIL	native	3	5
Geocaulon lividum	geocaulon	GEOLIV	native	9	0
Hieracium aurantiacum	**orange hawkweed**	**HIEAUR**	**non-native**	**0**	**5**
Hieracium caespitosum	**yellow hawkweed; king devil**	**HIECAE**	**non-native**	**0**	**5**
Hieracium scabrum	rough hawkweed	HIESCA	native	3	5
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Linnaea borealis	twinflower	LINBOR	native	6	0
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Milium effusum	wood millet	MILEFF	native	8	3
Oryzopsis asperifolia	rough-leaved rice-grass	ORYASP	native	6	5
Picea glauca	white spruce	PICGLA	native	3	3
Pinus strobus	white pine	PINSTR	native	3	3
Poa glauca	bluegrass	POAGLA	native	10	5
Poa saltuensis	bluegrass	POASAL	native	5	5
Polygonum douglasii	western smartweed	POLDOU	native	5	3
Polypodium virginianum	common polypody	POLVIR	native	8	5
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Potentilla norvegica	rough cinquefoil	POTNOR	native	0	0
Prosartes trachycarpa	northern fairy-bells	PROTRA	native	10	5
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3
Prunus virginiana	choke cherry	PRUVIR	native	2	3
Ribes glandulosum	skunk currant	RIBGLA	native	5	-3

Appendix 3.32. Moose Lightning Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Rosa acicularis	wild rose	ROSACI	native	4	3
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Sambucus racemosa	red-berried elder	SAMRAC	native	3	3
Schizachne purpurascens	false melic	SCHPUP	native	5	3
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Symphyotrichum ciliolatum	northern heart-leaved aster	SYMCIO	native	4	5
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Vaccinium myrtilloides	Canada blueberry	VACMYR	native	4	-3

Appendix 3.33. Mt. Saginaw Volcanic Bedrock Glade FQA

Conservatism-Based Metrics:

Total Mean C:	4.5
Native Mean C:	4.7
Total FQI:	33.1
Native FQI:	33.9
Adjusted FQI:	46.1
% C value 0:	5.6
% C value 1-3:	27.8
% C value 4-6:	50
% C value 7-10:	16.7
Native Tree Mean C:	2.4
Native Shrub Mean C:	4.9
Native Herbaceous Mean C:	5.1

Physiognomy Metrics:

Tree:	7	13.00%
Shrub:	13	24.10%
Vine:	2	3.70%
Forb:	22	40.70%
Grass:	6	11.10%
Sedge:	0	0.00%
Rush:	0	0%
Fern:	4	7.40%
Bryophyte:	0	0%

Species Richness:

Total Species:	54	
Native Species:	52	96.30%
Non-native Species:	2	3.70%

Duration Metrics:

Annual:	1	1.90%
Perennial:	51	94.40%
Biennial:	2	3.70%
Native Annual:	1	1.90%
Native Perennial:	49	90.70%
Native Biennial:	2	3.70%

Species Wetness:

Mean Wetness:	3
Native Mean Wetness:	2.9

Appendix 3.33. Mt. Saginaw Volcanic Bedrock Glade 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	0
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Amelanchier bartramiana	northern juneberry	AMEBAR	native	8	0
Amelanchier interior	serviceberry	AMEINT	native	4	5
Amelanchier sanguinea	round-leaved serviceberry	AMESAN	native	5	5
Anaphalis margaritacea	pearly everlasting	ANAMAR	native	3	5
Antennaria howellii	small pussytoes	ANTHOW	native	2	5
Apocynum androsaemifolium	spreading dogbane	APOAND	native	3	5
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Campanula rotundifolia	harebell	CAMROT	native	6	3
Capnoides sempervirens	pink or pale corydalis	CAPSEM	native	5	5
Clinopodium vulgare	wild-basil	CLIVUL	native	3	5
Clintonia borealis	bluebead-lily; corn-lily	CLIBOR	native	5	0
Comandra umbellata	bastard-toadflax	COMUMB	native	5	3
Cornus canadensis	bunchberry	CORCAA	native	6	0
Corylus cornuta	beaked hazelnut	CORCOR	native	5	3
Cryptogramma acrostichoides	American rock-brake	CRYACR	native	10	5
Cypripedium arietinum	ram's head lady-slipper	CYPARI	native	10	-3
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Diphasiastrum complanatum	ground-cedar	DIPCOM	native	5	3
Elymus trachycaulus	slender wheatgrass	ELYTRA	native	8	3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Hieracium piloselloides	**yellow hawkweed; king devil**	**HIEPIS**	**non-native**	**0**	**5**
Hieracium scabrum	rough hawkweed	HIESCA	native	3	5
Hieracium umbellatum	northern hawkweed	HIEUMB	native	7	5
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Lactuca canadensis	tall lettuce	LACCAN	native	2	3
Lathyrus ochroleucus	pale vetchling	LATOCH	native	8	5
Lonicera hirsuta	hairy honeysuckle	LONHIR	native	6	0
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Micranthes virginiensis	early saxifrage	MICVIR	native	10	3
Oryzopsis asperifolia	rough-leaved rice-grass	ORYASP	native	6	5
Picea glauca	white spruce	PICGLA	native	3	3
Pinus strobus	white pine	PINSTR	native	3	3
Poa compressa	**Canada bluegrass**	**POACOM**	**non-native**	**0**	**3**
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Prenanthes alba	white lettuce	PREALB	native	5	3
Pteridium aquilinum	bracken fern	PTEAQU	native	0	3
Rosa blanda	wild rose	ROSBLA	native	3	3
Salix humilis	prairie willow	SALHUM	native	4	3

Appendix 3.33. Mt. Saginaw Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Solidago juncea	early goldenrod	SOLJUN	native	3	5
Symphoricarpos albus var. albus	snowberry	SYMALA	native	5	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Vaccinium myrtilloides	Canada blueberry	VACMYR	native	4	-3
Viola adunca	sand violet	VIOADU	native	4	3
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.34. Ojibway Glade Volcanic Bedrock Glade FQA

Conservatism-Based Metrics:

Total Mean C:	4.1
Native Mean C:	4.7
Total FQI:	44.3
Native FQI:	47.7
Adjusted FQI:	44.1
% C value 0:	14.5
% C value 1-3:	25.6
% C value 4-6:	42.7
% C value 7-10:	17.1
Native Tree Mean C:	3.3
Native Shrub Mean C:	5
Native Herbaceous Mean C:	4.8

Physiognomy Metrics:

Tree:	11	9.40%
Shrub:	23	19.70%
Vine:	2	1.70%
Forb:	63	53.80%
Grass:	10	8.50%
Sedge:	2	1.70%
Rush:	0	0%
Fern:	6	5.10%
Bryophyte:	0	0%

Species Richness:

Total Species:	117	
Native Species:	103	88.00%
Non-native Species:	14	12.00%

Duration Metrics:

Annual:	7	6.00%
Perennial:	103	88.00%
Biennial:	7	6.00%
Native Annual:	7	6.00%
Native Perennial:	91	77.80%
Native Biennial:	5	4.30%

Species Wetness:

Mean Wetness:	3.1
Native Mean Wetness:	3

Appendix 3.34. Ojibway Glade Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Alnus viridis	mountain alder	ALNVIR	native	8	0
Amelanchier interior	serviceberry	AMEINT	native	4	5
Amelanchier sanguinea	round-leaved serviceberry	AMESAN	native	5	5
Amelanchier spicata	shadbush serviceberry	AMESPI	native	4	3
Anaphalis margaritacea	pearly everlasting	ANAMAR	native	3	5
Anemone virginiana	thimbleweed	ANEVIR	native	3	3
Antennaria howellii	small pussytoes	ANTHOW	native	2	5
Antennaria parlinii	smooth pussytoes	ANTPAL	native	2	5
Apocynum androsaemifolium	spreading dogbane	APOAND	native	3	5
Aquilegia canadensis	wild columbine	AQUCAN	native	5	3
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Boechera stricta	Drummond rock cress	BOESTR	native	6	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Calystegia spithamaea	low bindweed	CALSPI	native	8	5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Capnoides sempervirens	pink or pale corydalis	CAPSEM	native	5	5
Carex gracillima	sedge	CXGRAA	native	4	3
Carex umbellata	sedge	CXUMBE	native	5	5
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Chimaphila umbellata	pipsissewa	CHIUMB	native	8	5
Clinopodium vulgare	wild-basil	CLIVUL	native	3	5
Clintonia borealis	bluebead-lily; corn-lily	CLIBOR	native	5	0
Collinsia parviflora	blue-lips	COLPAR	native	8	5
Comandra umbellata	bastard-toadflax	COMUMB	native	5	3
Corallorhiza maculata	spotted coral-root	CORMAC	native	5	3
Cornus canadensis	bunchberry	CORCAA	native	6	0
Cornus rugosa	round-leaved dogwood	CORRUG	native	6	5
Corylus cornuta	beaked hazelnut	CORCOR	native	5	3
Crataegus douglasii	black hawthorn	CRADOU	native	7	0
Cryptogramma acrostichoides	American rock-brake	CRYACR	native	10	5
Cynoglossum boreale	northern wild comfrey	CYNBOR	native	7	5
Cypripedium arietinum	ram's head lady-slipper	CYPARI	native	10	-3
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Dichanthelium xanthophysum	panic grass	DICXAN	native	6	5
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Diphasiastrum complanatum	ground-cedar	DIPCOM	native	5	3
Dracocephalum parviflorum	dragonhead	DRAPAR	native	3	3
Drymocallis arguta	tall or prairie cinquefoil	DRYARG	native	8	3
Elymus trachycaulus	slender wheatgrass	ELYTRA	native	8	3
Epipactis helleborine	**helleborine**	**EPIHEL**	**non-native**	**0**	**0**
Erigeron strigosus	daisy fleabane	ERISTR	native	4	3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Fragaria vesca	woodland strawberry	FRAVES	native	2	3
Galium triflorum	fragrant bedstraw	GALTRR	native	4	3

Appendix 3.34. Ojibway Glade Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Geocaulon lividum	geocaulon	GEOLIV	native	9	0
Geranium bicknellii	northern crane's-bill	GERBIC	native	4	5
Geum fragarioides	barren-strawberry	GEUFRA	native	6	5
Halenia deflexa	spurred gentian	HALDEF	native	7	0
Hepatica americana	round-lobed hepatica	HEPAME	native	6	5
Hieracium aurantiacum	**orange hawkweed**	**HIEAUR**	**non-native**	**0**	**5**
Hieracium caespitosum	**yellow hawkweed; king devil**	**HIECAE**	**non-native**	**0**	**5**
Hieracium kalmii	Kalm's hawkweed	HIEKAL	native	3	5
Hieracium piloselloides	**yellow hawkweed; king devil**	**HIEPIS**	**non-native**	**0**	**5**
Hieracium scabrum	rough hawkweed	HIESCA	native	3	5
Hieracium umbellatum	northern hawkweed	HIEUMB	native	7	5
Hypericum perforatum	**common St. John's-wort**	**HYPPER**	**non-native**	**0**	**5**
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Lactuca biennis	tall blue lettuce	LACBIE	native	2	0
Lactuca canadensis	tall lettuce	LACCAN	native	2	3
Leucanthemum vulgare	**ox-eye daisy**	**LEUVUL**	**non-native**	**0**	**5**
Linnaea borealis	twinflower	LINBOR	native	6	0
Lonicera dioica	red honeysuckle	LONDIO	native	5	3
Lonicera hirsuta	hairy honeysuckle	LONHIR	native	6	0
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Micranthes virginiensis	early saxifrage	MICVIR	native	10	3
Oryzopsis asperifolia	rough-leaved rice-grass	ORYASP	native	6	5
Phleum pratense	**Timothy**	**PHLPRA**	**non-native**	**0**	**3**
Picea glauca	white spruce	PICGLA	native	3	3
Pinus banksiana	jack pine	PINBAN	native	5	3
Pinus strobus	white pine	PINSTR	native	3	3
Poa compressa	**Canada bluegrass**	**POACOM**	**non-native**	**0**	**3**
Poa nemoralis	**bluegrass**	**POANEM**	**non-native**	**0**	**3**
Poa saltuensis	bluegrass	POASAL	native	5	5
Polygala paucifolia	gay-wings	POLPAU	native	7	3
Polygonum douglasii	western smartweed	POLDOU	native	5	3
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Potentilla norvegica	rough cinquefoil	POTNOR	native	0	0
Prenanthes alba	white lettuce	PREALB	native	5	3
Prunella vulgaris	self-heal	PRUVUL	native	0	0
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3
Prunus virginiana	choke cherry	PRUVIR	native	2	3
Pteridium aquilinum	bracken fern	PTEAQU	native	0	3
Rhus typhina	staghorn sumac	RHUTYP	native	2	3
Rosa blanda	wild rose	ROSBLA	native	3	3
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Rubus pubescens	dwarf raspberry	RUBPUB	native	4	-3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Rumex acetosella	**sheep sorrel**	**RUMACL**	**non-native**	**0**	**3**
Salix humilis	prairie willow	SALHUM	native	4	3

Appendix 3.34. Ojibway Glade Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Sceptridium multifidum	leather grape-fern	SCEMUL	native	5	3
Selaginella rupestris	sand club moss	SELRUP	native	8	5
Shepherdia canadensis	soapberry	SHECAN	native	7	5
Silene antirrhina	sleepy catchfly	SILANT	native	2	5
Solidago hispida	hairy goldenrod	SOLHIS	native	3	5
Solidago juncea	early goldenrod	SOLJUN	native	3	5
Solidago nemoralis	old-field goldenrod	SOLNEM	native	2	5
Sorbus decora	mountain-ash	SORDEC	native	4	3
Streptopus lanceolatus	rose twisted-stalk	STRLAN	native	5	3
Symphoricarpos albus var. albus	snowberry	SYMALA	native	5	3
Symphyotrichum ciliolatum	northern heart-leaved aster	SYMCIO	native	4	5
Taxus canadensis	yew	TAXCAN	native	5	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Tragopogon pratensis	**common goat's beard**	**TRAPRA**	**non-native**	**0**	**5**
Trifolium pratense	**red clover**	**TRIPRA**	**non-native**	**0**	**3**
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Verbascum thapsus	**common mullein**	**VERTHA**	**non-native**	**0**	**5**
Veronica officinalis	**common speedwell**	**VEROOF**	**non-native**	**0**	**3**
Viola adunca	sand violet	VIOADU	native	4	3
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.34. Ojibway Glade Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Sceptridium multifidum	leather grape-fern	SCEMUL	native	5	3
Selaginella rupestris	sand club moss	SELRUP	native	8	5
Shepherdia canadensis	soapberry	SHECAN	native	7	5
Silene antirrhina	sleepy catchfly	SILANT	native	2	5
Solidago hispida	hairy goldenrod	SOLHIS	native	3	5
Solidago juncea	early goldenrod	SOLJUN	native	3	5
Solidago nemoralis	old-field goldenrod	SOLNEM	native	2	5
Sorbus decora	mountain-ash	SORDEC	native	4	3
Streptopus lanceolatus	rose twisted-stalk	STRLAN	native	5	3
Symphoricarpos albus var. albus	snowberry	SYMALA	native	5	3
Symphyotrichum ciliolatum	northern heart-leaved aster	SYMCIO	native	4	5
Taxus canadensis	yew	TAXCAN	native	5	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Tragopogon pratensis	**common goat's beard**	**TRAPRA**	**non-native**	**0**	**5**
Trifolium pratense	**red clover**	**TRIPRA**	**non-native**	**0**	**3**
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Verbascum thapsus	**common mullein**	**VERTHA**	**non-native**	**0**	**5**
Veronica officinalis	**common speedwell**	**VEROOF**	**non-native**	**0**	**3**
Viola adunca	sand violet	VIOADU	native	4	3
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.35. Scoville Point Volcanic Bedrock Glade FQA

Conservatism-Based Metrics:

Total Mean C:	4.6
Native Mean C:	5.1
Total FQI:	36.2
Native FQI:	38.2
Adjusted FQI:	48.5
% C value 0:	14.5
% C value 1-3:	21
% C value 4-6:	41.9
% C value 7-10:	22.6
Native Tree Mean C:	2.6
Native Shrub Mean C:	5.2
Native Herbaceous Mean C:	5.3

Species Richness:

Total Species:	62	
Native Species:	56	90.30%
Non-native Species:	6	9.70%

Species Wetness:

Mean Wetness:	2.8
Native Mean Wetness:	2.8

Physiognomy Metrics:

Tree:	5	8.10%
Shrub:	12	19.40%
Vine:	2	3.20%
Forb:	23	37.10%
Grass:	13	21.00%
Sedge:	1	1.60%
Rush:	1	2%
Fern:	5	8.10%
Bryophyte:	0	0%

Duration Metrics:

Annual:	4	6.50%
Perennial:	57	91.90%
Biennial:	1	1.60%
Native Annual:	4	6.50%
Native Perennial:	51	82.30%
Native Biennial:	1	1.60%

Appendix 3.35. Scoville Point Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Achillea millefolium	yarrow	ACHMIL	native	1	3
Agrostis gigantea	**redtop**	**AGRGIG**	**non-native**	**0**	**-3**
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Alnus viridis	mountain alder	ALNVIR	native	8	0
Amelanchier sanguinea	round-leaved serviceberry	AMESAN	native	5	5
Amelanchier spicata	shadbush serviceberry	AMESPI	native	4	3
Anaphalis margaritacea	pearly everlasting	ANAMAR	native	3	5
Antennaria howellii	small pussytoes	ANTHOW	native	2	5
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Capnoides sempervirens	pink or pale corydalis	CAPSEM	native	5	5
Carex umbellata	sedge	CXUMBE	native	5	5
Castilleja septentrionalis	northern paintbrush	CASSEP	native	10	0
Clematis occidentalis	purple clematis	CLEOCC	native	9	5
Clintonia borealis	bluebead-lily; corn-lily	CLIBOR	native	5	0
Conyza canadensis	horseweed	CONCAN	native	0	3
Cornus canadensis	bunchberry	CORCAA	native	6	0
Cryptogramma acrostichoides	American rock-brake	CRYACR	native	10	5
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Elymus trachycaulus	slender wheatgrass	ELYTRA	native	8	3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Festuca occidentalis	western fescue	FESOCC	native	6	5
Festuca saximontana	fescue	FESSAX	native	6	5
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Geranium bicknellii	northern crane's-bill	GERBIC	native	4	5
Hieracium aurantiacum	**orange hawkweed**	**HIEAUR**	**non-native**	**0**	**5**
Hieracium caespitosum	**yellow hawkweed; king devil**	**HIECAE**	**non-native**	**0**	**5**
Hieracium kalmii	Kalm's hawkweed	HIEKAL	native	3	5
Juncus tenuis	path rush	JUNTEN	native	1	0
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Linnaea borealis	twinflower	LINBOR	native	6	0
Lonicera hirsuta	hairy honeysuckle	LONHIR	native	6	0
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Micranthes virginiensis	early saxifrage	MICVIR	native	10	3
Oryzopsis asperifolia	rough-leaved rice-grass	ORYASP	native	6	5
Phleum pratense	**Timothy**	**PHLPRA**	**non-native**	**0**	**3**
Picea glauca	white spruce	PICGLA	native	3	3
Piptatherum pungens	rice-grass	PIPPUN	native	9	5
Poa compressa	**Canada bluegrass**	**POACOM**	**non-native**	**0**	**3**

Appendix 3.35. Scoville Point Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Polypodium virginianum	common polypody	POLVIR	native	8	5
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Potentilla norvegica	rough cinquefoil	POTNOR	native	0	0
Pteridium aquilinum	bracken fern	PTEAQU	native	0	3
Rosa acicularis	wild rose	ROSACI	native	4	3
Salix bebbiana	Bebb's willow	SALBEB	native	1	-3
Salix humilis	prairie willow	SALHUM	native	4	3
Selaginella rupestris	sand club moss	SELRUP	native	8	5
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Solidago juncea	early goldenrod	SOLJUN	native	3	5
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trifolium pratense	**red clover**	**TRIPRA**	**non-native**	**0**	**3**
Trisetum spicatum	downy oatgrass	TRISPI	native	10	0
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.36. Siskiwit Lake Volcanic Bedrock Glade FQA

Conservatism-Based Metrics:

Total Mean C:	4.1
Native Mean C:	4.6
Total FQI:	42
Native FQI:	44.8
Adjusted FQI:	43.8
% C value 0:	11.4
% C value 1-3:	29.5
% C value 4-6:	41.9
% C value 7-10:	17.1
Native Tree Mean C:	3.6
Native Shrub Mean C:	4.6
Native Herbaceous Mean C:	4.8

Species Richness:

Total Species:	105	
Native Species:	95	90.50%
Non-native Species:	10	9.50%

Species Wetness:

Mean Wetness:	2.4
Native Mean Wetness:	2.3

Physiognomy Metrics:

Tree:	13	12.40%
Shrub:	18	17.10%
Vine:	1	1.00%
Forb:	50	47.60%
Grass:	14	13.30%
Sedge:	5	4.80%
Rush:	0	0%
Fern:	4	3.80%
Bryophyte:	0	0%

Duration Metrics:

Annual:	5	4.80%
Perennial:	93	88.60%
Biennial:	7	6.70%
Native Annual:	4	3.80%
Native Perennial:	86	81.90%
Native Biennial:	5	4.80%

Appendix 3.36. Siskiwit Lake Volcanic Bedrock Glade 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	0
Acer saccharum	sugar maple	ACESAU	native	5	3
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Amelanchier interior	serviceberry	AMEINT	native	4	5
Amelanchier sanguinea	round-leaved serviceberry	AMESAN	native	5	5
Anaphalis margaritacea	pearly everlasting	ANAMAR	native	3	5
Anemone virginiana	thimbleweed	ANEVIR	native	3	3
Antennaria howellii	small pussytoes	ANTHOW	native	2	5
Antennaria parlinii	smooth pussytoes	ANTPAL	native	2	5
Apocynum androsaemifolium	spreading dogbane	APOAND	native	3	5
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Boechera grahamii	rock cress	BOEGRA	native	6	3
Bromus ciliatus	fringed brome	BROCIL	native	6	-3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Calystegia spithamaea	low bindweed	CALSPI	native	8	5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Capnoides sempervirens	pink or pale corydalis	CAPSEM	native	5	5
Carex arctata	sedge	CXARTT	native	3	5
Carex brunnescens	sedge	CXBRUN	native	5	-3
Carex intumescens	sedge	CXINTU	native	3	-3
Carex projecta	sedge	CXPROJ	native	3	-3
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Chimaphila umbellata	pipsissewa	CHIUMB	native	8	5
Clinopodium vulgare	wild-basil	CLIVUL	native	3	5
Clintonia borealis	bluebead-lily; corn-lily	CLIBOR	native	5	0
Corallorhiza striata	striped coral-root	CORSTR	native	6	3
Cornus canadensis	bunchberry	CORCAA	native	6	0
Corylus cornuta	beaked hazelnut	CORCOR	native	5	3
Crataegus douglasii	black hawthorn	CRADOU	native	7	0
Cynoglossum boreale	northern wild comfrey	CYNBOR	native	7	5
Cypripedium arietinum	ram's head lady-slipper	CYPARI	native	10	-3
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Deschampsia cespitosa	hair grass	DESCES	native	9	-3
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Doellingeria umbellata	flat-topped white aster	DOEUMB	native	5	-3
Elymus trachycaulus	slender wheatgrass	ELYTRA	native	8	3
Erigeron strigosus	daisy fleabane	ERISTR	native	4	3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Festuca occidentalis	western fescue	FESOCC	native	6	5
Fragaria vesca	woodland strawberry	FRAVES	native	2	3
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Galium triflorum	fragrant bedstraw	GALTRR	native	4	3
Geranium bicknellii	northern crane's-bill	GERBIC	native	4	5

Appendix 3.36. Siskiwit Lake Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Goodyera repens	creeping rattlesnake plantain	GOOREP	native	9	0
Hieracium aurantiacum	**orange hawkweed**	**HIEAUR**	**non-native**	**0**	**5**
Hieracium caespitosum	**yellow hawkweed; king devil**	**HIECAE**	**non-native**	**0**	**5**
Hieracium kalmii	Kalm's hawkweed	HIEKAL	native	3	5
Hieracium umbellatum	northern hawkweed	HIEUMB	native	7	5
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Lactuca biennis	tall blue lettuce	LACBIE	native	2	0
Lactuca canadensis	tall lettuce	LACCAN	native	2	3
Linnaea borealis	twinflower	LINBOR	native	6	0
Lonicera hirsuta	hairy honeysuckle	LONHIR	native	6	0
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Malaxis unifolia	green adder's-mouth	MALUNI	native	8	0
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Milium effusum	wood millet	MILEFF	native	8	3
Oryzopsis asperifolia	rough-leaved rice-grass	ORYASP	native	6	5
Physocarpus opulifolius	ninebark	PHYOPU	native	4	-3
Picea glauca	white spruce	PICGLA	native	3	3
Pinus resinosa	red pine	PINRES	native	6	3
Pinus strobus	white pine	PINSTR	native	3	3
Poa compressa	**Canada bluegrass**	**POACOM**	**non-native**	**0**	**3**
Poa nemoralis	**bluegrass**	**POANEM**	**non-native**	**0**	**3**
Poa pratensis	**Kentucky bluegrass**	**POAPRA**	**non-native**	**0**	**3**
Polygala paucifolia	gay-wings	POLPAU	native	7	3
Polygonum douglasii	western smartweed	POLDOU	native	5	3
Polypodium virginianum	common polypody	POLVIR	native	8	5
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Prunella vulgaris	self-heal	PRUVUL	native	0	0
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3
Prunus virginiana	choke cherry	PRUVIR	native	2	3
Pseudognaphalium macounii	clammy cudweed	PSEMAC	native	2	5
Pteridium aquilinum	bracken fern	PTEAQU	native	0	3
Quercus rubra	red oak	QUERUB	native	5	3
Rhus typhina	staghorn sumac	RHUTYP	native	2	3
Rosa acicularis	wild rose	ROSACI	native	4	3
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Rumex acetosella	**sheep sorrel**	**RUMACL**	**non-native**	**0**	**3**
Salix humilis	prairie willow	SALHUM	native	4	3
Schizachne purpurascens	false melic	SCHPUP	native	5	3
Scirpus atrocinctus	wool-grass	SCIATC	native	5	-5
Selaginella rupestris	sand club moss	SELRUP	native	8	5
Shepherdia canadensis	soapberry	SHECAN	native	7	5
Silene antirrhina	sleepy catchfly	SILANT	native	2	5
Solidago altissima	tall goldenrod	SOLALT	native	1	3
Solidago juncea	early goldenrod	SOLJUN	native	3	5
Sorbus decora	mountain-ash	SORDEC	native	4	3
Spiranthes lacera	slender ladies'-tresses	SPILAC	native	8	0

Appendix 3.36. Siskiwit Lake Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Symphyotrichum ciliolatum	northern heart-leaved aster	SYMCIO	native	4	5
Symphyotrichum lateriflorum	calico aster	SYMLAT	native	2	0
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Tragopogon pratensis	**common goat's beard**	**TRAPRA**	**non-native**	**0**	**5**
Trientalis borealis	star-flower	TRIBOR	native	5	0
Trifolium aureum	**hop clover**	**TRIAUM**	**non-native**	**0**	**5**
Trifolium pratense	**red clover**	**TRIPRA**	**non-native**	**0**	**3**
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Vaccinium myrtilloides	Canada blueberry	VACMYR	native	4	-3
Verbascum thapsus	**common mullein**	**VERTHA**	**non-native**	**0**	**5**
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.37. Siskiwit Mine Volcanic Bedrock Glade FQA

Conservatism-Based Metrics:

Total Mean C:	4
Native Mean C:	4.6
Total FQI:	34.2
Native FQI:	36.8
Adjusted FQI:	43.1
% C value 0:	13.7
% C value 1-3:	24.7
% C value 4-6:	46.6
% C value 7-10:	15.1
Native Tree Mean C:	3.2
Native Shrub Mean C:	4.5
Native Herbaceous Mean C:	5

Species Richness:

Total Species:	73	
Native Species:	64	87.70%
Non-native Species:	9	12.30%

Species Wetness:

Mean Wetness:	3.2
Native Mean Wetness:	3.1

Physiognomy Metrics:

Tree:	10	13.70%
Shrub:	15	20.50%
Vine:	1	1.40%
Forb:	32	43.80%
Grass:	8	11.00%
Sedge:	1	1.40%
Rush:	0	0%
Fern:	6	8.20%
Bryophyte:	0	0%

Duration Metrics:

Annual:	4	5.50%
Perennial:	64	87.70%
Biennial:	5	6.80%
Native Annual:	4	5.50%
Native Perennial:	57	78.10%
Native Biennial:	3	4.10%

Appendix 3.37. Siskiwit Mine Volcanic Bedrock Glade 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	0
Achillea millefolium	yarrow	ACHMIL	native	1	3
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Amelanchier interior	serviceberry	AMEINT	native	4	5
Amelanchier spicata	shadbush serviceberry	AMESPI	native	4	3
Anaphalis margaritacea	pearly everlasting	ANAMAR	native	3	5
Antennaria parlinii	smooth pussytoes	ANTPAL	native	2	5
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula alleghaniensis	yellow birch	BETALL	native	7	0
Betula papyrifera	paper birch	BETPAP	native	2	3
Boechera stricta	Drummond rock cress	BOESTR	native	6	3
Campanula rotundifolia	harebell	CAMROT	native	6	3
Capnoides sempervirens	pink or pale corydalis	CAPSEM	native	5	5
Carex umbellata	sedge	CXUMBE	native	5	5
Clinopodium vulgare	wild-basil	CLIVUL	native	3	5
Comandra umbellata	bastard-toadflax	COMUMB	native	5	3
Cornus canadensis	bunchberry	CORCAA	native	6	0
Cryptogramma acrostichoides	American rock-brake	CRYACR	native	10	5
Cystopteris fragilis	fragile fern	CYSFRA	native	4	3
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Elymus trachycaulus	slender wheatgrass	ELYTRA	native	8	3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Geranium bicknellii	northern crane's-bill	GERBIC	native	4	5
Hieracium aurantiacum	**orange hawkweed**	**HIEAUR**	**non-native**	**0**	**5**
Hieracium caespitosum	**yellow hawkweed; king devil**	**HIECAE**	**non-native**	**0**	**5**
Hieracium kalmii	Kalm's hawkweed	HIEKAL	native	3	5
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Lactuca canadensis	tall lettuce	LACCAN	native	2	3
Leucanthemum vulgare	**ox-eye daisy**	**LEUVUL**	**non-native**	**0**	**5**
Lonicera hirsuta	hairy honeysuckle	LONHIR	native	6	0
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Micranthes virginiensis	early saxifrage	MICVIR	native	10	3
Oryzopsis asperifolia	rough-leaved rice-grass	ORYASP	native	6	5
Phleum pratense	Timothy	PHLPRA	non-native	0	3
Picea glauca	white spruce	PICGLA	native	3	3
Poa compressa	**Canada bluegrass**	**POACOM**	**non-native**	**0**	**3**
Poa saltuensis	bluegrass	POASAL	native	5	5
Polygonum douglasii	western smartweed	POLDOU	native	5	3
Polypodium virginianum	common polypody	POLVIR	native	8	5
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3

Appendix 3.37. Siskiwit Mine Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Prunus virginiana	choke cherry	PRUVIR	native	2	3
Pteridium aquilinum	bracken fern	PTEAQU	native	0	3
Rosa acicularis	wild rose	ROSACI	native	4	3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Rumex acetosella	**sheep sorrel**	**RUMACL**	**non-native**	**0**	**3**
Salix humilis	prairie willow	SALHUM	native	4	3
Selaginella rupestris	sand club moss	SELRUP	native	8	5
Shepherdia canadensis	soapberry	SHECAN	native	7	5
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Silene antirrhina	sleepy catchfly	SILANT	native	2	5
Solidago juncea	early goldenrod	SOLJUN	native	3	5
Solidago nemoralis	old-field goldenrod	SOLNEM	native	2	5
Solidago simplex	Gillman's goldenrod	SOLSIM	native	10	3
Sorbus americana	American mountain-ash	SORAME	native	4	0
Sorbus decora	mountain-ash	SORDEC	native	4	3
Symphoricarpos albus var. albus	snowberry	SYMALA	native	5	3
Taxus canadensis	yew	TAXCAN	native	5	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Tragopogon pratensis	**common goat's beard**	**TRAPRA**	**non-native**	**0**	**5**
Trientalis borealis	star-flower	TRIBOR	native	5	0
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Vaccinium myrtilloides	Canada blueberry	VACMYR	native	4	-3
Verbascum thapsus	**common mullein**	**VERTHA**	**non-native**	**0**	**5**
Veronica officinalis	**common speedwell**	**VEROOF**	**non-native**	**0**	**3**
Viola adunca	sand violet	VIOADU	native	4	3
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.38. Stone's Point Volcanic Bedrock Glade FQA

Conservatism-Based Metrics:

Total Mean C:	5.8
Native Mean C:	5.9
Total FQI:	45.7
Native FQI:	46.1
Adjusted FQI:	58.5
% C value 0:	3.2
% C value 1-3:	17.7
% C value 4-6:	41.9
% C value 7-10:	37.1
Native Tree Mean C:	3.2
Native Shrub Mean C:	6.5
Native Herbaceous Mean C:	6.1

Species Richness:

Total Species:	62	
Native Species:	61	98.40%
Non-native Species:	1	1.60%

Species Wetness:

Mean Wetness:	2.3
Native Mean Wetness:	2.3

Physiognomy Metrics:

Tree:	6	9.70%
Shrub:	17	27.40%
Vine:	1	1.60%
Forb:	24	38.70%
Grass:	10	16.10%
Sedge:	0	0.00%
Rush:	0	0%
Fern:	4	6.50%
Bryophyte:	0	0%

Duration Metrics:

Annual:	3	4.80%
Perennial:	58	93.50%
Biennial:	1	1.60%
Native Annual:	3	4.80%
Native Perennial:	57	91.90%
Native Biennial:	1	1.60%

Appendix 3.38. Stone's Point Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Achillea millefolium	yarrow	ACHMIL	native	1	3
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Amelanchier bartramiana	northern juneberry	AMEBAR	native	8	0
Amelanchier sanguinea	round-leaved serviceberry	AMESAN	native	5	5
Amelanchier spicata	shadbush serviceberry	AMESPI	native	4	3
Antennaria howellii	small pussytoes	ANTHOW	native	2	5
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Capnoides sempervirens	pink or pale corydalis	CAPSEM	native	5	5
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Clintonia borealis	bluebead-lily; corn-lily	CLIBOR	native	5	0
Conyza canadensis	horseweed	CONCAN	native	0	3
Cornus canadensis	bunchberry	CORCAA	native	6	0
Cryptogramma acrostichoides	American rock-brake	CRYACR	native	10	5
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Dasiphora fruticosa	shrubby cinquefoil	DASFRU	native	8	-3
Deschampsia cespitosa	hair grass	DESCES	native	9	-3
Elymus trachycaulus	slender wheatgrass	ELYTRA	native	8	3
Festuca saximontana	fescue	FESSAX	native	6	5
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Geocaulon lividum	geocaulon	GEOLIV	native	9	0
Geranium bicknellii	northern crane's-bill	GERBIC	native	4	5
Hieracium aurantiacum	**orange hawkweed**	**HIEAUR**	**non-native**	**0**	**5**
Hieracium kalmii	Kalm's hawkweed	HIEKAL	native	3	5
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Lilium philadelphicum	wood lily	LILPHI	native	7	0
Linnaea borealis	twinflower	LINBOR	native	6	0
Lonicera hirsuta	hairy honeysuckle	LONHIR	native	6	0
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Micranthes virginiensis	early saxifrage	MICVIR	native	10	3
Oryzopsis asperifolia	rough-leaved rice-grass	ORYASP	native	6	5
Picea glauca	white spruce	PICGLA	native	3	3
Poa alpina	Alpine bluegrass	POAALP	native	10	3
Poa interior	bluegrass	POAINT	native	10	0
Polypodium virginianum	common polypody	POLVIR	native	8	5
Potentilla litoralis	prairie cinquefoil	POTLIT	native	9	3
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3
Ribes oxyacanthoides	northern gooseberry	RIBOXY	native	9	3
Rosa acicularis	wild rose	ROSACI	native	4	3
Salix humilis	prairie willow	SALHUM	native	4	3

Appendix 3.38. Stone's Point Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Saxifraga tricuspidata	prickly saxifrage	SAXTRI	native	10	5
Selaginella rupestris	sand club moss	SELRUP	native	8	5
Shepherdia canadensis	soapberry	SHECAN	native	7	5
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Solidago juncea	early goldenrod	SOLJUN	native	3	5
Solidago simplex	Gillman's goldenrod	SOLSIM	native	10	3
Sorbus americana	American mountain-ash	SORAME	native	4	0
Taxus canadensis	yew	TAXCAN	native	5	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Vaccinium myrtilloides	Canada blueberry	VACMYR	native	4	-3
Vaccinium uliginosum	Alpine bilberry	VACULI	native	10	0
Viburnum edule	squashberry	VIBEDU	native	10	-3
Viola adunca	sand violet	VIOADU	native	4	3
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.39. Sumner Lake Volcanic Bedrock Glade FQA

Conservatism-Based Metrics:

Total Mean C:	4.8
Native Mean C:	4.9
Total FQI:	34.6
Native FQI:	34.6
Adjusted FQI:	48
% C value 0:	3.8
% C value 1-3:	25
% C value 4-6:	51.9
% C value 7-10:	19.2
Native Tree Mean C:	3.1
Native Shrub Mean C:	5.4
Native Herbaceous Mean C:	5.3

Species Richness:

Total Species:	52	
Native Species:	50	96.20%
Non-native Species:	2	3.80%

Species Wetness:

Mean Wetness:	3
Native Mean Wetness:	2.9

Physiognomy Metrics:

Tree:	9	17.30%
Shrub:	12	23.10%
Vine:	1	1.90%
Forb:	22	42.30%
Grass:	8	15.40%
Sedge:	0	0.00%
Rush:	0	0%
Fern:	0	0.00%
Bryophyte:	0	0%

Duration Metrics:

Annual:	2	3.80%
Perennial:	48	92.30%
Biennial:	2	3.80%
Native Annual:	2	3.80%
Native Perennial:	46	88.50%
Native Biennial:	2	3.80%

Appendix 3.39. Sumner Lake Volcanic Bedrock Glade 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	0
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Amelanchier sanguinea	round-leaved serviceberry	AMESAN	native	5	5
Amelanchier spicata	shadbush serviceberry	AMESPI	native	4	3
Anaphalis margaritacea	pearly everlasting	ANAMAR	native	3	5
Apocynum androsaemifolium	spreading dogbane	APOAND	native	3	5
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Boechera stricta	Drummond rock cress	BOESTR	native	6	3
Campanula rotundifolia	harebell	CAMROT	native	6	3
Capnoides sempervirens	pink or pale corydalis	CAPSEM	native	5	5
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Clinopodium vulgare	wild-basil	CLIVUL	native	3	5
Comandra umbellata	bastard-toadflax	COMUMB	native	5	3
Cornus canadensis	bunchberry	CORCAA	native	6	0
Cynoglossum boreale	northern wild comfrey	CYNBOR	native	7	5
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Elymus trachycaulus	slender wheatgrass	ELYTRA	native	8	3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Geocaulon lividum	geocaulon	GEOLIV	native	9	0
Hieracium piloselloides	**yellow hawkweed; king devil**	**HIEPIS**	**non-native**	**0**	**5**
Hieracium umbellatum	northern hawkweed	HIEUMB	native	7	5
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Lilium philadelphicum	wood lily	LILPHI	native	7	0
Lonicera hirsuta	hairy honeysuckle	LONHIR	native	6	0
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Oryzopsis asperifolia	rough-leaved rice-grass	ORYASP	native	6	5
Picea glauca	white spruce	PICGLA	native	3	3
Pinus banksiana	jack pine	PINBAN	native	5	3
Pinus resinosa	red pine	PINRES	native	6	3
Pinus strobus	white pine	PINSTR	native	3	3
Piptatherum pungens	rice-grass	PIPPUN	native	9	5
Platanthera hookeri	Hooker's orchid	PLAHOO	native	8	0
Poa compressa	**Canada bluegrass**	**POACOM**	**non-native**	**0**	**3**
Polygonum douglasii	western smartweed	POLDOU	native	5	3
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Prenanthes alba	white lettuce	PREALB	native	5	3
Rosa blanda	wild rose	ROSBLA	native	3	3
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Salix humilis	prairie willow	SALHUM	native	4	3

Appendix 3.39. Sumner Lake Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Schizachne purpurascens	false melic	SCHPUP	native	5	3
Shepherdia canadensis	soapberry	SHECAN	native	7	5
Solidago hispida	hairy goldenrod	SOLHIS	native	3	5
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3

Appendix 3.40. Three Mile Volcanic Bedrock Glade FQA

Conservatism-Based Metrics:

Total Mean C:	4.6
Native Mean C:	5
Total FQI:	42.9
Native FQI:	44.7
Adjusted FQI:	47.9
% C value 0:	12.6
% C value 1-3:	24.1
% C value 4-6:	39.1
% C value 7-10:	24.1
Native Tree Mean C:	3.1
Native Shrub Mean C:	5.6
Native Herbaceous Mean C:	5.1

Species Richness:

Total Species:	87	
Native Species:	80	92.00%
Non-native Species:	7	8.00%

Species Wetness:

Mean Wetness:	2.6
Native Mean Wetness:	2.6

Physiognomy Metrics:

Tree:	9	10.30%
Shrub:	15	17.20%
Vine:	1	1.10%
Forb:	40	46.00%
Grass:	15	17.20%
Sedge:	2	2.30%
Rush:	1	1%
Fern:	4	4.60%
Bryophyte:	0	0%

Duration Metrics:

Annual:	5	5.70%
Perennial:	78	89.70%
Biennial:	4	4.60%
Native Annual:	5	5.70%
Native Perennial:	72	82.80%
Native Biennial:	3	3.40%

Appendix 3.40. Three Mile Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Achillea millefolium	yarrow	ACHMIL	native	1	3
Agrostis gigantea	**redtop**	**AGRGIG**	**non-native**	**0**	**-3**
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Alnus viridis	mountain alder	ALNVIR	native	8	0
Amelanchier sanguinea	round-leaved serviceberry	AMESAN	native	5	5
Amelanchier spicata	shadbush serviceberry	AMESPI	native	4	3
Anaphalis margaritacea	pearly everlasting	ANAMAR	native	3	5
Antennaria howellii	small pussytoes	ANTHOW	native	2	5
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Boechera grahamii	rock cress	BOEGRA	native	6	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Capnoides sempervirens	pink or pale corydalis	CAPSEM	native	5	5
Carex merritt-fernaldii	sedge	CXMERR	native	4	5
Carex umbellata	sedge	CXUMBE	native	5	5
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Clinopodium vulgare	wild-basil	CLIVUL	native	3	5
Comandra umbellata	bastard-toadflax	COMUMB	native	5	3
Conyza canadensis	horseweed	CONCAN	native	0	3
Cryptogramma acrostichoides	American rock-brake	CRYACR	native	10	5
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Deschampsia cespitosa	hair grass	DESCES	native	9	-3
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Drymocallis arguta	tall or prairie cinquefoil	DRYARG	native	8	3
Elymus trachycaulus	slender wheatgrass	ELYTRA	native	8	3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Festuca occidentalis	western fescue	FESOCC	native	6	5
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Geocaulon lividum	geocaulon	GEOLIV	native	9	0
Geranium bicknellii	northern crane's-bill	GERBIC	native	4	5
Geum fragarioides	barren-strawberry	GEUFRA	native	6	5
Hieracium caespitosum	**yellow hawkweed; king devil**	**HIECAE**	**non-native**	**0**	**5**
Hieracium kalmii	Kalm's hawkweed	HIEKAL	native	3	5
Hieracium umbellatum	northern hawkweed	HIEUMB	native	7	5
Juncus tenuis	path rush	JUNTEN	native	1	0
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Lactuca canadensis	tall lettuce	LACCAN	native	2	3
Lilium philadelphicum	wood lily	LILPHI	native	7	0
Lonicera hirsuta	hairy honeysuckle	LONHIR	native	6	0
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Micranthes virginiensis	early saxifrage	MICVIR	native	10	3

Appendix 3.40. Three Mile Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Oryzopsis asperifolia	rough-leaved rice-grass	ORYASP	native	6	5
Phleum pratense	**Timothy**	**PHLPRA**	**non-native**	**0**	**3**
Picea glauca	white spruce	PICGLA	native	3	3
Pinus banksiana	jack pine	PINBAN	native	5	3
Pinus strobus	white pine	PINSTR	native	3	3
Poa compressa	**Canada bluegrass**	**POACOM**	**non-native**	**0**	**3**
Poa glauca	bluegrass	POAGLA	native	10	5
Poa interior	bluegrass	POAINT	native	10	0
Poa pratensis	**Kentucky bluegrass**	**POAPRA**	**non-native**	**0**	**3**
Polygonum douglasii	western smartweed	POLDOU	native	5	3
Polypodium virginianum	common polypody	POLVIR	native	8	5
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Potentilla norvegica	rough cinquefoil	POTNOR	native	0	0
Prenanthes racemosa	glaucous white lettuce	PRERAC	native	8	-3
Prunella vulgaris	self-heal	PRUVUL	native	0	0
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3
Pteridium aquilinum	bracken fern	PTEAQU	native	0	3
Rosa acicularis	wild rose	ROSACI	native	4	3
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Salix humilis	prairie willow	SALHUM	native	4	3
Schizachne purpurascens	false melic	SCHPUP	native	5	3
Selaginella rupestris	sand club moss	SELRUP	native	8	5
Shepherdia canadensis	soapberry	SHECAN	native	7	5
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Solidago hispida	hairy goldenrod	SOLHIS	native	3	5
Solidago juncea	early goldenrod	SOLJUN	native	3	5
Solidago nemoralis	old-field goldenrod	SOLNEM	native	2	5
Solidago simplex	Gillman's goldenrod	SOLSIM	native	10	3
Sorbus decora	mountain-ash	SORDEC	native	4	3
Spiranthes romanzoffiana	hooded ladies'-tresses	SPIROM	native	8	-5
Symphyotrichum ciliolatum	northern heart-leaved aster	SYMCIO	native	4	5
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Tragopogon pratensis	**common goat's beard**	**TRAPRA**	**non-native**	**0**	**5**
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Vaccinium myrtilloides	Canada blueberry	VACMYR	native	4	-3
Veronica officinalis	**common speedwell**	**VEROOF**	**non-native**	**0**	**3**
Viburnum edule	squashberry	VIBEDU	native	10	-3
Viola adunca	sand violet	VIOADU	native	4	3
Viola labradorica	dog violet	VIOLAB	native	3	0

Appendix 3.41. Tobin Creek Volcanic Bedrock Glade FQA

Conservatism-Based Metrics:

Total Mean C:	4.2
Native Mean C:	4.6
Total FQI:	40.3
Native FQI:	41.9
Adjusted FQI:	43.7
% C value 0:	12
% C value 1-3:	30.4
% C value 4-6:	41.3
% C value 7-10:	16.3
Native Tree Mean C:	2.5
Native Shrub Mean C:	4.8
Native Herbaceous Mean C:	4.8

Species Richness:

Total Species:	92	
Native Species:	83	90.20%
Non-native Species:	9	9.80%

Species Wetness:

Mean Wetness:	3.3
Native Mean Wetness:	3.2

Physiognomy Metrics:

Tree:	8	8.70%
Shrub:	21	22.80%
Vine:	2	2.20%
Forb:	47	51.10%
Grass:	8	8.70%
Sedge:	2	2.20%
Rush:	0	0%
Fern:	4	4.30%
Bryophyte:	0	0%

Duration Metrics:

Annual:	5	5.40%
Perennial:	80	87.00%
Biennial:	7	7.60%
Native Annual:	5	5.40%
Native Perennial:	73	79.30%
Native Biennial:	5	5.40%

Appendix 3.41. Tobin Creek Volcanic Bedrock Glade 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	0
Achillea millefolium	yarrow	ACHMIL	native	1	3
Amelanchier interior	serviceberry	AMEINT	native	4	5
Amelanchier sanguinea	round-leaved serviceberry	AMESAN	native	5	5
Amelanchier spicata	shadbush serviceberry	AMESPI	native	4	3
Anaphalis margaritacea	pearly everlasting	ANAMAR	native	3	5
Antennaria howellii	small pussytoes	ANTHOW	native	2	5
Antennaria parlinii	smooth pussytoes	ANTPAL	native	2	5
Apocynum androsaemifolium	spreading dogbane	APOAND	native	3	5
Aquilegia canadensis	wild columbine	AQUCAN	native	5	3
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Boechera stricta	Drummond rock cress	BOESTR	native	6	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Calystegia spithamaea	low bindweed	CALSPI	native	8	5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Capnoides sempervirens	pink or pale corydalis	CAPSEM	native	5	5
Carex gracillima	sedge	CXGRAA	native	4	3
Carex umbellata	sedge	CXUMBE	native	5	5
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Clinopodium vulgare	wild-basil	CLIVUL	native	3	5
Collinsia parviflora	blue-lips	COLPAR	native	8	5
Comandra umbellata	bastard-toadflax	COMUMB	native	5	3
Cornus canadensis	bunchberry	CORCAA	native	6	0
Cornus rugosa	round-leaved dogwood	CORRUG	native	6	5
Corylus cornuta	beaked hazelnut	CORCOR	native	5	3
Cryptogramma acrostichoides	American rock-brake	CRYACR	native	10	5
Cynoglossum boreale	northern wild comfrey	CYNBOR	native	7	5
Cypripedium arietinum	ram's head lady-slipper	CYPARI	native	10	-3
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Dichanthelium xanthophysum	panic grass	DICXAN	native	6	5
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Dracocephalum parviflorum	dragonhead	DRAPAR	native	3	3
Drymocallis arguta	tall or prairie cinquefoil	DRYARG	native	8	3
Elymus trachycaulus	slender wheatgrass	ELYTRA	native	8	3
Epipactis helleborine	**helleborine**	**EPIHEL**	**non-native**	**0**	**0**
Fragaria vesca	woodland strawberry	FRAVES	native	2	3
Galium triflorum	fragrant bedstraw	GALTRR	native	4	3
Geranium bicknellii	northern crane's-bill	GERBIC	native	4	5
Geum fragarioides	barren-strawberry	GEUFRA	native	6	5
Hieracium aurantiacum	**orange hawkweed**	**HIEAUR**	**non-native**	**0**	**5**
Hieracium caespitosum	**yellow hawkweed; king devil**	**HIECAE**	**non-native**	**0**	**5**
Hieracium kalmii	Kalm's hawkweed	HIEKAL	native	3	5
Hieracium piloselloides	**yellow hawkweed; king devil**	**HIEPIS**	**non-native**	**0**	**5**

Appendix 3.41. Tobin Creek Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Hieracium scabrum	rough hawkweed	HIESCA	native	3	5
Hieracium umbellatum	northern hawkweed	HIEUMB	native	7	5
Hypericum perforatum	**common St. John's-wort**	**HYPPER**	**non-native**	**0**	**5**
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Lactuca biennis	tall blue lettuce	LACBIE	native	2	0
Lactuca canadensis	tall lettuce	LACCAN	native	2	3
Linnaea borealis	twinflower	LINBOR	native	6	0
Lonicera dioica	red honeysuckle	LONDIO	native	5	3
Lonicera hirsuta	hairy honeysuckle	LONHIR	native	6	0
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Micranthes virginiensis	early saxifrage	MICVIR	native	10	3
Oryzopsis asperifolia	rough-leaved rice-grass	ORYASP	native	6	5
Phleum pratense	**Timothy**	**PHLPRA**	**non-native**	**0**	**3**
Picea glauca	white spruce	PICGLA	native	3	3
Pinus strobus	white pine	PINSTR	native	3	3
Poa compressa	**Canada bluegrass**	**POACOM**	**non-native**	**0**	**3**
Polygala paucifolia	gay-wings	POLPAU	native	7	3
Polygonum douglasii	western smartweed	POLDOU	native	5	3
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Potentilla norvegica	rough cinquefoil	POTNOR	native	0	0
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3
Prunus virginiana	choke cherry	PRUVIR	native	2	3
Pteridium aquilinum	bracken fern	PTEAQU	native	0	3
Rhus typhina	staghorn sumac	RHUTYP	native	2	3
Ribes glandulosum	skunk currant	RIBGLA	native	5	-3
Rosa blanda	wild rose	ROSBLA	native	3	3
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Salix humilis	prairie willow	SALHUM	native	4	3
Selaginella rupestris	sand club moss	SELRUP	native	8	5
Shepherdia canadensis	soapberry	SHECAN	native	7	5
Solidago hispida	hairy goldenrod	SOLHIS	native	3	5
Solidago juncea	early goldenrod	SOLJUN	native	3	5
Solidago nemoralis	old-field goldenrod	SOLNEM	native	2	5
Sorbus decora	mountain-ash	SORDEC	native	4	3
Symphoricarpos albus var. albus	snowberry	SYMALA	native	5	3
Symphyotrichum ciliolatum	northern heart-leaved aster	SYMCIO	native	4	5
Taxus canadensis	yew	TAXCAN	native	5	3
Tragopogon pratensis	**common goat's beard**	**TRAPRA**	**non-native**	**0**	**5**
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Verbascum thapsus	**common mullein**	**VERTHA**	**non-native**	**0**	**5**
Viola adunca	sand violet	VIOADU	native	4	3
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.42. Tobin Harbor Volcanic Bedrock Glade FQA

Conservatism-Based Metrics:

Total Mean C:	4.8
Native Mean C:	5.1
Total FQI:	39.9
Native FQI:	41.4
Adjusted FQI:	49.9
% C value 0:	8.7
% C value 1-3:	21.7
% C value 4-6:	47.8
% C value 7-10:	21.7
Native Tree Mean C:	3.3
Native Shrub Mean C:	4.8
Native Herbaceous Mean C:	5.5

Species Richness:

Total Species:	69	
Native Species:	66	95.70%
Non-native Species:	3	4.30%

Species Wetness:

Mean Wetness:	2.8
Native Mean Wetness:	2.8

Physiognomy Metrics:

Tree:	8	11.60%
Shrub:	14	20.30%
Vine:	1	1.40%
Forb:	28	40.60%
Grass:	11	15.90%
Sedge:	1	1.40%
Rush:	0	0%
Fern:	6	8.70%
Bryophyte:	0	0%

Duration Metrics:

Annual:	5	7.20%
Perennial:	62	89.90%
Biennial:	2	2.90%
Native Annual:	5	7.20%
Native Perennial:	59	85.50%
Native Biennial:	2	2.90%

Appendix 3.42. Tobin Harbor Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Achillea millefolium	yarrow	ACHMIL	native	1	3
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Amelanchier sanguinea	round-leaved serviceberry	AMESAN	native	5	5
Amelanchier spicata	shadbush serviceberry	AMESPI	native	4	3
Antennaria howellii	small pussytoes	ANTHOW	native	2	5
Antennaria parlinii	smooth pussytoes	ANTPAL	native	2	5
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Capnoides sempervirens	pink or pale corydalis	CAPSEM	native	5	5
Carex umbellata	sedge	CXUMBE	native	5	5
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Clintonia borealis	bluebead-lily; corn-lily	CLIBOR	native	5	0
Comandra umbellata	bastard-toadflax	COMUMB	native	5	3
Conyza canadensis	horseweed	CONCAN	native	0	3
Cornus canadensis	bunchberry	CORCAA	native	6	0
Cryptogramma acrostichoides	American rock-brake	CRYACR	native	10	5
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Dryopteris fragrans	fragrant woodfern	DRYFRA	native	10	5
Elymus trachycaulus	slender wheatgrass	ELYTRA	native	8	3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Festuca occidentalis	western fescue	FESOCC	native	6	5
Festuca saximontana	fescue	FESSAX	native	6	5
Gaultheria procumbens	wintergreen	GAUPRO	native	5	3
Geocaulon lividum	geocaulon	GEOLIV	native	9	0
Geranium bicknellii	northern crane's-bill	GERBIC	native	4	5
Hieracium aurantiacum	**orange hawkweed**	**HIEAUR**	**non-native**	**0**	**5**
Hieracium caespitosum	**yellow hawkweeds; king devil**	**HIECAE**	**non-native**	**0**	**5**
Hieracium kalmii	Kalm's hawkweed	HIEKAL	native	3	5
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Lactuca biennis	tall blue lettuce	LACBIE	native	2	0
Larix laricina	tamarack	LARLAR	native	5	-3
Linnaea borealis	twinflower	LINBOR	native	6	0
Lonicera hirsuta	hairy honeysuckle	LONHIR	native	6	0
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Micranthes virginiensis	early saxifrage	MICVIR	native	10	3
Oryzopsis asperifolia	rough-leaved rice-grass	ORYASP	native	6	5
Picea glauca	white spruce	PICGLA	native	3	3
Pinus banksiana	jack pine	PINBAN	native	5	3
Pinus strobus	white pine	PINSTR	native	3	3

Appendix 3.42. Tobin Harbor Volcanic Bedrock Glade FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Poa compressa	**Canada bluegrass**	**POACOM**	**non-native**	**0**	**3**
Poa glauca	bluegrass	POAGLA	native	10	5
Poa interior	bluegrass	POAINT	native	10	0
Polygonum douglasii	western smartweed	POLDOU	native	5	3
Polypodium virginianum	common polypody	POLVIR	native	8	5
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Potentilla norvegica	rough cinquefoil	POTNOR	native	0	0
Pteridium aquilinum	bracken fern	PTEAQU	native	0	3
Ranunculus rhomboideus	prairie buttercup	RANRHO	native	9	5
Rosa acicularis	wild rose	ROSACI	native	4	3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Salix humilis	prairie willow	SALHUM	native	4	3
Sambucus racemosa	red-berried elder	SAMRAC	native	3	3
Selaginella rupestris	sand club moss	SELRUP	native	8	5
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Solidago juncea	early goldenrod	SOLJUN	native	3	5
Sorbus decora	mountain-ash	SORDEC	native	4	3
Spiranthes lacera	slender ladies'-tresses	SPILAC	native	8	0
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Vaccinium myrtilloides	Canada blueberry	VACMYR	native	4	-3
Viola adunca	sand violet	VIOADU	native	4	3
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.43. Minong Shores Volcanic Bedrock Lakeshore FQA

Conservatism-Based Metrics:

Total Mean C:	5.9
Native Mean C:	6.1
Total FQI:	60.2
Native FQI:	61.6
Adjusted FQI:	60.4
% C value 0:	1.9
% C value 1-3:	19.2
% C value 4-6:	40.4
% C value 7-10:	38.5
Native Tree Mean C:	3.3
Native Shrub Mean C:	6.2
Native Herbaceous Mean C:	6.4

Species Richness:

Total Species:	104	
Native Species:	102	98.10%
Non-native Species:	2	1.90%

Species Wetness:

Mean Wetness:	0.8
Native Mean Wetness:	0.7

Physiognomy Metrics:

Tree:	9	8.70%
Shrub:	26	25.00%
Vine:	4	3.80%
Forb:	41	39.40%
Grass:	12	11.50%
Sedge:	3	2.90%
Rush:	1	1%
Fern:	8	7.70%
Bryophyte:	0	0%

Duration Metrics:

Annual:	1	1.00%
Perennial:	101	97.10%
Biennial:	2	1.90%
Native Annual:	1	1.00%
Native Perennial:	99	95.20%
Native Biennial:	2	1.90%

Appendix 3.43. Minong Shores Volcanic Bedrock Lakeshore FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Acer spicatum	mountain maple	ACESPI	native	5	3
Achillea millefolium	yarrow	ACHMIL	native	1	3
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Alnus viridis	mountain alder	ALNVIR	native	8	0
Amelanchier bartramiana	northern juneberry	AMEBAR	native	8	0
Amelanchier interior	serviceberry	AMEINT	native	4	5
Anaphalis margaritacea	pearly everlasting	ANAMAR	native	3	5
Andromeda glaucophylla	bog-rosemary	ANDGLA	native	10	-5
Antennaria howellii	small pussytoes	ANTHOW	native	2	5
Aralia hispida	bristly sarsaparilla	ARAHIS	native	3	5
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Artemisia campestris	wormwood	ARTCAM	native	5	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Capnoides sempervirens	pink or pale corydalis	CAPSEM	native	5	5
Carex castanea	sedge	CXCAST	native	6	-3
Carex echinata	sedge	CXECHA	native	6	-5
Castilleja septentrionalis	northern paintbrush	CASSEP	native	10	0
Chamaedaphne calyculata	leatherleaf	CHACAL	native	8	-5
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Claytosmunda claytoniana	interrupted fern	OSMCLN	native	6	0
Comandra umbellata	bastard-toadflax	COMUMB	native	5	3
Cornus canadensis	bunchberry	CORCAA	native	6	0
Cornus sericea	red-osier dogwood	CORSER	native	2	-3
Cryptogramma acrostichoides	American rock-brake	CRYACR	native	10	5
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Dasiphora fruticosa	shrubby cinquefoil	DASFRU	native	8	-3
Deschampsia cespitosa	hair grass	DESCES	native	9	-3
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Drosera rotundifolia	round-leaved sundew	DROROT	native	6	-5
Dryopteris fragrans	fragrant woodfern	DRYFRA	native	10	5
Elymus trachycaulus	slender wheatgrass	ELYTRA	native	8	3
Eupatorium perfoliatum	boneset	EUPPER	native	4	-3
Euphrasia hudsoniana	eyebright	EUPHUD	native	8	3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Euthamia graminifolia	grass-leaved goldenrod	EUTGRA	native	3	0
Fallopia cilinodis	fringed false buckwheat	FALCIL	native	3	5
Festuca saximontana	fescue	FESSAX	native	6	5
Fragaria vesca	woodland strawberry	FRAVES	native	2	3
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Gaultheria hispidula	creeping-snowberry	GAUHIS	native	8	-3
Gymnocarpium dryopteris	oak fern	GYMDRY	native	5	3
Hieracium caespitosum	**yellow hawkweed; king devil**	**HIECAE**	**non-native**	**0**	**5**
Hieracium umbellatum	northern hawkweed	HIEUMB	native	7	5

Appendix 3.43. Minong Shores Volcanic Bedrock Lakeshore FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Iris versicolor	wild blue flag	IRIVER	native	5	-5
Juncus brevicaudatus	rush	JUNBRE	native	8	-5
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Lathyrus japonicus	beach pea	LATJAP	native	10	3
Lilium philadelphicum	wood lily	LILPHI	native	7	0
Linnaea borealis	twinflower	LINBOR	native	6	0
Lobelia kalmii	Kalm's lobelia	LOBKAL	native	10	-5
Lonicera dioica	red honeysuckle	LONDIO	native	5	3
Lonicera hirsuta	hairy honeysuckle	LONHIR	native	6	0
Lycopus uniflorus	northern bugle weed	LYCUNI	native	2	-5
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Micranthes virginiensis	early saxifrage	MICVIR	native	10	3
Myrica gale	sweet gale	MYRGAL	native	6	-5
Onoclea sensibilis	sensitive fern	ONOSEN	native	2	-3
Oryzopsis asperifolia	rough-leaved rice-grass	ORYASP	native	6	5
Packera paupercula	balsam ragwort	PACPAU	native	3	0
Physocarpus opulifolius	ninebark	PHYOPU	native	4	-3
Picea glauca	white spruce	PICGLA	native	3	3
Pinguicula vulgaris	butterwort	PINVUL	native	10	-5
Pinus banksiana	jack pine	PINBAN	native	5	3
Piptatherum pungens	rice-grass	PIPPUN	native	9	5
Platanthera clavellata	small green wood orchid	PLACLA	native	6	-3
Poa compressa	**Canada bluegrass**	**POACOM**	**non-native**	**0**	**3**
Poa glauca	bluegrass	POAGLA	native	10	5
Polypodium virginianum	common polypody	POLVIR	native	8	5
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Prenanthes racemosa	glaucous white lettuce	PRERAC	native	8	-3
Primula mistassinica	bird's-eye primrose	PRIMIS	native	10	-3
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3
Prunus pumila	sand cherry	PRUPUM	native	8	5
Rhododendron groenlandicum	Labrador-tea	RHOGRO	native	8	-5
Rosa acicularis	wild rose	ROSACI	native	4	3
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Rubus pubescens	dwarf raspberry	RUBPUB	native	4	-3
Sagina nodosa	pearlwort	SAGNOD	native	10	3
Salix humilis	prairie willow	SALHUM	native	4	3
Saxifraga paniculata	lime-encrusted saxifrage	SAXPAN	native	10	0
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Sisyrinchium montanum	mountain blue-eyed-grass	SISMON	native	4	0
Solidago ptarmicoides	upland white goldenrod	SOLPTA	native	6	3
Solidago simplex	Gillman's goldenrod	SOLSIM	native	10	3
Solidago uliginosa	bog goldenrod	SOLULI	native	4	-5
Sorbus decora	mountain-ash	SORDEC	native	4	3
Spiranthes romanzoffiana	hooded ladies'-tresses	SPIROM	native	8	-5
Taxus canadensis	yew	TAXCAN	native	5	3

Appendix 3.43. Minong Shores Volcanic Bedrock Lakeshore FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Thalictrum dasycarpum	purple meadow-rue	THADAS	native	3	-3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Triantha glutinosa	false asphodel	TRIGLU	native	10	-5
Trichophorum cespitosum	bulrush	TRICES	native	10	-5
Trisetum spicatum	downy oatgrass	TRISPI	native	10	0
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Vaccinium oxycoccos	small cranberry	VACOXY	native	8	-5
Viburnum edule	squashberry	VIBEDU	native	10	-3
Viola adunca	sand violet	VIOADU	native	4	3
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.44. Mott Island Volcanic Bedrock Lakeshore FQA

Conservatism-Based Metrics:

Total Mean C:	5.9
Native Mean C:	5.9
Total FQI:	38.7
Native FQI:	38.7
Adjusted FQI:	59
% C value 0:	0
% C value 1-3:	25.6
% C value 4-6:	32.6
% C value 7-10:	41.9
Native Tree Mean C:	2.8
Native Shrub Mean C:	5.2
Native Herbaceous Mean C:	6.8

Species Richness:

Total Species:	43	
Native Species:	43	100.00%
Non-native Species:	0	0.00%

Species Wetness:

Mean Wetness:	0.7
Native Mean Wetness:	0.7

Physiognomy Metrics:

Tree:	5	11.60%
Shrub:	13	30.20%
Vine:	1	2.30%
Forb:	19	44.20%
Grass:	4	9.30%
Sedge:	1	2.30%
Rush:	0	0%
Fern:	0	0.00%
Bryophyte:	0	0%

Duration Metrics:

Annual:	1	2.30%
Perennial:	41	95.30%
Biennial:	1	2.30%
Native Annual:	1	2.30%
Native Perennial:	41	95.30%
Native Biennial:	1	2.30%

Appendix 3.44. Mott Island Volcanic Bedrock Lakeshore FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Achillea millefolium	yarrow	ACHMIL	native	1	3
Alnus viridis	mountain alder	ALNVIR	native	8	0
Antennaria howellii	small pussytoes	ANTHOW	native	2	5
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Artemisia campestris	wormwood	ARTCAM	native	5	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Deschampsia cespitosa	hair grass	DESCES	native	9	-3
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Drosera rotundifolia	round-leaved sundew	DROROT	native	6	-5
Drymocallis arguta	tall or prairie cinquefoil	DRYARG	native	8	3
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Hieracium kalmii	Kalm's hawkweed	HIEKAL	native	3	5
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Lathyrus japonicus	beach pea	LATJAP	native	10	3
Lobelia kalmii	Kalm's lobelia	LOBKAL	native	10	-5
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Physocarpus opulifolius	ninebark	PHYOPU	native	4	-3
Picea glauca	white spruce	PICGLA	native	3	3
Pinguicula vulgaris	butterwort	PINVUL	native	10	-5
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Prenanthes racemosa	glaucous white lettuce	PRERAC	native	8	-3
Primula mistassinica	bird's-eye primrose	PRIMIS	native	10	-3
Rhododendron groenlandicum	Labrador-tea	RHOGRO	native	8	-5
Rosa acicularis	wild rose	ROSACI	native	4	3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Salix bebbiana	Bebb's willow	SALBEB	native	1	-3
Saxifraga paniculata	lime-encrusted saxifrage	SAXPAN	native	10	0
Shepherdia canadensis	soapberry	SHECAN	native	7	5
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Solidago simplex	Gillman's goldenrod	SOLSIM	native	10	3
Sorbus decora	mountain-ash	SORDEC	native	4	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Triantha glutinosa	false asphodel	TRIGLU	native	10	-5
Trichophorum alpinum	bulrush	TRIALP	native	10	-5
Trisetum spicatum	downy oatgrass	TRISPI	native	10	0
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Vaccinium myrtilloides	Canada blueberry	VACMYR	native	4	-3

Appendix 3.45. Sam Hill Volcanic Bedrock Lakeshore FQA

Conservatism-Based Metrics:

Total Mean C:	6.6
Native Mean C:	6.6
Total FQI:	37.9
Native FQI:	37.9
Adjusted FQI:	66
% C value 0:	0
% C value 1-3:	15.2
% C value 4-6:	33.3
% C value 7-10:	51.5
Native Tree Mean C:	3.7
Native Shrub Mean C:	7.5
Native Herbaceous Mean C:	6.6

Physiognomy Metrics:

Tree:	3	9.10%
Shrub:	11	33.30%
Vine:	1	3.00%
Forb:	11	33.30%
Grass:	4	12.10%
Sedge:	1	3.00%
Rush:	0	0%
Fern:	2	6.10%
Bryophyte:	0	0%

Species Richness:

Total Species:	33	
Native Species:	33	100.00%
Non-native Species:	0	0.00%

Duration Metrics:

Annual:	0	0.00%
Perennial:	33	100.00%
Biennial:	0	0.00%
Native Annual:	0	0.00%
Native Perennial:	33	100.00%
Native Biennial:	0	0.00%

Species Wetness:

Mean Wetness:	-0.4
Native Mean Wetness:	-0.4

Appendix 3.45. Sam Hill Volcanic Bedrock Lakeshore FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Achillea millefolium	yarrow	ACHMIL	native	1	3
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Alnus viridis	mountain alder	ALNVIR	native	8	0
Amelanchier bartramiana	northern juneberry	AMEBAR	native	8	0
Andromeda glaucophylla	bog-rosemary	ANDGLA	native	10	-5
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Chamaedaphne calyculata	leatherleaf	CHACAL	native	8	-5
Dasiphora fruticosa	shrubby cinquefoil	DASFRU	native	8	-3
Deschampsia cespitosa	hair grass	DESCES	native	9	-3
Drosera rotundifolia	round-leaved sundew	DROROT	native	6	-5
Elymus trachycaulus	slender wheatgrass	ELYTRA	native	8	3
Empetrum nigrum	black crowberry	EMPNIG	native	10	0
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Gymnocarpium dryopteris	oak fern	GYMDRY	native	5	3
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Lobelia kalmii	Kalm's lobelia	LOBKAL	native	10	-5
Lonicera hirsuta	hairy honeysuckle	LONHIR	native	6	0
Phegopteris connectilis	northern beech-fern	PHECON	native	5	3
Physocarpus opulifolius	ninebark	PHYOPU	native	4	-3
Picea glauca	white spruce	PICGLA	native	3	3
Pinguicula vulgaris	butterwort	PINVUL	native	10	-5
Prenanthes racemosa	glaucous white lettuce	PRERAC	native	8	-3
Primula mistassinica	bird's-eye primrose	PRIMIS	native	10	-3
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Solidago hispida	hairy goldenrod	SOLHIS	native	3	5
Sorbus decora	mountain-ash	SORDEC	native	4	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Triantha glutinosa	false asphodel	TRIGLU	native	10	-5
Trichophorum cespitosum	bulrush	TRICES	native	10	-5
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3

Appendix 3.46. Scoville Point Volcanic Bedrock Lakeshore FQA

Conservatism-Based Metrics:

Total Mean C:	6
Native Mean C:	6.2
Total FQI:	49.5
Native FQI:	50.4
Adjusted FQI:	61.1
% C value 0:	4.4
% C value 1-3:	19.1
% C value 4-6:	35.3
% C value 7-10:	41.2
Native Tree Mean C:	2.8
Native Shrub Mean C:	6.6
Native Herbaceous Mean C:	6.4

Species Richness:

Total Species:	68	
Native Species:	66	97.10%
Non-native Species:	2	2.90%

Species Wetness:

Mean Wetness:	0.8
Native Mean Wetness:	0.7

Physiognomy Metrics:

Tree:	6	8.80%
Shrub:	21	30.90%
Vine:	1	1.50%
Forb:	27	39.70%
Grass:	8	11.80%
Sedge:	2	2.90%
Rush:	1	2%
Fern:	2	2.90%
Bryophyte:	0	0%

Duration Metrics:

Annual:	2	2.90%
Perennial:	64	94.10%
Biennial:	2	2.90%
Native Annual:	2	2.90%
Native Perennial:	62	91.20%
Native Biennial:	2	2.90%

Appendix 3.46. Scoville Point Volcanic Bedrock Lakeshore FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Achillea millefolium	yarrow	ACHMIL	native	1	3
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Alnus viridis	mountain alder	ALNVIR	native	8	0
Amelanchier sanguinea	round-leaved serviceberry	AMESAN	native	5	5
Andromeda glaucophylla	bog-rosemary	ANDGLA	native	10	-5
Antennaria howellii	small pussytoes	ANTHOW	native	2	5
Arabidopsis lyrata	sand cress	ARALYR	native	7	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Artemisia campestris	wormwood	ARTCAM	native	5	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Carex echinata	sedge	CXECHA	native	6	-5
Chamaedaphne calyculata	leatherleaf	CHACAL	native	8	-5
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Cornus canadensis	bunchberry	CORCAA	native	6	0
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Dasiphora fruticosa	shrubby cinquefoil	DASFRU	native	8	-3
Deschampsia cespitosa	hair grass	DESCES	native	9	-3
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Empetrum nigrum	black crowberry	EMPNIG	native	10	0
Euphrasia nemorosa	eyebright	EUPNEM	native	8	3
Euthamia graminifolia	grass-leaved goldenrod	EUTGRA	native	3	0
Festuca saximontana	fescue	FESSAX	native	6	5
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Geocaulon lividum	geocaulon	GEOLIV	native	9	0
Hieracium caespitosum	**yellow hawkweed; king devil**	**HIECAE**	**non-native**	**0**	**5**
Huperzia appressa	mountain fir moss	HUPAPP	native	10	3
Iris versicolor	wild blue flag	IRIVER	native	5	-5
Juncus tenuis	path rush	JUNTEN	native	1	0
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Lilium philadelphicum	wood lily	LILPHI	native	7	0
Lobelia kalmii	Kalm's lobelia	LOBKAL	native	10	-5
Lonicera hirsuta	hairy honeysuckle	LONHIR	native	6	0
Micranthes virginiensis	early saxifrage	MICVIR	native	10	3
Myrica gale	sweet gale	MYRGAL	native	6	-5
Physocarpus opulifolius	ninebark	PHYOPU	native	4	-3
Picea glauca	white spruce	PICGLA	native	3	3
Pinguicula vulgaris	butterwort	PINVUL	native	10	-5
Platanthera clavellata	small green wood orchid	PLACLA	native	6	-3
Poa compressa	**Canada bluegrass**	**POACOM**	**non-native**	**0**	**3**
Poa glauca	bluegrass	POAGLA	native	10	5
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Potentilla norvegica	rough cinquefoil	POTNOR	native	0	0

Appendix 3.46. Scoville Point Volcanic Bedrock Lakeshore FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Prenanthes racemosa	glaucous white lettuce	PRERAC	native	8	-3
Primula mistassinica	bird's-eye primrose	PRIMIS	native	10	-3
Rhododendron groenlandicum	Labrador-tea	RHOGRO	native	8	-5
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Sagina nodosa	pearlwort	SAGNOD	native	10	3
Salix humilis	prairie willow	SALHUM	native	4	3
Saxifraga tricuspidata	prickly saxifrage	SAXTRI	native	10	5
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Solidago hispida	hairy goldenrod	SOLHIS	native	3	5
Solidago ptarmicoides	upland white goldenrod	SOLPTA	native	6	3
Solidago simplex	Gillman's goldenrod	SOLSIM	native	10	3
Sorbus decora	mountain-ash	SORDEC	native	4	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trichophorum cespitosum	bulrush	TRICES	native	10	-5
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Vaccinium myrtilloides	Canada blueberry	VACMYR	native	4	-3
Vaccinium uliginosum	Alpine bilberry	VACULI	native	10	0
Viburnum edule	squashberry	VIBEDU	native	10	-3
Viola adunca	sand violet	VIOADU	native	4	3
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.47. Stone's Point Volcanic Bedrock Lakeshore FQA

Conservatism-Based Metrics:

Total Mean C:	6.4
Native Mean C:	6.4
Total FQI:	37.9
Native FQI:	37.9
Adjusted FQI:	64
% C value 0:	0
% C value 1-3:	25.7
% C value 4-6:	25.7
% C value 7-10:	48.6
Native Tree Mean C:	3
Native Shrub Mean C:	6.4
Native Herbaceous Mean C:	6.9

Species Richness:

Total Species:	35	
Native Species:	35	100.00%
Non-native Species:	0	0.00%

Species Wetness:

Mean Wetness:	-0.1
Native Mean Wetness:	-0.1

Physiognomy Metrics:

Tree:	3	8.60%
Shrub:	9	25.70%
Vine:	0	0.00%
Forb:	16	45.70%
Grass:	4	11.40%
Sedge:	1	2.90%
Rush:	1	3%
Fern:	1	2.90%
Bryophyte:	0	0%

Duration Metrics:

Annual:	1	2.90%
Perennial:	34	97.10%
Biennial:	0	0.00%
Native Annual:	1	2.90%
Native Perennial:	34	97.10%
Native Biennial:	0	0.00%

Appendix 3.47. Stone's Point Volcanic Bedrock Lakeshore FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Achillea millefolium	yarrow	ACHMIL	native	1	3
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Betula papyrifera	paper birch	BETPAP	native	2	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Cornus sericea	red-osier dogwood	CORSER	native	2	-3
Dasiphora fruticosa	shrubby cinquefoil	DASFRU	native	8	-3
Deschampsia cespitosa	hair grass	DESCES	native	9	-3
Euthamia graminifolia	grass-leaved goldenrod	EUTGRA	native	3	0
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Juncus brevicaudatus	rush	JUNBRE	native	8	-5
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Lobelia kalmii	Kalm's lobelia	LOBKAL	native	10	-5
Micranthes virginiensis	early saxifrage	MICVIR	native	10	3
Myrica gale	sweet gale	MYRGAL	native	6	-5
Persicaria sagittata	arrow-leaved tear-thumb	PERSAG	native	5	-5
Physocarpus opulifolius	ninebark	PHYOPU	native	4	-3
Picea glauca	white spruce	PICGLA	native	3	3
Pinguicula vulgaris	butterwort	PINVUL	native	10	-5
Poa alpina	Alpine bluegrass	POAALP	native	10	3
Potentilla litoralis	prairie cinquefoil	POTLIT	native	9	3
Prenanthes racemosa	glaucous white lettuce	PRERAC	native	8	-3
Primula mistassinica	bird's-eye primrose	PRIMIS	native	10	-3
Rosa acicularis	wild rose	ROSACI	native	4	3
Saxifraga paniculata	lime-encrusted saxifrage	SAXPAN	native	10	0
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Solidago hispida	hairy goldenrod	SOLHIS	native	3	5
Solidago juncea	early goldenrod	SOLJUN	native	3	5
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trichophorum cespitosum	bulrush	TRICES	native	10	-5
Vaccinium uliginosum	Alpine bilberry	VACULI	native	10	0
Viburnum edule	squashberry	VIBEDU	native	10	-3
Viola adunca	sand violet	VIOADU	native	4	3
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.48. Chippewa Harbor Volcanic Cliff FQA

Conservatism-Based Metrics:

Total Mean C:	6.3
Native Mean C:	6.3
Total FQI:	33.3
Native FQI:	33.3
Adjusted FQI:	63
% C value 0:	0
% C value 1-3:	14.3
% C value 4-6:	46.4
% C value 7-10:	39.3
Native Tree Mean C:	3.7
Native Shrub Mean C:	5.1
Native Herbaceous Mean C:	8.6

Species Richness:

Total Species:	28	
Native Species:	28	100.00%
Non-native Species:	0	0.00%

Species Wetness:

Mean Wetness:	2.9
Native Mean Wetness:	2.9

Physiognomy Metrics:

Tree:	7	25.00%
Shrub:	9	32.10%
Vine:	0	0.00%
Forb:	4	14.30%
Grass:	4	14.30%
Sedge:	0	0.00%
Rush:	0	0%
Fern:	4	14.30%
Bryophyte:	0	0%

Duration Metrics:

Annual:	0	0.00%
Perennial:	28	100.00%
Biennial:	0	0.00%
Native Annual:	0	0.00%
Native Perennial:	28	100.00%
Native Biennial:	0	0.00%

Appendix 3.48. Chippewa Harbor Volcanic Cliff FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Acer spicatum	mountain maple	ACESPI	native	5	3
Amelanchier interior	serviceberry	AMEINT	native	4	5
Amelanchier spicata	shadbush serviceberry	AMESPI	native	4	3
Aralia hispida	bristly sarsaparilla	ARAHIS	native	3	5
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Campanula rotundifolia	harebell	CAMROT	native	6	3
Cryptogramma acrostichoides	American rock-brake	CRYACR	native	10	5
Dryopteris fragrans	fragrant woodfern	DRYFRA	native	10	5
Elymus trachycaulus	slender wheatgrass	ELYTRA	native	8	3
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Linnaea borealis	twinflower	LINBOR	native	6	0
Lonicera canadensis	Canadian fly honeysuckle	LONCAN	native	5	3
Micranthes virginiensis	early saxifrage	MICVIR	native	10	3
Picea glauca	white spruce	PICGLA	native	3	3
Pinus banksiana	jack pine	PINBAN	native	5	3
Piptatherum pungens	rice-grass	PIPPUN	native	9	5
Poa glauca	bluegrass	POAGLA	native	10	5
Polypodium virginianum	common polypody	POLVIR	native	8	5
Rubus pubescens	dwarf raspberry	RUBPUB	native	4	-3
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Sorbus decora	mountain-ash	SORDEC	native	4	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Viburnum edule	squashberry	VIBEDU	native	10	-3
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.49. Feldtmann Ridge Volcanic Cliff FQA

Conservatism-Based Metrics:

Total Mean C:	5.2
Native Mean C:	5.2
Total FQI:	28
Native FQI:	28
Adjusted FQI:	52
% C value 0:	0
% C value 1-3:	13.8
% C value 4-6:	65.5
% C value 7-10:	20.7
Native Tree Mean C:	3.8
Native Shrub Mean C:	5.1
Native Herbaceous Mean C:	6.1

Species Richness:

Total Species:	29	
Native Species:	29	100.00%
Non-native Species:	0	0.00%

Species Wetness:

Mean Wetness:	2
Native Mean Wetness:	2

Physiognomy Metrics:

Tree:	8	27.60%
Shrub:	7	24.10%
Vine:	0	0.00%
Forb:	8	27.60%
Grass:	3	10.30%
Sedge:	0	0.00%
Rush:	0	0%
Fern:	3	10.30%
Bryophyte:	0	0%

Duration Metrics:

Annual:	0	0.00%
Perennial:	29	100.00%
Biennial:	0	0.00%
Native Annual:	0	0.00%
Native Perennial:	29	100.00%
Native Biennial:	0	0.00%

Appendix 3.49. Feldtmann Ridge Volcanic Cliff FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Acer spicatum	mountain maple	ACESPI	native	5	3
Actaea pachypoda	doll's-eyes	ACTPAC	native	7	5
Alnus viridis	mountain alder	ALNVIR	native	8	0
Amelanchier interior	serviceberry	AMEINT	native	4	5
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Campanula rotundifolia	harebell	CAMROT	native	6	3
Circaea alpina	small enchanter's-nightshade	CIRALP	native	4	-3
Clintonia borealis	bluebead-lily; corn-lily	CLIBOR	native	5	0
Cornus canadensis	bunchberry	CORCAA	native	6	0
Corylus cornuta	beaked hazelnut	CORCOR	native	5	3
Cryptogramma stelleri	slender rock-brake	CRYSTE	native	10	3
Cystopteris fragilis	fragile fern	CYSFRA	native	4	3
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Mitella nuda	naked miterwort	MITNUD	native	8	-3
Picea glauca	white spruce	PICGLA	native	3	3
Picea mariana	black spruce	PICMAR	native	6	-3
Pinus strobus	white pine	PINSTR	native	3	3
Poa glauca	bluegrass	POAGLA	native	10	5
Polypodium virginianum	common polypody	POLVIR	native	8	5
Sorbus decora	mountain-ash	SORDEC	native	4	3
Streptopus lanceolatus	rose twisted-stalk	STRLAN	native	5	3
Taxus canadensis	yew	TAXCAN	native	5	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Vaccinium myrtilloides	Canada blueberry	VACMYR	native	4	-3

Appendix 3.50. Lake Whittlesey Volcanic Cliff FQA

Conservatism-Based Metrics:

Total Mean C:	5.9
Native Mean C:	5.9
Total FQI:	25.7
Native FQI:	25.7
Adjusted FQI:	59
% C value 0:	0
% C value 1-3:	15.8
% C value 4-6:	52.6
% C value 7-10:	31.6
Native Tree Mean C:	3.8
Native Shrub Mean C:	7
Native Herbaceous Mean C:	6.8

Species Richness:

Total Species:	19	
Native Species:	19	100.00%
Non-native Species:	0	0.00%

Species Wetness:

Mean Wetness:	2.6
Native Mean Wetness:	2.6

Physiognomy Metrics:

Tree:	6	31.60%
Shrub:	4	21.10%
Vine:	0	0.00%
Forb:	2	10.50%
Grass:	3	15.80%
Sedge:	0	0.00%
Rush:	0	0%
Fern:	4	21.10%
Bryophyte:	0	0%

Duration Metrics:

Annual:	0	0.00%
Perennial:	18	94.70%
Biennial:	1	5.30%
Native Annual:	0	0.00%
Native Perennial:	18	94.70%
Native Biennial:	1	5.30%

Appendix 3.50. Lake Whittlesey Volcanic Cliff FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Acer spicatum	mountain maple	ACESPI	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Capnoides sempervirens	pink or pale corydalis	CAPSEM	native	5	5
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Cryptogramma acrostichoides	American rock-brake	CRYACR	native	10	5
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Dryopteris fragrans	fragrant woodfern	DRYFRA	native	10	5
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Myrica gale	sweet gale	MYRGAL	native	6	-5
Phegopteris connectilis	northern beech-fern	PHECON	native	5	3
Picea glauca	white spruce	PICGLA	native	3	3
Pinus banksiana	jack pine	PINBAN	native	5	3
Poa glauca	bluegrass	POAGLA	native	10	5
Polypodium virginianum	common polypody	POLVIR	native	8	5
Sorbus decora	mountain-ash	SORDEC	native	4	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Viburnum edule	squashberry	VIBEDU	native	10	-3

Appendix 3.51. McGinty Cove Volcanic Cliff FQA

Conservatism-Based Metrics:

Total Mean C:	4.7
Native Mean C:	4.7
Total FQI:	16.9
Native FQI:	16.9
Adjusted FQI:	47
% C value 0:	0
% C value 1-3:	15.4
% C value 4-6:	76.9
% C value 7-10:	7.7
Native Tree Mean C:	3.8
Native Shrub Mean C:	4.5
Native Herbaceous Mean C:	5.5

Species Richness:

Total Species:	13	
Native Species:	13	100.00%
Non-native Species:	0	0.00%

Species Wetness:

Mean Wetness:	2.2
Native Mean Wetness:	2.2

Physiognomy Metrics:

Tree:	5	38.50%
Shrub:	2	15.40%
Vine:	0	0.00%
Forb:	5	38.50%
Grass:	0	0.00%
Sedge:	0	0.00%
Rush:	0	0%
Fern:	1	7.70%
Bryophyte:	0	0%

Duration Metrics:

Annual:	0	0.00%
Perennial:	13	100.00%
Biennial:	0	0.00%
Native Annual:	0	0.00%
Native Perennial:	13	100.00%
Native Biennial:	0	0.00%

Appendix 3.51. McGinty Cove Volcanic Cliff FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Acer spicatum	mountain maple	ACESPI	native	5	3
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Campanula rotundifolia	harebell	CAMROT	native	6	3
Clintonia borealis	bluebead-lily; corn-lily	CLIBOR	native	5	0
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Picea glauca	white spruce	PICGLA	native	3	3
Polypodium virginianum	common polypody	POLVIR	native	8	5
Sorbus decora	mountain-ash	SORDEC	native	4	3
Taxus canadensis	yew	TAXCAN	native	5	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trientalis borealis	star-flower	TRIBOR	native	5	0

Appendix 3.52. Moose Lightning Volcanic Cliff FQA

Conservatism-Based Metrics:

Total Mean C:	4.8
Native Mean C:	5.2
Total FQI:	26.3
Native FQI:	27.5
Adjusted FQI:	50.2
% C value 0:	6.7
% C value 1-3:	20
% C value 4-6:	56.7
% C value 7-10:	16.7
Native Tree Mean C:	3.5
Native Shrub Mean C:	5.2
Native Herbaceous Mean C:	5.8

Species Richness:

Total Species:	30	
Native Species:	28	93.30%
Non-native Species:	2	6.70%

Species Wetness:

Mean Wetness:	1.7
Native Mean Wetness:	1.5

Physiognomy Metrics:

Tree:	6	20.00%
Shrub:	5	16.70%
Vine:	0	0.00%
Forb:	10	33.30%
Grass:	2	6.70%
Sedge:	1	3.30%
Rush:	0	0%
Fern:	6	20.00%
Bryophyte:	0	0%

Duration Metrics:

Annual:	1	3.30%
Perennial:	29	96.70%
Biennial:	0	0.00%
Native Annual:	1	3.30%
Native Perennial:	27	90.00%
Native Biennial:	0	0.00%

Appendix 3.52. Moose Lightning Volcanic Cliff FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Acer spicatum	mountain maple	ACESPI	native	5	3
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Athyrium angustum	lady fern	ATHFIL	native	4	0
Betula papyrifera	paper birch	BETPAP	native	2	3
Campanula rotundifolia	harebell	CAMROT	native	6	3
Cinna latifolia	wood reedgrass	CINLAT	native	5	-3
Cornus canadensis	bunchberry	CORCAA	native	6	0
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Dryopteris carthusiana	spinulose woodfern	DRYCAR	native	5	-3
Dryopteris fragrans	fragrant woodfern	DRYFRA	native	10	5
Dryopteris intermedia	evergreen woodfern	DRYINT	native	5	0
Hieracium caespitosum	**yellow hawkweed; king devil**	**HIECAE**	**non-native**	**0**	**5**
Hieracium scabrum	rough hawkweed	HIESCA	native	3	5
Impatiens capensis	spotted touch-me-not	IMPCAP	native	2	-3
Linnaea borealis	twinflower	LINBOR	native	6	0
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Picea glauca	white spruce	PICGLA	native	3	3
Poa nemoralis	**bluegrass**	**POANEM**	**non-native**	**0**	**3**
Polypodium virginianum	common polypody	POLVIR	native	8	5
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Scirpus atrocinctus	wool-grass	SCIATC	native	5	-5
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Sorbus decora	mountain-ash	SORDEC	native	4	3
Streptopus lanceolatus	rose twisted-stalk	STRLAN	native	5	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trientalis borealis	star-flower	TRIBOR	native	5	0
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.53. Sumner Lake Volcanic Cliff FQA

Conservatism-Based Metrics:

Total Mean C:	4.6
Native Mean C:	4.6
Total FQI:	19
Native FQI:	19
Adjusted FQI:	46
% C value 0:	0
% C value 1-3:	35.3
% C value 4-6:	47.1
% C value 7-10:	17.6
Native Tree Mean C:	3.1
Native Shrub Mean C:	4.4
Native Herbaceous Mean C:	6.8

Physiognomy Metrics:

Tree:	7	41.20%
Shrub:	5	29.40%
Vine:	0	0.00%
Forb:	2	11.80%
Grass:	2	11.80%
Sedge:	0	0.00%
Rush:	0	0%
Fern:	1	5.90%
Bryophyte:	0	0%

Species Richness:

Total Species:	17	
Native Species:	17	100.00%
Non-native Species:	0	0.00%

Duration Metrics:

Annual:	0	0.00%
Perennial:	17	100.00%
Biennial:	0	0.00%
Native Annual:	0	0.00%
Native Perennial:	17	100.00%
Native Biennial:	0	0.00%

Species Wetness:

Mean Wetness:	2.5
Native Mean Wetness:	2.5

Appendix 3.53. Sumner Lake Volcanic Cliff FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Campanula rotundifolia	harebell	CAMROT	native	6	3
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Picea glauca	white spruce	PICGLA	native	3	3
Pinus strobus	white pine	PINSTR	native	3	3
Poa glauca	bluegrass	POAGLA	native	10	5
Polypodium virginianum	common polypody	POLVIR	native	8	5
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Sorbus decora	mountain-ash	SORDEC	native	4	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Vaccinium myrtilloides	Canada blueberry	VACMYR	native	4	-3

Appendix 3.54. Huginnin Cove Volcanic Cobble Shore FQA

Conservatism-Based Metrics:

Total Mean C:	5
Native Mean C:	5
Total FQI:	24.5
Native FQI:	24.5
Adjusted FQI:	50
% C value 0:	0
% C value 1-3:	33.3
% C value 4-6:	41.7
% C value 7-10:	25
Native Tree Mean C:	2.9
Native Shrub Mean C:	4.2
Native Herbaceous Mean C:	7.8

Species Richness:

Total Species:	24	
Native Species:	24	100.00%
Non-native Species:	0	0.00%

Species Wetness:

Mean Wetness:	0.5
Native Mean Wetness:	0.5

Physiognomy Metrics:

Tree:	7	29.20%
Shrub:	9	37.50%
Vine:	1	4.20%
Forb:	5	20.80%
Grass:	1	4.20%
Sedge:	0	0.00%
Rush:	0	0%
Fern:	1	4.20%
Bryophyte:	0	0%

Duration Metrics:

Annual:	1	4.20%
Perennial:	23	95.80%
Biennial:	0	0.00%
Native Annual:	1	4.20%
Native Perennial:	23	95.80%
Native Biennial:	0	0.00%

Appendix 3.54. Huginnin Cove Volcanic Cobble Shore FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Alnus viridis	mountain alder	ALNVIR	native	8	0
Betula papyrifera	paper birch	BETPAP	native	2	3
Campanula rotundifolia	harebell	CAMROT	native	6	3
Cornus canadensis	bunchberry	CORCAA	native	6	0
Cornus sericea	red-osier dogwood	CORSER	native	2	-3
Deschampsia cespitosa	hair grass	DESCES	native	9	-3
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Gymnocarpium dryopteris	oak fern	GYMDRY	native	5	3
Impatiens capensis	spotted touch-me-not	IMPCAP	native	2	-3
Lathyrus japonicus	beach pea	LATJAP	native	10	3
Physocarpus opulifolius	ninebark	PHYOPU	native	4	-3
Picea glauca	white spruce	PICGLA	native	3	3
Pinguicula vulgaris	butterwort	PINVUL	native	10	-5
Pinus strobus	white pine	PINSTR	native	3	3
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Primula mistassinica	bird's-eye primrose	PRIMIS	native	10	-3
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3
Rosa acicularis	wild rose	ROSACI	native	4	3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Salix humilis	prairie willow	SALHUM	native	4	3
Solidago simplex	Gillman's goldenrod	SOLSIM	native	10	3
Sorbus decora	mountain-ash	SORDEC	native	4	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Vaccinium myrtilloides	Canada blueberry	VACMYR	native	4	-3

Appendix 3.55. Amygdaloid Island Volcanic Lakeshore Cliff FQA

Conservatism-Based Metrics:

Total Mean C:	6.2
Native Mean C:	6.2
Total FQI:	40.7
Native FQI:	40.7
Adjusted FQI:	62
% C value 0:	0
% C value 1-3:	14
% C value 4-6:	46.5
% C value 7-10:	39.5
Native Tree Mean C:	3.3
Native Shrub Mean C:	6.1
Native Herbaceous Mean C:	7

Species Richness:

Total Species:	43	
Native Species:	43	100.00%
Non-native Species:	0	0.00%

Species Wetness:

Mean Wetness:	1.7
Native Mean Wetness:	1.7

Physiognomy Metrics:

Tree:	6	14.00%
Shrub:	14	32.60%
Vine:	0	0.00%
Forb:	15	34.90%
Grass:	6	14.00%
Sedge:	0	0.00%
Rush:	0	0%
Fern:	2	4.70%
Bryophyte:	0	0%

Duration Metrics:

Annual:	1	2.30%
Perennial:	40	93.00%
Biennial:	2	4.70%
Native Annual:	1	2.30%
Native Perennial:	40	93.00%
Native Biennial:	2	4.70%

Appendix 3.55. Amygdaloid Island Volcanic Lakeshore Cliff FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Achillea millefolium	yarrow	ACHMIL	native	1	3
Alnus viridis	mountain alder	ALNVIR	native	8	0
Amelanchier bartramiana	northern juneberry	AMEBAR	native	8	0
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Boechera retrofracta	rock cress	BOERET	native	10	5
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Capnoides sempervirens	pink or pale corydalis	CAPSEM	native	5	5
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Clintonia borealis	bluebead-lily; corn-lily	CLIBOR	native	5	0
Cornus canadensis	bunchberry	CORCAA	native	6	0
Deschampsia cespitosa	hair grass	DESCES	native	9	-3
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Festuca saximontana	fescue	FESSAX	native	6	5
Geocaulon lividum	geocaulon	GEOLIV	native	9	0
Goodyera tesselata	tesselated rattlesnake plantain	GOOTES	native	8	3
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Linnaea borealis	twinflower	LINBOR	native	6	0
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Physocarpus opulifolius	ninebark	PHYOPU	native	4	-3
Picea glauca	white spruce	PICGLA	native	3	3
Poa glauca	bluegrass	POAGLA	native	10	5
Polypodium virginianum	common polypody	POLVIR	native	8	5
Rosa acicularis	wild rose	ROSACI	native	4	3
Rubus pubescens	dwarf raspberry	RUBPUB	native	4	-3
Salix humilis	prairie willow	SALHUM	native	4	3
Shepherdia canadensis	soapberry	SHECAN	native	7	5
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Solidago simplex	Gillman's goldenrod	SOLSIM	native	10	3
Sorbus americana	American mountain-ash	SORAME	native	4	0
Sorbus decora	mountain-ash	SORDEC	native	4	3
Stellaria borealis	northern stitchwort	STEBOR	native	10	-3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trisetum spicatum	downy oatgrass	TRISPI	native	10	0
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Viburnum edule	squashberry	VIBEDU	native	10	-3
Viola adunca	sand violet	VIOADU	native	4	3
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.56. Minong Shores Volcanic Lakeshore Cliff FQA

Conservatism-Based Metrics:

Total Mean C:	5.3
Native Mean C:	5.3
Total FQI:	30.4
Native FQI:	30.4
Adjusted FQI:	53
% C value 0:	0
% C value 1-3:	27.3
% C value 4-6:	45.5
% C value 7-10:	27.3
Native Tree Mean C:	3.3
Native Shrub Mean C:	5.5
Native Herbaceous Mean C:	6.1

Physiognomy Metrics:

Tree:	7	21.20%
Shrub:	8	24.20%
Vine:	0	0.00%
Forb:	12	36.40%
Grass:	5	15.20%
Sedge:	0	0.00%
Rush:	0	0%
Fern:	1	3.00%
Bryophyte:	0	0%

Species Richness:

Total Species:	33	
Native Species:	33	100.00%
Non-native Species:	0	0.00%

Duration Metrics:

Annual:	0	0.00%
Perennial:	32	97.00%
Biennial:	1	3.00%
Native Annual:	0	0.00%
Native Perennial:	32	97.00%
Native Biennial:	1	3.00%

Species Wetness:

Mean Wetness:	1.2
Native Mean Wetness:	1.2

Appendix 3.56. Minong Shores Volcanic Lakeshore Cliff FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Achillea millefolium	yarrow	ACHMIL	native	1	3
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Alnus viridis	mountain alder	ALNVIR	native	8	0
Aquilegia canadensis	wild columbine	AQUCAN	native	5	3
Artemisia campestris	wormwood	ARTCAM	native	5	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Campanula rotundifolia	harebell	CAMROT	native	6	3
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Cystopteris fragilis	fragile fern	CYSFRA	native	4	3
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Deschampsia cespitosa	hair grass	DESCES	native	9	-3
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Micranthes virginiensis	early saxifrage	MICVIR	native	10	3
Packera paupercula	balsam ragwort	PACPAU	native	3	0
Physocarpus opulifolius	ninebark	PHYOPU	native	4	-3
Picea glauca	white spruce	PICGLA	native	3	3
Pinus banksiana	jack pine	PINBAN	native	5	3
Poa glauca	bluegrass	POAGLA	native	10	5
Populus balsamifera	balsam poplar	POPBAL	native	2	-3
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3
Rhododendron groenlandicum	Labrador-tea	RHOGRO	native	8	-5
Rubus pubescens	dwarf raspberry	RUBPUB	native	4	-3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Saxifraga paniculata	lime-encrusted saxifrage	SAXPAN	native	10	0
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Solidago hispida	hairy goldenrod	SOLHIS	native	3	5
Solidago ptarmicoides	upland white goldenrod	SOLPTA	native	6	3
Sorbus decora	mountain-ash	SORDEC	native	4	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Triadenum fraseri	marsh St. John's-wort	TRIFRA	native	6	-5
Trisetum spicatum	downy oatgrass	TRISPI	native	10	0
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3

Appendix 3.57. Mott Island Volcanic Lakeshore Cliff FQA

Conservatism-Based Metrics:

Total Mean C:	5.2
Native Mean C:	5.3
Total FQI:	29.9
Native FQI:	30
Adjusted FQI:	52.2
% C value 0:	3
% C value 1-3:	27.3
% C value 4-6:	39.4
% C value 7-10:	30.3
Native Tree Mean C:	2.6
Native Shrub Mean C:	5.8
Native Herbaceous Mean C:	5.9

Physiognomy Metrics:

Tree:	5	15.20%
Shrub:	12	36.40%
Vine:	0	0.00%
Forb:	12	36.40%
Grass:	3	9.10%
Sedge:	0	0.00%
Rush:	0	0%
Fern:	1	3.00%
Bryophyte:	0	0%

Species Richness:

Total Species:	33	
Native Species:	32	97.00%
Non-native Species:	1	3.00%

Duration Metrics:

Annual:	1	3.00%
Perennial:	31	93.90%
Biennial:	1	3.00%
Native Annual:	1	3.00%
Native Perennial:	30	90.90%
Native Biennial:	1	3.00%

Species Wetness:

Mean Wetness:	2.5
Native Mean Wetness:	2.5

Appendix 3.57. Mott Island Volcanic Lakeshore Cliff FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Achillea millefolium	yarrow	ACHMIL	native	1	3
Alnus viridis	mountain alder	ALNVIR	native	8	0
Amelanchier sanguinea	round-leaved serviceberry	AMESAN	native	5	5
Antennaria howellii	small pussytoes	ANTHOW	native	2	5
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Artemisia campestris	wormwood	ARTCAM	native	5	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Campanula rotundifolia	harebell	CAMROT	native	6	3
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Hieracium kalmii	Kalm's hawkweed	HIEKAL	native	3	5
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Melampyrum lineare	cow-wheat	MELLIN	native	6	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**
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3
Rosa acicularis	wild rose	ROSACI	native	4	3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Saxifraga paniculata	lime-encrusted saxifrage	SAXPAN	native	10	0
Shepherdia canadensis	soapberry	SHECAN	native	7	5
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Solidago simplex	Gillman's goldenrod	SOLSIM	native	10	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trisetum spicatum	downy oatgrass	TRISPI	native	10	0
Vaccinium myrtilloides	Canada blueberry	VACMYR	native	4	-3
Vaccinium uliginosum	Alpine bilberry	VACULI	native	10	0
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.58. North Shore Volcanic Lakeshore Cliff FQA

Conservatism-Based Metrics:

Total Mean C:	5.4
Native Mean C:	5.4
Total FQI:	42.9
Native FQI:	42.9
Adjusted FQI:	54
% C value 0:	0
% C value 1-3:	28.6
% C value 4-6:	41.3
% C value 7-10:	30.2
Native Tree Mean C:	2.9
Native Shrub Mean C:	5.7
Native Herbaceous Mean C:	6

Physiognomy Metrics:

Tree:	10	15.90%
Shrub:	20	31.70%
Vine:	0	0.00%
Forb:	25	39.70%
Grass:	3	4.80%
Sedge:	1	1.60%
Rush:	0	0%
Fern:	4	6.30%
Bryophyte:	0	0%

Species Richness:

Total Species:	63	
Native Species:	63	100.00%
Non-native Species:	0	0.00%

Duration Metrics:

Annual:	2	3.20%
Perennial:	61	96.80%
Biennial:	0	0.00%
Native Annual:	2	3.20%
Native Perennial:	61	96.80%
Native Biennial:	0	0.00%

Species Wetness:

Mean Wetness:	0.4
Native Mean Wetness:	0.4

Appendix 3.58. North Shore Volcanic Lakeshore Cliff FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Achillea millefolium	yarrow	ACHMIL	native	1	3
Alnus viridis	mountain alder	ALNVIR	native	8	0
Amelanchier arborea	juneberry	AMEARB	native	4	3
Amelanchier interior	serviceberry	AMEINT	native	4	5
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Circaea alpina	small enchanter's-nightshade	CIRALP	native	4	-3
Clintonia borealis	bluebead-lily; corn-lily	CLIBOR	native	5	0
Cornus canadensis	bunchberry	CORCAA	native	6	0
Cornus sericea	red-osier dogwood	CORSER	native	2	-3
Dasiphora fruticosa	shrubby cinquefoil	DASFRU	native	8	-3
Deschampsia cespitosa	hair grass	DESCES	native	9	-3
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Empetrum nigrum	black crowberry	EMPNIG	native	10	0
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Geocaulon lividum	geocaulon	GEOLIV	native	9	0
Gymnocarpium dryopteris	oak fern	GYMDRY	native	5	3
Impatiens capensis	spotted touch-me-not	IMPCAP	native	2	-3
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Linnaea borealis	twinflower	LINBOR	native	6	0
Lobelia kalmii	Kalm's lobelia	LOBKAL	native	10	-5
Lonicera canadensis	Canadian fly honeysuckle	LONCAN	native	5	3
Lycopus uniflorus	northern bugle weed	LYCUNI	native	2	-5
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Mitella nuda	naked miterwort	MITNUD	native	8	-3
Onoclea sensibilis	sensitive fern	ONOSEN	native	2	-3
Phegopteris connectilis	northern beech-fern	PHECON	native	5	3
Physocarpus opulifolius	ninebark	PHYOPU	native	4	-3
Picea glauca	white spruce	PICGLA	native	3	3
Pinguicula vulgaris	butterwort	PINVUL	native	10	-5
Pinus strobus	white pine	PINSTR	native	3	3
Polypodium virginianum	common polypody	POLVIR	native	8	5
Populus balsamifera	balsam poplar	POPBAL	native	2	-3
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Prenanthes racemosa	glaucous white lettuce	PRERAC	native	8	-3
Primula mistassinica	bird's-eye primrose	PRIMIS	native	10	-3
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3
Ribes glandulosum	skunk currant	RIBGLA	native	5	-3
Rosa acicularis	wild rose	ROSACI	native	4	3
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3

Appendix 3.58. North Shore Volcanic Lakeshore Cliff FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Salix humilis	prairie willow	SALHUM	native	4	3
Saxifraga paniculata	lime-encrusted saxifrage	SAXPAN	native	10	0
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Solidago hispida	hairy goldenrod	SOLHIS	native	3	5
Solidago simplex	Gillman's goldenrod	SOLSIM	native	10	3
Sorbus decora	mountain-ash	SORDEC	native	4	3
Streptopus lanceolatus	rose twisted-stalk	STRLAN	native	5	3
Taxus canadensis	yew	TAXCAN	native	5	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trichophorum cespitosum	bulrush	TRICES	native	10	-5
Trientalis borealis	star-flower	TRIBOR	native	5	0
Trisetum spicatum	downy oatgrass	TRISPI	native	10	0
Vaccinium myrtilloides	Canada blueberry	VACMYR	native	4	-3
Viburnum edule	squashberry	VIBEDU	native	10	-3
Viola labradorica	dog violet	VIOLAB	native	3	0

Appendix 3.59. Scoville Point Volcanic Lakeshore Cliff FQA

Conservatism-Based Metrics:

Total Mean C:	6.6
Native Mean C:	6.7
Total FQI:	45.2
Native FQI:	45.4
Adjusted FQI:	66.3
% C value 0:	4.3
% C value 1-3:	14.9
% C value 4-6:	29.8
% C value 7-10:	51.1
Native Tree Mean C:	3
Native Shrub Mean C:	7.2
Native Herbaceous Mean C:	7

Species Richness:

Total Species:	47	
Native Species:	46	97.90%
Non-native Species:	1	2.10%

Species Wetness:

Mean Wetness:	1.1
Native Mean Wetness:	1.1

Physiognomy Metrics:

Tree:	4	8.50%
Shrub:	14	29.80%
Vine:	0	0.00%
Forb:	16	34.00%
Grass:	9	19.10%
Sedge:	1	2.10%
Rush:	0	0%
Fern:	3	6.40%
Bryophyte:	0	0%

Duration Metrics:

Annual:	2	4.30%
Perennial:	45	95.70%
Biennial:	0	0.00%
Native Annual:	2	4.30%
Native Perennial:	44	93.60%
Native Biennial:	0	0.00%

Appendix 3.59. Scoville Point Volcanic Lakeshore Cliff FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Achillea millefolium	yarrow	ACHMIL	native	1	3
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Alnus viridis	mountain alder	ALNVIR	native	8	0
Amelanchier sanguinea	round-leaved serviceberry	AMESAN	native	5	5
Andromeda glaucophylla	bog-rosemary	ANDGLA	native	10	-5
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Dasiphora fruticosa	shrubby cinquefoil	DASFRU	native	8	-3
Deschampsia cespitosa	hair grass	DESCES	native	9	-3
Empetrum nigrum	black crowberry	EMPNIG	native	10	0
Euphrasia nemorosa	eyebright	EUPNEM	native	8	3
Festuca saximontana	fescue	FESSAX	native	6	5
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Geocaulon lividum	geocaulon	GEOLIV	native	9	0
Huperzia appressa	mountain fir moss	HUPAPP	native	10	3
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Micranthes virginiensis	early saxifrage	MICVIR	native	10	3
Myrica gale	sweet gale	MYRGAL	native	6	-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**
Poa glauca	bluegrass	POAGLA	native	10	5
Polypodium virginianum	common polypody	POLVIR	native	8	5
Potentilla norvegica	rough cinquefoil	POTNOR	native	0	0
Prenanthes racemosa	glaucous white lettuce	PRERAC	native	8	-3
Primula mistassinica	bird's-eye primrose	PRIMIS	native	10	-3
Rhododendron groenlandicum	Labrador-tea	RHOGRO	native	8	-5
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Saxifraga tricuspidata	prickly saxifrage	SAXTRI	native	10	5
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Solidago hispida	hairy goldenrod	SOLHIS	native	3	5
Solidago ptarmicoides	upland white goldenrod	SOLPTA	native	6	3
Solidago simplex	Gillman's goldenrod	SOLSIM	native	10	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trichophorum cespitosum	bulrush	TRICES	native	10	-5
Trisetum spicatum	downy oatgrass	TRISPI	native	10	0
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Vaccinium uliginosum	Alpine bilberry	VACULI	native	10	0
Viola adunca	sand violet	VIOADU	native	4	3
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.60. Stone's Point Volcanic Lakeshore Cliff FQA

Conservatism-Based Metrics:

Total Mean C:	6.2
Native Mean C:	6.2
Total FQI:	44.7
Native FQI:	44.7
Adjusted FQI:	62
% C value 0:	1.9
% C value 1-3:	21.2
% C value 4-6:	34.6
% C value 7-10:	42.3
Native Tree Mean C:	2.9
Native Shrub Mean C:	6.3
Native Herbaceous Mean C:	6.9

Species Richness:

Total Species:	52	
Native Species:	52	100.00%
Non-native Species:	0	0.00%

Species Wetness:

Mean Wetness:	0.7
Native Mean Wetness:	0.7

Physiognomy Metrics:

Tree:	7	13.50%
Shrub:	12	23.10%
Vine:	0	0.00%
Forb:	18	34.60%
Grass:	9	17.30%
Sedge:	1	1.90%
Rush:	0	0%
Fern:	5	9.60%
Bryophyte:	0	0%

Duration Metrics:

Annual:	1	1.90%
Perennial:	51	98.10%
Biennial:	0	0.00%
Native Annual:	1	1.90%
Native Perennial:	51	98.10%
Native Biennial:	0	0.00%

Appendix 3.60. Stone's Point Volcanic Lakeshore Cliff FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Alnus viridis	mountain alder	ALNVIR	native	8	0
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Avenella flexuosa	hair grass	AVEFLE	native	6	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Chamaenerion angustifolium	fireweed	CHAANG	native	3	0
Cystopteris fragilis	fragile fern	CYSFRA	native	4	3
Danthonia spicata	poverty grass; oatgrass	DANSPI	native	4	5
Dasiphora fruticosa	shrubby cinquefoil	DASFRU	native	8	-3
Deschampsia cespitosa	hair grass	DESCES	native	9	-3
Diphasiastrum complanatum	ground-cedar	DIPCOM	native	5	3
Draba arabisans	rock whitlow-grass	DRAARA	native	10	5
Dryopteris fragrans	fragrant woodfern	DRYFRA	native	10	5
Euthamia graminifolia	grass-leaved goldenrod	EUTGRA	native	3	0
Festuca saximontana	fescue	FESSAX	native	6	5
Geocaulon lividum	geocaulon	GEOLIV	native	9	0
Juniperus communis	common or ground juniper	JUNCOI	native	4	3
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Lobelia kalmii	Kalm's lobelia	LOBKAL	native	10	-5
Lycopus americanus	common water horehound	LYCAME	native	2	-5
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Myrica gale	sweet gale	MYRGAL	native	6	-5
Physocarpus opulifolius	ninebark	PHYOPU	native	4	-3
Picea glauca	white spruce	PICGLA	native	3	3
Pinguicula vulgaris	butterwort	PINVUL	native	10	-5
Poa alpina	Alpine bluegrass	POAALP	native	10	3
Poa glauca	bluegrass	POAGLA	native	10	5
Polypodium virginianum	common polypody	POLVIR	native	8	5
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Potentilla norvegica	rough cinquefoil	POTNOR	native	0	0
Prenanthes racemosa	glaucous white lettuce	PRERAC	native	8	-3
Primula mistassinica	bird's-eye primrose	PRIMIS	native	10	-3
Prunus pensylvanica	pin cherry	PRUPEN	native	3	3
Rubus parviflorus	thimbleberry	RUBPAR	native	6	3
Rubus pubescens	dwarf raspberry	RUBPUB	native	4	-3
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Saxifraga tricuspidata	prickly saxifrage	SAXTRI	native	10	5
Sibbaldiopsis tridentata	three-toothed cinquefoil	SIBTRI	native	10	3
Solidago hispida	hairy goldenrod	SOLHIS	native	3	5
Solidago simplex	Gillman's goldenrod	SOLSIM	native	10	3
Sorbus decora	mountain-ash	SORDEC	native	4	3
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trichophorum cespitosum	bulrush	TRICES	native	10	-5
Trientalis borealis	star-flower	TRIBOR	native	5	0
Trisetum spicatum	downy oatgrass	TRISPI	native	10	0
Vaccinium myrtilloides	Canada blueberry	VACMYR	native	4	-3
Vaccinium uliginosum	Alpine bilberry	VACULI	native	10	0
Viburnum edule	squashberry	VIBEDU	native	10	-3
Woodsia ilvensis	rusty woodsia	WOOILV	native	10	5

Appendix 3.61. Siskiwit Bay Wooded Dune and Swale Complex FQA

Conservatism-Based Metrics:

Total Mean C:	6.5
Native Mean C:	6.5
Total FQI:	43.1
Native FQI:	43.1
Adjusted FQI:	65
% C value 0:	0
% C value 1-3:	9.1
% C value 4-6:	50
% C value 7-10:	40.9
Native Tree Mean C:	4.2
Native Shrub Mean C:	6.4
Native Herbaceous Mean C:	6.9

Physiognomy Metrics:

Tree:	5	11.40%
Shrub:	12	27.30%
Vine:	0	0.00%
Forb:	18	40.90%
Grass:	1	2.30%
Sedge:	7	15.90%
Rush:	0	0%
Fern:	1	2.30%
Bryophyte:	0	0%

Species Richness:

Total Species:	44	
Native Species:	44	100.00%
Non-native Species:	0	0.00%

Duration Metrics:

Annual:	1	2.30%
Perennial:	43	97.70%
Biennial:	0	0.00%
Native Annual:	1	2.30%
Native Perennial:	43	97.70%
Native Biennial:	0	0.00%

Species Wetness:

Mean Wetness:	-2.9
Native Mean Wetness:	-2.9

Appendix 3.61. Siskiwit Bay Wooded Dune and Swale Complex FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Alnus incana	speckled alder	ALNINC	native	5	-3
Andromeda glaucophylla	bog-rosemary	ANDGLA	native	10	-5
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Carex lasiocarpa	sedge	CXLASI	native	8	-5
Carex livida	sedge	CXLIVI	native	10	-5
Carex michauxiana	sedge	CXMICH	native	10	-5
Carex stricta	sedge	CXSTRI	native	4	-5
Chamaedaphne calyculata	leatherleaf	CHACAL	native	8	-5
Clintonia borealis	bluebead-lily; corn-lily	CLIBOR	native	5	0
Comarum palustre	marsh cinquefoil	COMPAL	native	7	-5
Cornus canadensis	bunchberry	CORCAA	native	6	0
Cornus sericea	red-osier dogwood	CORSER	native	2	-3
Drosera rotundifolia	round-leaved sundew	DROROT	native	6	-5
Eriophorum angustifolium	narrow-leaved cotton-grass	ERIANG	native	10	-5
Eurybia macrophylla	big-leaved aster	EURMAC	native	4	5
Gaultheria hispidula	creeping-snowberry	GAUHIS	native	8	-3
Iris versicolor	wild blue flag	IRIVER	native	5	-5
Larix laricina	tamarack	LARLAR	native	5	-3
Linnaea borealis	twinflower	LINBOR	native	6	0
Maianthemum canadense	Canada mayflower	MAICAN	native	4	3
Maianthemum trifolium	false mayflower	MAITRI	native	10	-5
Melampyrum lineare	cow-wheat	MELLIN	native	6	3
Menyanthes trifoliata	buckbean	MENTRI	native	8	-5
Myrica gale	sweet gale	MYRGAL	native	6	-5
Osmundastrum cinnamomeum	cinnamon fern	OSMCIN	native	5	-3
Picea glauca	white spruce	PICGLA	native	3	3
Picea mariana	black spruce	PICMAR	native	6	-3
Rhododendron groenlandicum	Labrador-tea	RHOGRO	native	8	-5
Rhynchospora alba	beak-rush	RHYALB	native	6	-5
Rubus pubescens	dwarf raspberry	RUBPUB	native	4	-3
Salix pedicellaris	bog willow	SALPED	native	8	-5
Sarracenia purpurea	pitcher-plant	SARPUR	native	10	-5
Scheuchzeria palustris	arrow-grass	SCHPAL	native	10	-5
Solidago uliginosa	bog goldenrod	SOLULI	native	4	-5
Symphyotrichum boreale	northern bog aster	SYMBOR	native	9	-5
Symplocarpus foetidus	skunk-cabbage	SYMFOE	native	6	-5
Thuja occidentalis	northern white-cedar	THUOCC	native	4	-3
Trichophorum cespitosum	bulrush	TRICES	native	10	-5
Trientalis borealis	star-flower	TRIBOR	native	5	0
Utricularia cornuta	horned bladderwort	UTRCOR	native	10	-5
Vaccinium angustifolium	low sweet blueberry	VACANG	native	4	3
Vaccinium oxycoccos	small cranberry	VACOXY	native	8	-5

Appendix 4 - Ojibwe Names for Plants Observed on Isle Royale

This appendix includes a crosswalk between Ojibwe names, scientific names, and common English names for all plant species observed on Isle Royale 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 4.1**) and then alphabetized by scientific names second (**Appendix 4.2**).

Appendix 4.1. Crosswalk between Ojibwe names and scientific and English names alphabetized by Ojibwe names.

Ojibwe Name	Restored	Page	Scientific Name	English Name
(g)odotaagaans	Yes	318	*Clintonia borealis*	bluebead-lily; corn-lily
(g)odotaagaans; ?ziiginise; ziiginish (e)	Yes	35	*Campanula aparanoides (*C. rotundifolia)*	marsh bellflower
(g)odotaagaans; ?ziiginise; ziiginis (e)	Yes	35	*Campanula rotundifolia*	harebell
(gi)chigamiiwashk, -oon	Yes	112	*Juncus tenuis*	path rush
(gi)chi-mazaanashk	Yes	103	*Cirsium vulgare*	bull thistle
(gi)chi-okaadaak; nezhikewang; okaadaak	Yes	274	*Aralia racemosa*	spikenard
?bebaamaabiig; okaaadaak; waaboozojiibik	Yes	235	*Aralia nudicaulis*	wild sarsaparilla
?wenabozhoo nookomis wiinizisan; ?nenzbozh ookomisan miinizisan	Yes	159	*Castilleja septentrionalis (*C. coccinea)*	northern paintbrush
a ' nana ' ganuck	No	344	*Onoclea sensibilis*	sensitive fern
a 'sawan; ana ' ganuck; nokomi ' skinun	No	238	*Athyrium angustum; a. filix-femina*	lady fern
aagimaak; wiisagaak	Yes	380	*Fraxinus nigra*	black ash
aandegopin	Yes	39	*Empetrum nigrum*	black crowberry
aandegopin	Yes	174	*Lycopus americanus (*L. asper)*	common water horehound
aandegopin	Yes	174	*Lycopus uniflorus (*L. asper)*	northern bugle weed
aditeminagaanwanzh (plant); atiteminagaawanzh (plant); aditemin (berry); atitemin (berry)	Yes	267	*Viburnum edule (*V. lentago)*	squashberry
aginiiminagaawanzh	Yes	225	*Rosa blanda*	wild rose
aginiiminagaawanzh	Yes	225	*Rosa palustris (*R. blanda)*	swamp rose
agobizowin	Yes	377	*Cypripedium reginae*	showy or queen's lady-slipper
agongosimin, -ag	Yes	217	*Melampyrum lineare*	cow-wheat
agongosimin, -an, -ag	Yes	326	*Maianthemum canadense*	Canada mayflower
agongosimin, -an, -ag	Yes	326	*Maianthemum trifolium (M. canadense)*	false mayflower
agwingosibag; agongosibag	Yes	334	*Streptopus lanceolatus; S. roseus*	rose twisted-stalk
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. (*S. canadensis)*	goldenrods
ajidamoowaanow; waabigwan	Yes	93	*Achillea millefolium*	yarrow
ana ' ganuck	No	378	*Dryopteris cristata*	crested shield fern
ana ' ganuck	No	378	*Dryopteris fragrans; D. intermedia; D. marginalis (*D. cristata)*	woodferns
anagone ' wuck	No	166	*Glyceria borealis, G. striata (*G.canadensis)*	manna grasses
anagone ' wuck	No	166	*Glyceria canadensis*	rattlesnake grass
aniibimin	Yes	204	*Vaccinium macrocarpon*	large cranberry
animozid	Yes	323	*Hepatica americana*	round-lobed hepatica

Appendix 4.1. Crosswalk between Ojibwe names and scientific and English names alphabetized by Ojibwe names (continued)

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
aninaatig, -oog	Yes	270	*Acer saccharum*	sugar maple
apaakozigan; miskwaabiimag	Yes	18	*Arctostaphylos uva-ursi*	bearberry
apakwanagemag; bapakwanagemag; zhingobiins; zhingwaak	Yes	219	*Pinus resinosa*	red pine
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
bagaan, -ag; bagaanens; bagaanimizh; bagaanak	Yes	243	*Corylus cornuta*	beaked hazelnut
bagwajipin, iig; baasibagak	Yes	249	*Lathyrus ochroleucus*	pale vetchling
bawa'iminaan; gozigwaakomin, -ag	Yes	329	*Prunus pensylvanica*	pin cherry
bebezhigooganshii-mashkiki	Yes	172	*Lathyrus japonicus (*L. palustris)*	beach pea
beemsquandawish	No	58	*Spiranthes romanzoffiana*	hooded ladies'-tresses
bezhigoojiibik; ozaawaaskoniins	Yes	290	*Geranium bicknellii (*G. maculatum)*	northern crane's-bill
bibigwewanashk, -oon	Yes	167	*Heracleum maximum (H. lanatum)*	cow-parsnip
bine ' mikci	No	187	*Andromeda glaucophyllia*	bog-rosemary
bine(wi)bag	Yes	223	*Pyrola americana (P. rotundifolia)*	round-leaved pyrola
bine(wi)bag; gidagi-bineobag; mashkiigojiibik	Yes	199	*Comarum palustre (Potentilla palustris)*	marsh cinquefoil
bine(wi)min; bine(wi)man	Yes	294	*Mitchella repens*	partridge berry
binemizh; binemizhiins	Yes	189	*Betula pumila*	bog birch
biwee ' ckinuk; mesadi ' wackons	No	193	*Eriophorum angustifolium viridi-carinatum (*E. vaginatum)*	green-keeled cotton-grass
biwee ' ckinuk; mesadi ' wackons	No	193	*Eriophorum vaginatum*	cotton-grass
cigona ' gan	No	250	*Dendrolycopodium dendroideum (*Lycopodium obscurum)*	tree clubmoss
doodooshaabonjiibik; zhiishiigwebik	Yes	254	*Prenanthes alba*	white lettuce
doodooshaaboo	Yes	361	*Lactuca biennis*	tall blue lettuce
gaagaagiwanzh; zesegaandag; zhingob; zhingob gaawaandag	Yes	382	*Picea mariana*	black spruce
gaagigebag	Yes	15	*Antennaria howellii (*A. neglecta)*	small pussytoes
gaagigebag	Yes	15	*Antennaria parlinii (*A. neglecta)*	smooth pussytoes

Appendix 4.1. Crosswalk between Ojibwe names and scientific and English names alphabetized by Ojibwe names (continued)

Ojibwe Name	Restored	Page	Scientific Name	English Name
gaagigebag	Yes	209	*Chimaphila umbellata*	pipsissewa
gaawaandag; gaawaandagwaatig; mina'ig; wadab; zesegaandag	Yes	327	*Picea glauca*	white spruce
gaie 'wuckuk	No	150	*Scirpus atrocinctus (S cyperinus)*	wool-grass
gaie 'wuckuk	No	150	*Scirpus atrovirens (*S. cyperinus)*	bulrush
gichi-ode'iminijiibik	Yes	25	*Drymocallis arguta (Potentilla a.)*	tall or prairie cinquefoil
gichi-ode'iminijiibik	Yes	49	*Potentilla norvegica*	rough cinquefoil
giizhigaandagizi; ogaawa/inzh	Yes	43	*Juniperus communis*	common or ground juniper
giizhik, -ag; gizhikens, -ag; giizhikenh	Yes	387	*Thuja occidentalis*	northern white-cedar
ginoozhewashk; ozawijiibik; zhiiwibag	Yes	127	*Rumex crispus*	curly dock
ginoozhewashk; ozawijiibik; zhiiwibag	Yes	127	*Rumex orbiculata (*R. crispus)*	great water 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
jasibonskok; aiankosing; gezibnusk; giji ' binusk	No	107	*Equisetum arvense*	common horsetail
jasibonskok; aiankosing; gezibnusk; giji ' binusk	No	107	*Equisetum palustre (*E. arvense)*	marsh horsetail
jasibonskok; aiankosing; gezibnusk; giji ' binusk	No	107	*Equisetum variegatum (*E. arvense)*	common horsetail
kokbenognik keya; sasgob-mins	No	54	*Salix spp. (*Salix exigua)*	willows
main 'gamuna 'tig; anigomiji ' minaga 'wunj	No	59	*Symphoricarpos albus var. albus*	snowberry
makizin	Yes	376	*Cypripedium acaule; Cypripedium arietinum (*C. calceolus)*	pink lady-slipper
makizin	Yes	376	*Cypripedium parviflorum (C. calceolus)*	yellow lady-slipper
makonagizh-ojiibik; makonagizhiijiibik; mi/agoosing ezhinnaagwak; midewijiibik	Yes	94	*Apocynum androsaemifolium*	spreading dogbane
mashkiigiminagaawanzh (plant); mashkiigimin (berry)	Yes	205	*Vaccinium oxycoccos*	small cranberry
mashkiigobag; mashkiikaang niibish; waabashkikiibag	Yes	196	*Rhododendron groenlandicum (Ledum g.)*	Labrador-tea
mashkiigwaatig	Yes	381	*Larix laricina*	tamarack
mashkode-miizhimizh; mitigomizh; wiisagi-mitigomizh	Yes	304	*Quercus rubra*	red oak

Appendix 4.1. Crosswalk between Ojibwe names and scientific and English names alphabetized by Ojibwe names (continued)

Ojibwe Name	Restored	Page	Scientific Name	English Name
mashkodepin	Yes	45	*Lilium philadelphicum*	wood lily
maskwi ' widzhi ' wiko 'kok	No	312	*Viola nephrophylla; V. renifolia (*V. canadensis)*	violets
me -skwana 'kuk bu ' giso ' win; maeskwanakukbugisowin	No	162	*Eutrochium maculatum (Eupatorium m.)*	Joe-pye-weed
midodjidamo ' anuk	No	17	*Turritis glabra (Arabis glabra)*	tower mustard
migiziibag; migiziwibag; naemgosibag	Yes	237	*Eurybia macrophylla (Aster macrophyllus)*	big-leaved aster
miinagaawanzh (plant); miin, -an (berry)	Yes	227	*Vaccinium angustifolium*	low sweet blueberry
miinagaawanzh (plant); miin, -an (berry)	Yes	227	*Vaccinium myrtilloides (*V. angustifolium)*	Canada blueberry
miishijiiminagaawanzh, iig (plant); miishijiimin -ag (berry); zhaaboomin	Yes	385	*Ribes lacustre (* R. triste)*	swamp black currant
miskominagaawanzh; miskwiminagaawanzh; miskomin, -ag; miskimin, -ag	Yes	125	*Rubus hispidus; R. strigosus (R. idaeus)*	raspberries
miskoobimizh; miskwaabiimizh	Yes	340	*Cornus rugosa (*C. sericea)*	round-leaved dogwood
miskoobimizh; miskwaabiimizh	Yes	340	*Cornus sericea*	red-osier dogwood
miskwazi-wusk	No	47	*Physocarpus opulifolius*	ninebark
misodjidamo	Yes	17	*Arabis lyrata (*Arabis glabra)*	sand cress
misudidjeebik	No	234	*Aquilegia canadensis*	wild columbine
moosewijiibik	Yes	34	*Artemisia campestris*	wormwood
moozwemizh; moozomish	Yes	241	*Cornus alternifolia*	alternate-leaved dogwood
naaniibide'oodegin	Yes	303	*Polygonatum pubescens*	downy Solomon seal
nabagashk; wiikenh; zhaabozigan	Yes	170	*Iris versicolor*	wild blue flag
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
ne 'bone ' ankwe 'ak	No	341	*Geum aleppicum*	yellow avens
neezhodaeyun	No	325	*Linnaea borealis*	twinflower
ni ' begoskok; yaskobgedek	No	222	*Pyrola asarifolia, P. chlorantha; P. minor (*P. elliptica)*	pyrolas and shinleags
ni ' begoskok; yaskobgedek	No	222	*Pyrola elliptica*	large-leaved shinleaf
nikaunowuhnshk	No	190	*Calla palustris*	wild calla
niya 'wibukuk '; siabuksing, sasabwaksing; piskagamisag	No	163	*Eupatorium perfoliatum*	boneset
nookwezigan	Yes	71	*Erigeron strigosus; E. annus*	daisy fleabane
ode'imin	Yes	379	*Fragaria vesca*	woodland strawberry
ode'imin, -an; ode'iminijiibik	Yes	109	*Fragaria virginiana*	wild strawberry
ode'iminijiibik; zhakaagomin; zhaashaagomin; zhaashaagominens	Yes	319	*Cornus canadensis*	bunchberry
odiga'dimanido	No	208	*Ceanothus herbaceus*	New Jersey tea

Appendix 4.1. Crosswalk between Ojibwe names and scientific and English names alphabetized by Ojibwe names (continued)

Ojibwe Name	Restored	Page	Scientific Name	English Name
odjici ' gomin	No	362	*Lactuca canadensis*	tall lettuce
ogin, iig	Yes	390	*Crataegus douglasii (*C. coccinea)*	black hawthorn
oginiiminagaawanzh	Yes	82	*Rosa acicularis*	wild rose
ojiibikens; waashkobijiibikak; wiishkbobijiibik	Yes	316	*Actaea rubra*	red baneberry
okikaandag	Yes	218	*Pinus banksiana*	jack pine
omakakiiwidaasan; omakaiiwidaas	Yes	202	*Sarracenia purpurea*	pitcher plant
ozaawaajiibik; ozaawijiibik	Yes	375	*Coptis trifolia*	goldthread
ozaawashkojiibik	Yes	360	*Impatiens capensis*	spotted touch-me-not
ozagadigom	Yes	295	*Osmorhiza berteroi (*O. claytonii)*	sweet-cicely
ozagadigom	Yes	295	*Osmorhiza claytonii*	hairy sweet-cicely
ozhaashijiibik; ozhaashijiibikens; zhooshkijiibik	Yes	106	*Chamaenerion angustifolium; epilobium a.*	fireweed
oziisigobimizh	Yes	386	*Salix pedicellaris*	bog willow
papshkisiganak; papskatciksi ' gana 'tig	Yes	305	*Sambucus racemosa*	red-berried elder
sabankuk	No	215	*Lonicera dioica*	red honeysuckle
sasbob-mins; zasgomizh	No	348	*Salix discolor*	pussy willow
sewa 'komin	No	50	*Prunus pumila*	sand cherry
siba ' muckun	Yes	320	*Equisetum sylvaticum*	woodland horsetail
skizu-min	No	331	*Rubus pubescens*	dwarf raspberry
tikizidgeebikohnse	Yes	24	*Polygala paucifolia*	gay-wings
wa 'sawasni 'mike	No	175	*Myrica gale*	sweet gale
waabashkikiibag; mashkiigobagoons	Yes	191	*Chamaedaphne calyculata*	leatherleaf
waabigwan	Yes	104	*Conyza canadensis*	horseweed
waabigwan; baasibagak	Yes	14	*Anaphalis margaritacea*	pearly everlasting
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*	Kalm's hawkweed
waaboozobagoons; waaboozobanzh	Yes	42	*Gaultheria hispidula*	creeping-snowberry
waaboozojiibik	Yes	330	*Ribes glandulosum*	skunk currant
waboskiki ' minun	No	164	*Galium triflorum (*G. tinctorium)*	bedstraws
wadoop, -iin	Yes	339	*Alnus incana*	speckled alder
wadoop, -iin	Yes	339	*Alnus viridis (*A. incana)*	mountain alder
wapkadak; weekizigun	Yes	271	*Actaea pachypoda (*A. alba)*	doll's-eyes
wawiaeneegaeguhnsh	No	192	*Drosera rotundifolia*	round-leaved sundew
wewai ' bugug	Yes	338	*Viola labradorica (*V. conspersa)*	dog violet
wezaawaaskoneg	Yes	41	*Euthamia graminifolia*	flat-topped goldenrod
wezaawashkoneg	Yes	131	*Solidago juncea*	early goldenrod
wezauskwagmik; osawa ' skanet	No	245	*Diervilla lonicera*	bush-honeysuckle

Appendix 4.1. Crosswalk between Ojibwe names and scientific and English names alphabetized by Ojibwe names (continued)

Ojibwe Name	Restored	Page	Scientific Name	English Name
wi 'nibidja 'bibaga 'no	No	132	*Stellaria borealis (S. media)*	northern stichwort
wiigwaas, -an, -ag; wiigwaasaatig; wiigwaasi-mitig; wiigwaasimizh	Yes	239	*Betula papyrifera*	paper birch
wiinisiibag; wiinisiibagoons; wiinisiibagad	Yes	213	*Gaultheria procumbens*	wintergreen
wiiniziikens	Yes	157	*Symphyotrichum spp. (*S. puniceus)*	asters
wiinizik	Yes	277	*Betula alleghaniensis*	yellow birch
wiisagibag	Yes	233	*Anemone virginiana*	thimbleweed
zeewunubugushk	No	298	*Oxalis acetosella*	northern wood-sorrel
zhaabominagaawanzh (plant); zhaaboomin -ag (berry)			*Ribes oxyacanthoides*	northern gooseberry
zhaashaagobiimag	Yes	315	*Acer spicatum*	mountain maple
zhaashaagomin	Yes	275	*Arisaema triphyllum*	Jack-in-the-pulpit
zhigaagobag	Yes	371	*Symplocarpus foetidus*	skunk-cabbage
zhiishiiginewanzh, iig; zhiishiigimiiwanzh, -iig	Yes	229	*Acer rubrum*	red maple
zhingwaak	Yes	220	*Pinus strobus*	white pine

Appendix 4.2. Crosswalk between Ojibwe names and scientific and English names alphabetized by scientific 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
aninaatig, -oog	Yes	270	*Acer saccharum*	sugar maple
zhaashaagobiimag	Yes	315	*Acer spicatum*	mountain maple
ajidamoowaanow; waabigwan	Yes	93	*Achillea millefolium*	yarrow
wapkadak; weekizigun	Yes	271	*Actaea pachypoda (*A. alba)*	doll's-eyes
ojiibikens; waashkobijiibikak; wiishkbobijiibik	Yes	316	*Actaea rubra*	red baneberry
wadoop, -iin	Yes	339	*Alnus incana*	speckled alder
wadoop, -iin	Yes	339	*Alnus viridis (*A. incana)*	mountain alder
gozwgwaakominagaawanzh (plant); gozigwaakomin, -ag (berry); ozagadigom; zazigaakominagaawamzh	Yes	231	*Amelanchier arborea; A. bartramiana; A. interior; A. sanguinea; A. spicata (*A. laevis)*	serviceberries
waabigwan; baasibagak	Yes	14	*Anaphalis margaritacea*	pearly everlasting
bine ' mikci	No	187	*Andromeda glaucophyllia*	bog-rosemary
wiisagibag	Yes	233	*Anemone virginiana*	thimbleweed
gaagigebag	Yes	15	*Antennaria howellii (*A. neglecta)*	small pussytoes
gaagigebag	Yes	15	*Antennaria parlinii (*A. neglecta)*	smooth pussytoes
makonagizh-ojiibik; makonagizhiijiibik; mi/agoosing ezhinnaagwak; midewijiibik	Yes	94	*Apocynum androsaemifolium*	spreading dogbane
misudidjeebik	No	234	*Aquilegia canadensis*	wild columbine
misodjidamo	Yes	17	*Arabis lyrata (*Arabis glabra)*	sand cress
?bebaamaabiig; okaaadaak; waaboozojiibik	Yes	235	*Aralia nudicaulis*	wild sarsaparilla
(gi)chi-okaadaak; nezhikewang; okaadaak	Yes	274	*Aralia racemosa*	spikenard
apaakozigan; miskwaabiimag	Yes	18	*Arctostaphylos uva-ursi*	bearberry
zhaashaagomin	Yes	275	*Arisaema triphyllum*	Jack-in-the-pulpit
moosewijiibik	Yes	34	*Artemisia campestris*	wormwood
a 'sawan; ana ' ganuck; nokomi ' skinun	No	238	*Athyrium angustum; a. filix-femina*	lady fern
wiinizik	Yes	277	*Betula alleghaniensis*	yellow birch
wiigwaas, -an, -ag; wiigwaasaatig; wiigwaasi-mitig; wiigwaasimizh	Yes	239	*Betula papyrifera*	paper birch
binemizh; binemizhiins	Yes	189	*Betula pumila*	bog birch
nikaunowuhnshk	No	190	*Calla palustris*	wild calla

Appendix 4.2. Crosswalk between Ojibwe names and scientific and English names alphabetized by scientific names (continued)

Ojibwe Name	Restored	Page	Scientific Name	English Name
(g)odotaagaans; ?ziiginise; ziiginish (e)	Yes	35	*Campanula aparanoides (*C. rotundifolia)*	marsh bellflower
(g)odotaagaans; ?ziiginise; ziiginis (e)	Yes	35	*Campanula rotundifolia*	harebell
?wenabozhoo nookomis wiinizisan; ?nenzbozh ookomisan miinizisan	Yes	159	*Castilleja septentrionalis (*C. coccinea)*	northern paintbrush
odiga'dimanido	No	208	*Ceanothus herbaceus*	New Jersey tea
waabashkikiibag; mashkiigobagoons	Yes	191	*Chamaedaphne calyculata*	leatherleaf
ozhaashijiibik; ozhaashijiibikens; zhooshkijiibik	Yes	106	*Chamaenerion angustifolium; epilobium a.*	fireweed
gaagigebag	Yes	209	*Chimaphila umbellata*	pipsissewa
(gi)chi-mazaanashk	Yes	103	*Cirsium vulgare*	bull thistle
(g)odotaagaans	Yes	318	*Clintonia borealis*	bluebead-lily; corn-lily
bine(wi)bag; gidagi-bineobag; mashkiigojiibik	Yes	199	*Comarum palustre (Potentilla palustris)*	marsh cinquefoil
waabigwan	Yes	104	*Conyza canadensis*	horseweed
ozaawaajiibik; ozaawijiibik	Yes	375	*Coptis trifolia*	goldthread
moozwemizh; moozomish	Yes	241	*Cornus alternifolia*	alternate-leaved dogwood
ode'iminijiibik; zhakaagomin; zhaashaagomin; zhaashaagominens	Yes	319	*Cornus canadensis*	bunchberry
miskoobimizh; miskwaabiimizh	Yes	340	*Cornus rugosa (*C. sericea)*	round-leaved dogwood
miskoobimizh; miskwaabiimizh	Yes	340	*Cornus sericea*	red-osier dogwood
bagaan, -ag; bagaanens; bagaanimizh; bagaanak	Yes	243	*Corylus cornuta*	beaked hazelnut
ogin, iig	Yes	390	*Crataegus douglasii (*C. coccinea)*	black hawthorn
makizin	Yes	376	*Cypripedium acaule; Cypripedium arietinum (*C. calceolus)*	pink lady-slipper
makizin	Yes	376	*Cypripedium parviflorum (C. calceolus)*	yellow lady-slipper
agobizowin	Yes	377	*Cypripedium reginae*	showy or queen's lady-slipper
cigona ' gan	No	250	*Dendrolycopodium dendroideum (*Lycopodium obscurum)*	tree clubmoss
wezauskwagmik; osawa ' skanet	No	245	*Diervilla lonicera*	bush-honeysuckle
wawiaeneegaeguhnsh	No	192	*Drosera rotundifolia*	round-leaved sundew
gichi-ode'iminijiibik	Yes	25	*Drymocallis arguta (Potentilla a.)*	tall or prairie cinquefoil
ana ' ganuck	No	378	*Dryopteris cristata*	crested shield fern
ana ' ganuck	No	378	*Dryopteris fragrans; D. intermedia; D. marginalis (*D. cristata)*	woodferns
aandegopin	Yes	39	*Empetrum nigrum*	black crowberry
jasibonskok; aiankosing; gezibnusk; giji ' binusk	No	107	*Equisetum arvense*	common horsetail
jasibonskok; aiankosing; gezibnusk; giji ' binusk	No	107	*Equisetum palustre (*E. arvense)*	marsh horsetail
siba ' muckun	Yes	320	*Equisetum sylvaticum*	woodland horsetail

Appendix 4.2. Crosswalk between Ojibwe names and scientific and English names alphabetized by scientific names (continued)

Ojibwe Name	Restored	Page	Scientific Name	English Name
jasibonskok; aiankosing; gezibnusk; giji ' binusk	No	107	*Equisetum variegatum (*E. arvense)*	common horsetail
nookwezigan	Yes	71	*Erigeron strigosus; E. annus*	daisy fleabane
biwee ' ckinuk; mesadi ' wackons	No	193	*Eriophorum angustifolium viridi-carinatum (*E. vaginatum)*	green-keeled cotton-grass
biwee ' ckinuk; mesadi ' wackons	No	193	*Eriophorum vaginatum*	cotton-grass
niya 'wibukuk '; siabuksing, sasabwaksing; piskagamisag	No	163	*Eupatorium perfoliatum*	boneset
migiziibag; migiziwibag; naemgosibag	Yes	237	*Eurybia macrophylla (Aster macrophyllus)*	big-leaved aster
wezaawaaskoneg	Yes	41	*Euthamia graminifolia*	flat-topped goldenrod
me -skwana 'kuk bu ' giso ' win; maeskwanakukbugisowin	No	162	*Eutrochium maculatum (Eupatorium m.)*	Joe-pye-weed
ode'imin	Yes	379	*Fragaria vesca*	woodland strawberry
ode'imin, -an; ode'iminijiibik	Yes	109	*Fragaria virginiana*	wild strawberry
aagimaak; wiisagaak	Yes	380	*Fraxinus nigra*	black ash
waboskiki ' minun	No	164	*Galium triflorum (*G. tinctorium)*	bedstraws
waaboozobagoons; waaboozobanzh	Yes	42	*Gaultheria hispidula*	creeping-snowberry
wiinisiibag; wiinisiibagoons; wiinisiibagad	Yes	213	*Gaultheria procumbens*	wintergreen
bezhigoojiibik; ozaawaaskoniins	Yes	290	*Geranium bicknellii (*G. maculatum)*	northern crane's-bill
ne 'bone ' ankwe 'ak	No	341	*Geum aleppicum*	yellow avens
anagone ' wuck	No	166	*Glyceria borealis, G. striata (*G.canadensis)*	manna grasses
anagone ' wuck	No	166	*Glyceria canadensis*	rattlesnake grass
animozid	Yes	323	*Hepatica americana*	round-lobed hepatica
bibigwewanashk, -oon	Yes	167	*Heracleum maximum (H. lanatum)*	cow-parsnip
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*	Kalm's hawkweed
ozaawashkojiibik	Yes	360	*Impatiens capensis*	spotted touch-me-not
nabagashk; wiikenh; zhaabozigan	Yes	170	*Iris versicolor*	wild blue flag
(gi)chigamiiwashk, -oon	Yes	112	*Juncus tenuis*	path rush
giizhigaandagizi; ogaawa/inzh	Yes	43	*Juniperus communis*	common or ground juniper
doodooshaaboo	Yes	361	*Lactuca biennis*	tall blue lettuce
odjici ' gomin	No	362	*Lactuca canadensis*	tall lettuce
mashkiigwaatig	Yes	381	*Larix laricina*	tamarack
bebezhigooganshii-mashkiki	Yes	172	*Lathyrus japonicus (*L. palustris)*	beach pea
bagwajipin, iig; baasibagak	Yes	249	*Lathyrus ochroleucus*	pale vetchling
mashkodepin	Yes	45	*Lilium philadelphicum*	wood lily

Appendix 4.2. Crosswalk between Ojibwe names and scientific and English names alphabetized by scientific names (continued)

Ojibwe Name	Restored	Page	Scientific Name	English Name
neezhodaeyun	No	325	*Linnaea borealis*	twinflower
sabankuk	No	215	*Lonicera dioica*	red honeysuckle
aandegopin	Yes	174	*Lycopus americanus (*L. asper)*	common water horehound
aandegopin	Yes	174	*Lycopus uniflorus (*L. asper)*	northern bugle weed
agongosimin, -an, -ag	Yes	326	*Maianthemum canadense*	Canada mayflower
agongosimin, -an, -ag	Yes	326	*Maianthemum trifolium (M. canadense)*	false mayflower
agongosimin, -ag	Yes	217	*Melampyrum lineare*	cow-wheat
bine(wi)min; bine(wi)man	Yes	294	*Mitchella repens*	partridge berry
wa 'sawasni 'mike	No	175	*Myrica gale*	sweet gale
a ' nana ' ganuck	No	344	*Onoclea sensibilis*	sensitive fern
ozagadigom	Yes	295	*Osmorhiza berteroi (*O. claytonii)*	sweet-cicely
ozagadigom	Yes	295	*Osmorhiza claytonii*	hairy sweet-cicely
zeewunubugushk	No	298	*Oxalis acetosella*	northern wood-sorrel
miskwazi-wusk	No	47	*Physocarpus opulifolius*	ninebark
gaawaandag; gaawaandagwaatig; mina'ig; wadab; zesegaandag	Yes	327	*Picea glauca*	white spruce
gaagaagiwanzh; zesegaandag; zhingob; zhingob gaawaandag	Yes	382	*Picea mariana*	black spruce
okikaandag	Yes	218	*Pinus banksiana*	jack pine
apakwanagemag; bapakwanagemag; zhingobiins; zhingwaak	Yes	219	*Pinus resinosa*	red pine
zhingwaak	Yes	220	*Pinus strobus*	white pine
tikizidgeebikohnse	Yes	24	*Polygala paucifolia*	gay-wings
naaniibide'oodegin	Yes	303	*Polygonatum pubescens*	downy Solomon seal
azaadi(i); maanazaadi(i)	Yes	328	*Populus balsamifera*	balsam poplar
azaadi(i); azaadiins	Yes	253	*Populus tremuloides*	quaking aspen
gichi-ode'iminijiibik	Yes	49	*Potentilla norvegica*	rough cinquefoil
doodooshaabonjiibik; zhiishiigwebik	Yes	254	*Prenanthes alba*	white lettuce
baasibagak; nameswashk; namewashkoons	Yes	120	*Prunella vulgaris*	self-heal
bawa'iminaan; gozigwaakomin, -ag	Yes	329	*Prunus pensylvanica*	pin cherry
sewa 'komin	No	50	*Prunus pumila*	sand cherry
asa/isaweminagaawanzh (plant); asa/isawemin (berry)	Yes	256	*Prunus virginiana*	choke cherry
bine(wi)bag	Yes	223	*Pyrola americana (P. rotundifolia)*	round-leaved pyrola
ni ' begoskok; yaskobgedek	No	222	*Pyrola asarifolia, P. chlorantha; P. minor (*P. elliptica)*	pyrolas and shinleags
ni ' begoskok; yaskobgedek	No	222	*Pyrola elliptica*	large-leaved shinleaf
mashkode-miizhimizh; mitigomizh; wiisagi-mitigomizh	Yes	304	*Quercus rubra*	red oak

Appendix 4.2. Crosswalk between Ojibwe names and scientific and English names alphabetized by scientific names (continued)

Ojibwe Name	Restored	Page	Scientific Name	English Name
mashkiigobag; mashkiikaang niibish; waabashkikiibag	Yes	196	*Rhododendron groenlandicum (Ledum g.)*	Labrador-tea
baakwaanaatig; baakwaanimizh	Yes	28	*Rhus typhina*	staghorn sumac
waaboozojiibik	Yes	330	*Ribes glandulosum*	skunk currant
miishijiiminagaawanzh, iig (plant); miishijiimin -ag (berry); zhaaboomin	Yes	385	*Ribes lacustre (* R. triste)*	swamp black currant
zhaaboominagaawanzh (plant); zhaaboomin -ag (berry)			*Ribes oxyacanthoides*	northern gooseberry
oginiiminagaawanzh	Yes	82	*Rosa acicularis*	wild rose
aginiiminagaawanzh	Yes	225	*Rosa blanda*	wild rose
aginiiminagaawanzh	Yes	225	*Rosa palustris (*R. blanda)*	swamp rose
miskominagaawanzh; miskwiminagaawanzh; miskomin, -ag; miskimin, -ag	Yes	125	*Rubus hispidus; R. strigosus (R. idaeus)*	raspberries
skizu-min	No	331	*Rubus pubescens*	dwarf raspberry
ginoozhewashk; ozawijiibik; zhiiwibag	Yes	127	*Rumex crispus*	curly dock
ginoozhewashk; ozawijiibik; zhiiwibag	Yes	127	*Rumex orbiculata (*R. crispus)*	great water dock
sasbob-mins; zasgomizh	No	348	*Salix discolor*	pussy 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
omakakiiwidaasan; omakaiiwidaas	Yes	202	*Sarracenia purpurea*	pitcher plant
gaie 'wuckuk	No	150	*Scirpus atrocinctus (S cyperinus)*	wool-grass
gaie 'wuckuk	No	150	*Scirpus atrovirens (*S. cyperinus)*	bulrush
naubishkaukoot	No	129	*Sisyrinchium montanum*	mountain blue-eyed-grass
ajidamoowaanow; giiziso-mashkiki	Yes	349	*Solidago canadensis*	Canada goldenrod
wezaawashkoneg	Yes	131	*Solidago juncea*	early goldenrod
ajidamoowaanow; giiziso-mashkiki	Yes	349	*Solidago spp. (*S. canadensis)*	goldenrods
ah-o-je-mahg (adjimag)	No	333	*Sorbus americana; Sorbus decora*	mountain-ash
beemsquandawish	No	58	*Spiranthes romanzoffiana*	hooded ladies'-tresses
wi 'nibidja 'bibaga 'no	No	132	*Stellaria borealis (S. media)*	northern stichwort
agwingosibag; agongosibag	Yes	334	*Streptopus lanceolatus; S. roseus*	rose twisted-stalk
main 'gamuna 'tig; anigomiji ' minaga 'wunj	No	59	*Symphoricarpos albus var. albus*	snowberry
wiiniziikens	Yes	157	*Symphyotrichum spp. (*S. puniceus)*	asters
zhigaagobag	Yes	371	*Symplocarpus foetidus*	skunk-cabbage
ne 'bagandag '; pebamabid-singup	No	335	*Taxus canadensis*	yew
giizhik, -ag; gizhikens, -ag; giizhikenh	Yes	387	*Thuja occidentalis*	northern white-cedar
nawo 'buguk; wunukibugauh	No	336	*Trientalis borealis*	star-flower

Appendix 4.2. Crosswalk between Ojibwe names and scientific and English names alphabetized by scientific names (continued)

Ojibwe Name	Restored	Page	Scientific Name	English Name
ini 'niwin'dibige'gun; baushkindjibgwaun	No	308	*Trillium cernuum (*T. grandiflorum)*	nodding trillium
midodjidamo ' anuk	No	17	*Turritis glabra (Arabis glabra)*	tower mustard
apakway; apakweshk; apakweshkway; nabagashk	Yes	152	*Typha latifolia*	broad-leaved cat-tail
miinagaawanzh (plant); miin, -an (berry)	Yes	227	*Vaccinium angustifolium*	low sweet blueberry
aniibimin	Yes	204	*Vaccinium macrocarpon*	large cranberry
miinagaawanzh (plant); miin, -an (berry)	Yes	227	*Vaccinium myrtilloides (*V. angustifolium)*	Canada blueberry
mashkiigiminagaawanzh (plant); mashkiigimin (berry)	Yes	205	*Vaccinium oxycoccos*	small cranberry
aditeminagaanwanzh (plant); atiteminagaawanzh (plant); aditemin (berry); atitemin (berry)	Yes	267	*Viburnum edule (*V. lentago)*	squashberry
wewai ' bugug	Yes	338	*Viola labradorica (*V. conspersa)*	dog violet
maskwi ' widzhi ' wiko 'kok	No	312	*Viola nephrophylla; V. renifolia (*V. canadensis)*	violets

Appendix 5 - Incidental Rare Plant Observations

Throughout the course of the natural community surveys of Isle Royale, MNFI ecologists opportunistically documented rare plants. This appendix provides a table of the rare plants recorded. The table is organized by natural community type and site. The information can help direct systematic surveys to evaluate and map rare plant populations on Isle Royale.



Ram's head lady-slipper (*Cypripedium arietinum*, State Special Concern) recorded in the Lane Cove volcanic bedrock glade. Photo by Joshua G. Cohen.



Lingonberry (*Vaccinium vitis-idaea*, State Endangered) recorded in the Siskiwit Bay poor fen. Photo by Jesse M. Lincoln.

Appendix 5. Rare plants by natural community type and survey site

Scientific Name	Common Name	State Status	Natural Community Type	Site Name
Castilleja septentrionalis	northern paintbrush	Threatened	Sandstone Bedrock Glade	Houghton Point, Houghton Ridge
			Sandstone Bedrock Lakeshore	Houghton Point, Houghton Ridge
			Volcanic Bedrock Glade	Banksi Glade, The Glade Coast, Lake Whittlesey, Scoville Point
			Volcanic Bedrock Lakeshore	Minong Shores
Collinsia parviflora	blue-lips	Special Concern	Volcanic Bedrock Glade	Ojibway, Tobin Creek
Crataegus douglasii	black hawthorn	Special Concern	Volcanic Bedrock Glade	Lane Cove, Ojibway, Siskiwit Lake
Cryptogramma acrostichoides	American rock-brake	Threatened	Volcanic Bedrock Glade	Three Mile, Amygdaloid Island, Banksi Glade, The Glade Coast, Lake Whittlesey, Lane Cove, Malone Bay, Moose Lake, Mt. Saginaw, Ojibway, Scoville Point, Siskiwit Mine, Stone's Point, Tobin Creek, Tobin Harbor
			Volcanic Bedrock Lakeshore	Minong Shores
			Volcanic Cliff	Lake Whittlesey
Cypripedium arietinum	ram's head lady-slipper	Special Concern	Sandstone Bedrock Glade	Houghton Ridge
			Volcanic Bedrock Glade	Banksi Glade, Lane Cove, Mt. Saginaw, Ojibway, Siskiwit Lake, Tobin Creek
Draba arabisans	rock whitlow-grass	Special Concern	Volcanic Lakeshore Cliff	Stone's Point
Dryopteris fragrans	fragrant woodfern	Special Concern	Volcanic Bedrock Glade	Amygdaloid Island, Banksi Glade, Tobin Harbor
			Volcanic Bedrock Lakeshore	Minong Shores
			Volcanic Cliff	Chippewa Harbor, Lake Whittlesey, Moose Lightning
			Volcanic Lakeshore Cliff	Stone's Point
Empetrum nigrum	black crowberry	Threatened	Volcanic Bedrock Lakeshore	Sam Hill, Scoville Point
			Volcanic Lakeshore Cliff	North Shore, Scoville Point
Euphrasia hudsoniana	eyebright	Threatened	Sandstone Bedrock Lakeshore	Houghton Point, Houghton Ridge
			Volcanic Bedrock Lakeshore	Minong Shores
Euphrasia nemorosa	eyebright	Threatened	Volcanic Bedrock Lakeshore	Scoville Point
			Volcanic Lakeshore Cliff	Scoville Point
Huperzia appressa; h. appalachiana	mountain fir moss	Endangered	Volcanic Bedrock Lakeshore	Minong Shores, Scoville Point
			Volcanic Lakeshore Cliff	Scoville Point
Lonicera involucrata	black twinberry	Threatened	Boreal Forest	Houghton Ridge
Luzula parviflora	small-flowered wood rush	Threatened	Boreal Forest	Huginnin Cove
Parnassia palustris	marsh grass-of-Parnassus	Threatened	Patterned Fen	Feldtmann Fen
			Poor Fen	Sumner Lake and Newt Lake
Pinguicula vulgaris	butterwort	Special Concern	Sandstone Bedrock Lakeshore	Malone Bay, Wright Island
			Volcanic Bedrock Lakeshore	Minong Shores, Mott Island, Sam Hill, Scoville Point, Stone's Point
			Volcanic Cobble Shore	Huginnin Cove
			Volcanic Lakeshore Cliff	North Shore, Scoville Point, Stone's Point
Poa alpina	Alpine bluegrass	Threatened	Volcanic Bedrock Glade	Stone's Point
			Volcanic Bedrock Lakeshore	Stone's Point
			Volcanic Lakeshore Cliff	Stone's Point

Appendix 5. Rare plants by natural community type and survey site (continued)

Scientific Name	Common Name	State Status	Natural Community Type	Site Name
Poa interior; p. glauca	bluegrass	Special Concern	Sandstone Bedrock Glade	Houghton Point
			Volcanic Bedrock Glade	Three Mile, Amygdaloid Island, Stone's Point, Tobin Harbor
Potentilla litoralis; p. pensylvanica	prairie cinquefoil	Threatened	Sandstone Bedrock Lakeshore	Malone Bay
			Volcanic Bedrock Glade	Stone's Point
			Volcanic Bedrock Lakeshore	Stone's Point
Prosartes trachycarpa	northern fairy-bells	Threatened	Boreal Forest	Huginnin Cove
			Volcanic Bedrock Glade	Moose Lightning
Pyrola minor	lesser pyrola	Special Concern	Boreal Forest	Houghton Ridge
Ranunculus rhomboideus	prairie buttercup	Threatened	Sandstone Bedrock Glade	Houghton Ridge
			Volcanic Bedrock Glade	The Glade Coast, Lane Cove, Malone Bay, Moose Lake, Tobin Harbor
Ribes oxyacanthoides	northern gooseberry	Special Concern	Sandstone Bedrock Glade	Houghton Ridge
			Volcanic Bedrock Glade	Lake Whittlesey, Stone's Point
Sagina nodosa	pearlwort	Threatened	Volcanic Bedrock Lakeshore	Minong Shores, Scoville Point
Saxifraga paniculata	lime-encrusted saxifrage	Threatened	Sandstone Bedrock Lakeshore	Malone Bay
			Sandstone Lakeshore Cliff	Malone Bay
			Volcanic Bedrock Lakeshore	Minong Shores, Mott Island, Stone's Point
			Volcanic Lakeshore Cliff	Minong Shores, Mott Island, North Shore
Saxifraga tricuspidata	prickly saxifrage	Threatened	Volcanic Bedrock Glade	Stone's Point
			Volcanic Bedrock Lakeshore	Scoville Point
			Volcanic Lakeshore Cliff	Scoville Point, Stone's Point
Trisetum spicatum	downy oatgrass	Special Concern	Sandstone Bedrock Glade	Houghton Point
			Sandstone Bedrock Lakeshore	Houghton Point, Houghton Ridge, Malone Bay
			Sandstone Lakeshore Cliff	Houghton Point
			Volcanic Bedrock Glade	Amygdaloid Island, Glade of Ages, Scoville Point
			Volcanic Bedrock Lakeshore	Minong Shores, Mott Island, Scoville Point
			Volcanic Lakeshore Cliff	Amygdaloid Island, Minong Shores, Mott Island, North Shore, Scoville Point, Stone's Point
Vaccinium cespitosum	dwarf bilberry	Threatened	Volcanic Bedrock Glade	Banksi Glade
Vaccinium uliginosum	Alpine bilberry	Threatened	Volcanic Bedrock Glade	Stone's Point
			Volcanic Bedrock Lakeshore	Scoville Point, Stone's Point
			Volcanic Lakeshore Cliff	Mott Island, Scoville Point, Stone's Point
Vaccinium vitis-idaea	lingonberry	Endangered	Poor Fen	Siskiwit Bay
Viburnum edule	squashberry	Threatened	Boreal Forest	Chippewa Harbor, Houghton Ridge, Starvation Point
			Sandstone Bedrock Glade	Houghton Point, Houghton Ridge
			Sandstone Bedrock Lakeshore	Houghton Point, Houghton Ridge, Malone Bay, Wright Island
			Sandstone Cobble Shore	Wright Island
			Volcanic Bedrock Glade	Three Mile, Amygdaloid Island, The Glade Coast, Lane Cove, Malone Bay, Stone's Point
			Volcanic Bedrock Lakeshore	Minong Shores, Scoville Point, Stone's Point
			Volcanic Cliff	Chippewa Harbor, Lake Whittlesey
			Volcanic Lakeshore Cliff	Amygdaloid Island, North Shore, Stone's Point