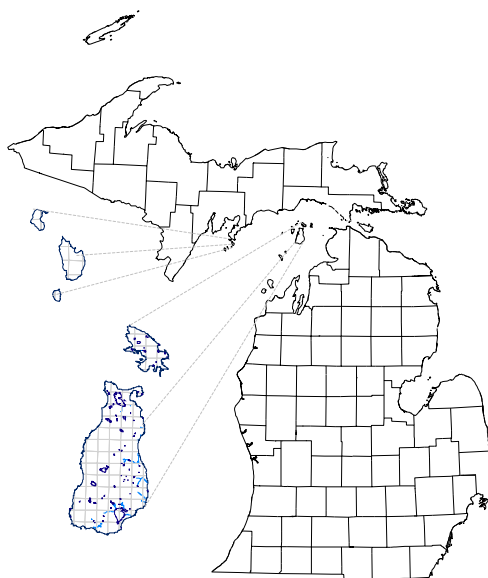




## BIOLOGICAL INVENTORY FOR CONSERVATION OF GREAT LAKES ISLANDS: 1998 PROGRESS REPORT



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## Executive Summary

In 1998, Michigan Natural Features Inventory (MNFI) initiated a multi-year project to conduct biological inventories for the conservation of Great Lakes islands. The fundamental goal of this project is to systematically examine selected Great Lakes islands to elucidate their natural features and significant biodiversity areas, and then to convey this information in a form that can be used for landowner education and conservation planning purposes. The first year of the project concentrated solely on biological inventories, emphasizing animal, plant, and natural community surveys. From the Beaver Island archipelago, we selected Beaver and Garden islands for inventory; within the Garden Peninsula island group, Little Summer, Summer, and Poverty islands were selected. From the latter group, St. Martin Island was prioritized for inventory, but access was denied and this island was not surveyed.

Animal surveys were conducted on Beaver and Garden islands in May and August, focusing on the inventory of migratory birds and targeted insects and snails. Sixty-two bird species were observed during the study, of which 29 were long distance migrants, 23 species were short distance migrants, and 10 species were residents. Fifty-two bird species were observed at 31 point count sites during three days of surveys on Beaver Island, comprised of 22 species of long distance migrants, 22 species of short distance migrants, and 8 resident species. Thirty-three bird species were observed at 15 point count sites on Garden Island, consisting of 20 species of long distance migrants, 8 species of short distance migrants, and 5 resident species. For insects, targeted surveys were conducted on Beaver Island to determine the status of the State special concern (SC) aweme borer moth (*Papaipema aweme*) and the State threatened (T) Lake Huron locust (*Trimerotropis huroniana*). No borer moths were found during limited blacklighting surveys. Of nine sites surveyed on Beaver Island for Lake Huron locust, eight populations were found, seven of which constituted new occurrences. Several areas were examined for the red-legged spittle-

bug (*Prosapia ignipectus*, SC) and no occurrences were documented. Historical sites for the deepwater pondsnail (*Stagnicola contractus*, SC) were briefly surveyed; no collected shells were identified as those of this species.

Rare plant inventories and natural community reconnaissance were conducted on Beaver and Garden islands in late June and late August. Systematic inventories of the shoreline and selected interior areas resulted in a total of nine new rare plant occurrences (one of Pumpell's brome grass (*Bromus pumpellianus*, T), one of English sundew (*Drosera anglica*, SC), four of Pitcher's thistle (*Cirsium pitcheri*, T), and three of Lake Huron tansy (*Tanacetum huronense*, T). Detailed status and location information was obtained for twenty-two previously known rare plant occurrences throughout Beaver and Garden islands. A previously known occurrence of the state endangered (E) Michigan monkey-flower (*Mimulus glabratus* var. *michiganensis*), one of two on Beaver Island, was determined to be likely extirpated due to human disturbance on the shoreline in St. James Harbor. Several potential high quality examples of three natural community types (mesic northern forest, open dunes, and boreal forest) were delineated during reconnaissance for subsequent evaluation by staff ecologists.

Spring floristic inventories were conducted on Poverty, Summer, and Little Summer islands in the Garden Peninsula group, resulting in significant additions to the documented flora for each island. Additional location and status information were provided for previously documented rare plant occurrences. Among the new species documented for Little Summer Island were populations of climbing fumitory (*Adlumia fungosa*) and dwarf lake iris (*Iris lacustris*). On Summer Island, in addition to locating several new colonies for beauty sedge (*Carex concinna*) and dwarf lake iris, a new area of a globally rare alvar community was identified along the shore.

Formal natural community surveys took place in late August on Beaver and Garden

Islands. On Beaver Island, several new occurrences of open dunes were confirmed, in addition to a small but significant hemlock stand and a 20-30 acre tract of old-growth mesic northern forest. On Garden Island, surveys corroborated an outstanding example of boreal forest, a northern fen, and mesic northern forest, the latter co-dominated by red oak and thus possibly an artifact of Native American agriculture.

Projected work for 1999 includes continued inventories of Beaver and Garden islands and possibly natural community surveys and sampling on selected islands within the Garden Peninsula group. Inventories are targeted for

islands in northern Lake Huron, including Bois Blanc Island, Marquette and the La Salle islands in the Les Cheneaux chain, and Drummond Island. Aquatic zoology reconnaissance will form a new component of the project, with preliminary studies targeted for Beaver and Garden Island, and possible additional work in the Garden Peninsula group and on Drummond Island. The conservation planning phase of the island project will be initiated with the formation of focus groups to determine the most effective methods of conveying the results of biological inventory such that effective conservation of biodiversity can be achieved

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## Introduction

A considerable portion of the biological diversity unique to the Great Lakes is supported by the thousands of islands found within the region. As characterized by Soule (1993), “nowhere else does the combination of vast, interconnected, mid-continental bodies of freshwater and such a number and variety of islands occur.” The nearly 600 islands contained within Michigan’s border’s represent a critical part of this freshwater landscape, owing to their richness in variety of geography, geological origin, history, and biodiversity.

The intrinsic values of islands are well known. As detailed in an assessment of the biodiversity of Michigan islands, Soule (1993) discussed the importance of habitat for waterfowl, colonial nesting waterbirds, and neotropical migratory songbirds. Because of the relatively undisturbed and isolated nature of their habitat, islands may be especially important for neotropical migrants. Many species have become greatly diminished through the loss and fragmentation of mainland forest and grassland habitats throughout their summer and winter ranges, and migratory pathways have been similarly affected (M. Hamas, pers. comm.). Islands also provide significant habitat for numerous other species, including many rare plants and animals, several of which are endemic or largely restricted to the Great Lakes region. Due to their isolation, islands provide good examples of many Great Lakes-associated natural communities and ecosystems, and thus have potential to provide insights for understanding the consequences of human disturbance on the increasingly fragmented ecosystems of the mainland.

Conducting comprehensive biological inventories on Great Lakes islands is both timely and crucial to future conservation planning. Home building and construction along Great Lakes shorelines continues at an unprecedented pace, and islands, owing to their isolation and exclusivity, are particularly valued by developers. The increasing interest in tract projects, such as a large, golf-course

condominium complex proposed for North Fox Island, is indicative of the increasing pressure to develop Michigan islands, which are beginning to sustain the cumulative effects evident on the mainland (Olson & Soule 1998.) In contrast, the recent formation of the Great Lakes Island Project in the Department of Resource Development at Michigan State University, coordinated by doctoral candidate Ms. Karen Vigmostad, demonstrates the widespread concern for conserving islands and their biological as well as cultural resources. A 1996 meeting in Michigan concerning the initiation of this project induced several Great Lakes stakeholders to attend, including a wide variety of international partners. This ground-breaking meeting will be presented in an upcoming publication (Vigmostad et al. 1999, in press) summarizing, among other topics, strategies for conservation. Among the strategies, biological inventory was considered to be an essential and fundamental component.

Over approximately the past two decades Michigan Natural Features Inventory (MNFI) has systematically surveyed many natural communities and rare species found on or allied with Great Lakes islands. Early surveys included Bureau of Land Management (BLM) islands that were being considered for relinquishment to state ownership (Penskar & Ludwig 1981). Subsequent MNFI projects have included comprehensive surveys of several natural community types, such as coastal dune systems (Chapman et al. 1985, Reese et al. 1986), Great Lakes marshes (Albert et al. 1987, Albert et al. 1988, Albert et al. 1989), dune and swale complexes (Comer & Albert 1991, Comer & Albert 1993), lakeplain prairies (Comer et al. 1995a), and bedrock lakeshores (Albert et al. 1994, Albert et al. 1995, Albert et al. 1997). Additional inventories have focused on targeting unexplored or poorly known shoreline areas for endemic plant species to enhance the statewide database for environmental reviews and conservation planning (Penskar et al. 1993; Penskar et al. 1997). However, the vast majority of this

work has been directed toward completing inventories of mainland areas.

Using the island biodiversity assessment by Soule (1993), in conjunction with data obtained from recent inventories, MNFI has initiated a projected multi-year project to systematically target and inventory Michigan's most significant islands. Biological inventories will be followed by the dissemination of appropriate information to island communities such that stakeholders can be enabled to make effective conservation planning decisions, a project component that will begin in 1999. Because the full scope and approach of this project cannot be determined at its inception, we have focused our initial efforts

on two significant island assemblages in northern Lake Michigan. Within this biologically rich region, several Garden Peninsula islands (Little Summer, Summer, Poverty, and St. Martin) and two of the largest islands in the Beaver Island archipelago (Beaver and Garden islands) were selected as our first targets. Although emphasis was placed on planning and conducting standard field inventories, considerable efforts were directed toward learning the particular logistics of performing island surveys. We present here the progress report on the first year of our biological inventory for the conservation of Michigan's Great Lakes islands.

## Organization of Report

This report has been organized according to the three main components of the inventory: animal surveys, with an emphasis on migratory birds and rare invertebrates; plant inventories, focusing on Great Lakes shoreline endemics and the identification of intact coastal and interior habitats; and natural community surveys,

emphasizing the delineation and assessment of high quality natural communities. Methods, results, and discussion are provided separately for each of these components. A preliminary assessment of significant biodiversity areas and a brief description of projected work for 1999 surveys follow those sections.

## The Study Area

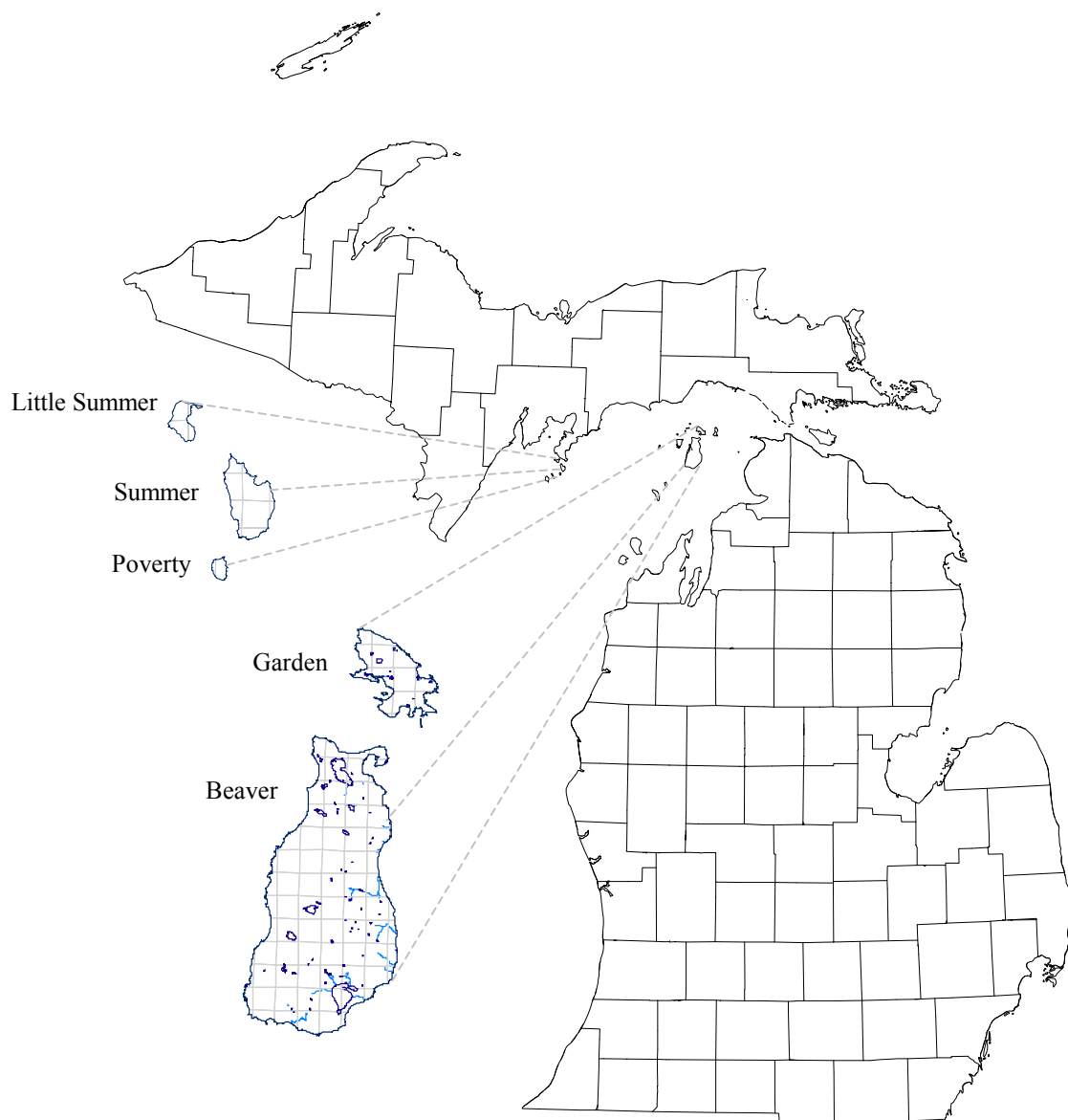
The principal study sites for the first year of island inventory included Beaver and Garden islands, two of nine islands that comprise the Beaver Island Group in northeast Lake Michigan (Figure 1). Located approximately 19 miles west of its nearest point in Emmet County on the Lower Peninsula mainland, Beaver is the largest of these islands, covering approximately 35,466 acres. Several thousand acres of the southern half of the island occur within the Mackinac and Jordan River State Forests. Public land thus comprises the majority of this region of the island. To the north about 1.25 miles at its closest point, lies Garden Island, the second largest of the group, covering approximately 4,372 acres and occurring entirely within the Beaver Islands State Wildlife Research Area. The remaining islands of the Beaver

archipelago, which were not visited during this inventory, are Gull, Hat, High, Hog, Squaw, Trout, and Whiskey island, variously located to the east, west and south of Beaver and Garden islands. These island range in size from 11.25 to 3,510 acres.

Several islands of the Garden Peninsula group were identified for floristic inventory, consisting of (from north to south) Little Summer, Summer, Poverty, and St. Martin islands (Fig. 1). St. Martin Island, the southernmost island of the group about 10 miles southwest of Fairport, was identified as a survey site but could not be accessed, and is not depicted. Little Summer Island, occurring about one mile directly southwest of the city of Fairport at the tip of the Garden Peninsula, is

approximately 600 acres in size, with less than 100 acres contained within Lake Superior State Forest. Summer Island, the largest of the Garden Peninsula group, lies about 2.5 miles south of Fairport, and is more than 2200 acres in size, approximately 1000 acres of which are Lake Superior State Forest land. Poverty Island

is a nearly 200 acre island that lies within the Lake Superior State Forest, and also includes federal land associated with a former lighthouse facility. Although currently within state ownership, Poverty Island may ultimately be transferred to the U.S. Fish and Wildlife Service refuge system.



**Figure 1. Location of study areas in northern Lake Michigan**



## Methods for Animal Surveys

Neotropical migratory birds and rare invertebrates endemic or largely restricted to the Great Lakes region were the primary targets of animal surveys on Beaver and Garden Islands (Figures 2 and 3). The Natural Heritage Biological and Conservation Database (BCD) was consulted for known occurrences of rare animal species associated with these islands. Information on various species was gathered by consulting expert zoologists and wildlife biologists, pertinent unpublished reports, and a variety of published sources. Survey sites for each target species or group were selected based upon historical occurrence records, air photo interpretation, current land cover maps, and by consulting with individuals knowledgeable about the islands' flora and fauna. In addition, MNFI ecologists and botanists identified poten-

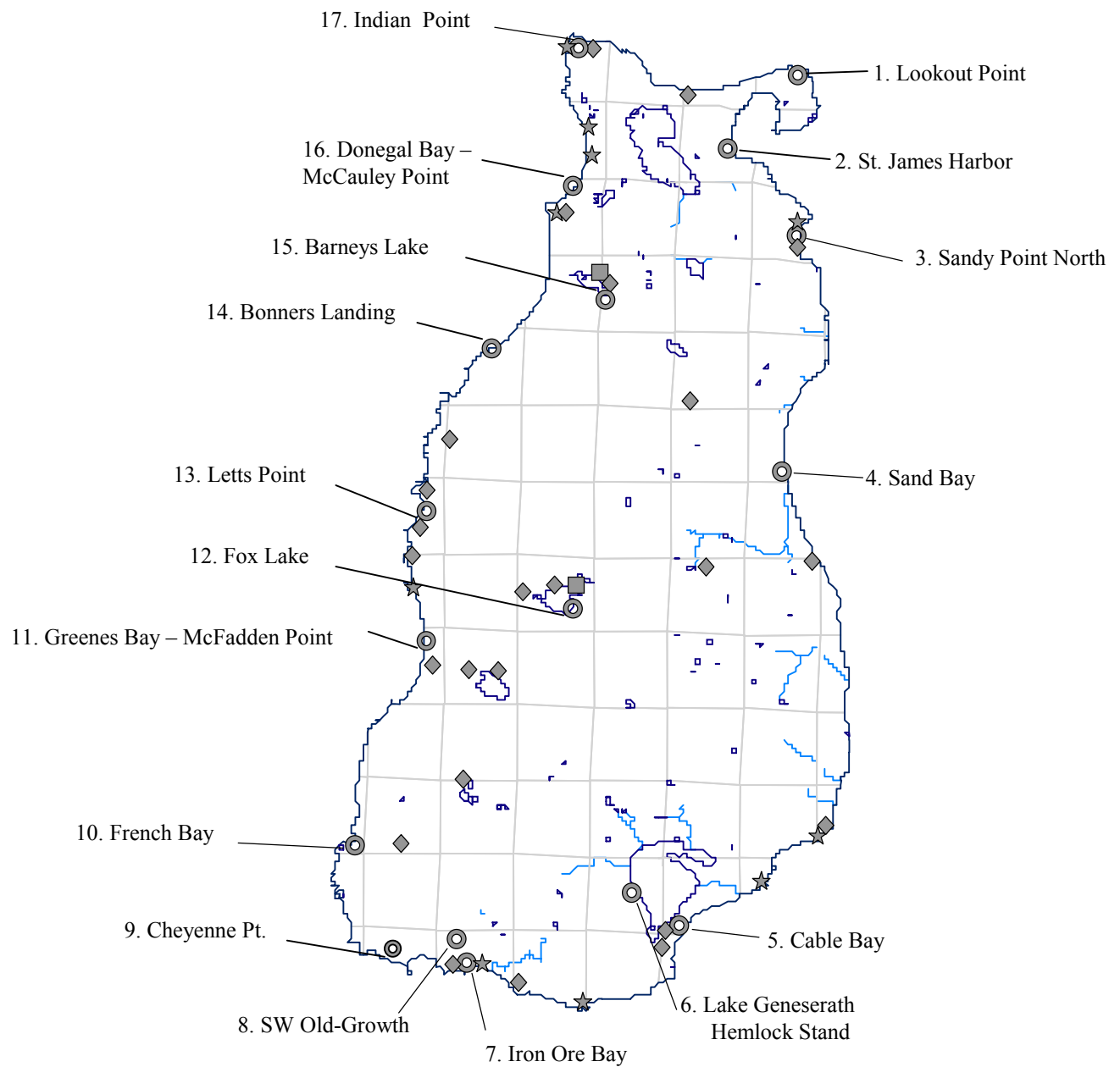
tial survey sites. A field schedule was developed based on prior Michigan observation and collection dates for each animal group or species, and the extent of suitable habitat. Survey techniques varied according to species and are described in the following sections. Incidental observations of listed species, which have been designated under the federal and/or state Endangered Species Acts as endangered, threatened, or special concern status, were noted by all project staff when they occurred. Data from all sightings of listed animal species were recorded on MNFI field forms, including numbers of individuals observed and the extent and quality of occupied habitat. These data were then entered into the BCD. In addition, all birds species observed during spring migration were recorded.

### *Birds*

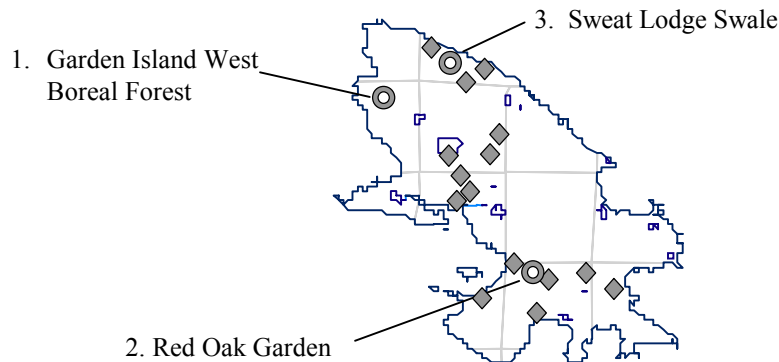
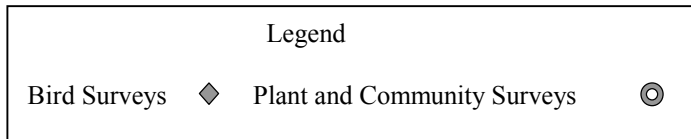
The Great Lakes shorelines serve as important migration corridors for large concentrations of migrant landbirds (Beebe 1933, Perkins 1964, Hessel et al. 1992). Great Lakes islands may act as focal points for migratory birds which tend to accumulate near ecological barriers (Moore and Simons 1992). Scharf (1973) suggested that islands forming northward extensions of the Michigan mainland might concentrate migratory birds. He further hypothesized that islands in general act as attractants for nocturnal migrants caught over open water at dawn and that the island-hopping path is part of traditional or hereditary patterns of the birds. Scharf (1973) documents large numbers of passerines moving along the shorelines of North and South Manitou and South Fox Islands as part of a very large and important flyway. He remarks that it is surprising that Beaver Island has not been documented as an important migration area. Although previous studies have recorded the avifauna of Beaver Island (Hatt et al. 1948, Drew and Phillips 1964, Mahan 1969, Grudzien 1979), this survey further elucidates the role that Beaver Island and other islands in the Beaver archipelago may play in providing critical stop-over habitat to migratory birds.

Dr. Michael Hamas of Central Michigan University (CMU), Dr. James Gillingham of the CMU Biological Station on Beaver Island, and local birdwatchers Irmgard Neils, Donna Hardenberg and Marilyn Reed who live on Beaver Island, were consulted in selecting areas and in targeting the most appropriate time period to conduct surveys for migratory birds. Bird counts using the point count method were conducted using standard methodology as outlined by Ralph et al. (1993, 1995). All birds seen or heard within a 50-meter radius were tallied for 5 minutes. Birds seen or heard outside the 50-meter radius circle were noted also. Point counts were conducted at thirty-two different sites on Beaver Island and at fifteen sites on Garden Island in a variety of habitats (Table 1). Spring bird counts were conducted between sunrise and 1200 hr on 14-16 May 1998 on Beaver Island and 17-18 May 1998 on Garden Island. All counts were conducted when there was no precipitation and little or no wind. Surveys began immediately after the observer arrived at the location. Field staff conducting the point counts were able to identify Michigan birds by sight and sound. Only one observer counted birds at each site. Point counts were

Legend			
Bird Survey Sites	◆	Insect Survey Sites	★
Snail Survey Sites	■	Plant and Community Survey Sites	○



**Figure 2. Sites visited on Beaver Island noted by type of survey. Site summaries are provided for numbered sites.**



**Figure 3. Garden Island Survey Sites by type. Site summaries are included for numbered sites.**

conducted at least 250 m apart to ensure that each bird was counted only once. Standard field forms for point counts were used.

The federally endangered piping plover (*Charadrius melodus*), and the state threatened common loon (*Gavia immer*) are known to occur on Beaver Island. Although they were not

targeted for survey, their presence or absence was noted during spring surveys for Neotropical migratory birds. Areas of cobble beach habitat along Donegal Bay where piping plovers have a history of occurrence were surveyed on 15 May 1998. Other historical piping plover sites were not surveyed.

### ***Insects***

The aweme borer (*Papaipema aweme*) is an extremely rare noctuid moth known from only four sites globally. It was collected in 1925 on Beaver Island (Moore 1930), and has not been documented since, despite a survey in 1987 and 1988 (Profant 1991). No rangewide surveys have been conducted for this species and this is the only known Michigan record. Virtually nothing is known about the life history of this species. Based on collection locations it is believed to be associated with the dune formations of lakes (present day or glacial) or adjacent wetlands (Profant 1991).

Blacklighting for *Papaipema aweme* was conducted using standard light trapping methods at three sites on Beaver Island on 17-19 August

1998. These sites include McFadden Point, McCauley Point and Mount Pisgah, all of which are located on the west side of the island. Sites were located adjacent to dune formations and targeted a variety of microhabitats located within these dune communities. Light trapping was conducted with a standard 1500-watt mercury-vapor light and a 15-watt UV black-light powered by portable Honda generator. A 2 x 2 meter metal conduit frame supporting a large white sheet was used as a collecting surface. Collection periods generally started at sunset (about 2000 hr) and lasted for 4 - 6 hr. Insects collected from the sheet were transferred to an ethyl acetate-charged killing jar and later transferred to a zip-lock plastic bag and placed into a

cooler. Bagged samples were then frozen until they could be processed. At a later date, insects were identified and prepared following standard insect collection techniques. Prepared specimens were identified to genus or species using published references.

The Lake Huron locust (*Trimerotropis huroniana*) is a Great Lakes endemic known only from high quality, sparsely vegetated coastal sand dunes of Michigan, Wisconsin and Ontario. It is presently listed as State threatened and has been recommended to the U.S. Fish and Wildlife service for consideration as a federally listed species. Previous surveys for this species on Beaver Island have been restricted to the northeastern portion of the island between St. James and the Central Michigan University Biological Station. Survey sites for this study included high quality open dune communities on Beaver Island near Indian Point, McFadden Point, Donegal Bay Park, McCauley Point, Cable Bay North, Little Sandy Bay, the Karl Erber Nature Preserve, Iron Ore Bay and open dunes at the southernmost tip of the island.

The deepwater pondsnail (*Stagnicola contractus*) is endemic to Michigan and is only known from four sites. Live individuals have been found at only a single site, Higgins Lake, Roscommon County, in *Chara* at depths of approximately 33 feet (10 m) (Burch 1994). Two of the historical locations for this species occur on Beaver Island. Specimens were taken

Surveys were conducted between 1000-1800 hr on 17-19 August 1998, by walking through areas of suitable habitat and searching for adults. At new locations, voucher specimens were collected with an aerial net.

Large areas of little bluestem (*Andropogon scoparius*) in large open dune systems at Iron Ore Bay and McFadden Point on Beaver Island were sampled with a sweepnet to determine the presence of red-legged spittlebug (*Prosapia ignipectus*). This is a species of special concern in Michigan and is associated with native grasses in jack pine barrens, lakeplain prairies, prairie fens, and alvars. Standard samples consisted of sixty sweeps of a sweepnet, with one swing taken with each step as the collector walked. The contents of the net were emptied into a large killing jar charged with ethyl acetate, which was then transferred to a zip-lock plastic bag and placed into a cooler. Bagged samples were frozen until they could be sorted and processed. Standard MNFI field forms were completed in the field for all surveys.

### ***Snails***

from the shorelines of Fox Lake and Barneys Lake in 1939 and 1940. These lakes were briefly surveyed on 19 August 1998. Shoreline areas were searched and dead snail shells were collected. These shells were sent to University of Michigan Museum of Zoology for identification.

## **Results of Animal Surveys**

### ***Birds***

Sixty-two bird species were observed as part of this study (Table 1). Twenty-nine species can be classified as long distance migrants (birds that winter south and breed north of the Tropic of Cancer), 23 species are short distance migrants (birds that winter in the southern U.S. and northern Mexico and breed in the U.S. and Canada), and 10 species can be considered resi-

dents (birds that winter and breed in the same region).

Fifty-two bird species were observed at thirty-one sites where point counts were conducted during three days of surveys on Beaver Island (Table 1). Of these, 22 species are long-distance migrants, 22 species are short-distance migrants and 8 species are residents.

Thirty-three bird species were observed at fifteen sites where point counts were conducted during two days of surveys on Garden Island

(Table 1). Of these, 20 species are long-distance migrants, 8 species are short-distance migrants, and 5 species are residents.

### *Insects*

No aweme borer moths were found at the three sites where blacklighting was conducted on Beaver Island. With so few specimens known for this species it is difficult to predict with great accuracy the flight period for adult moths. The flight period is suspected to occur in the last two weeks of August but it is possible that we surveyed too late in the year based on the unusually warm spring and summer. In addition, sampling conditions were not optimal due to excessive wind speeds, therefore further survey work should be undertaken.

Early season field surveys by botany and zoology staff resulted in the identification of high quality open dunes with potential for Lake Huron locust populations. Of the nine sites surveyed for the grasshopper, populations were found at eight of these locations. Seven of these sites resulted in new occurrence records for this species and one site reconfirmed a previously known occurrence. No red-legged spittlebugs were found in the two areas that were sampled.

### *Snails*

No specimens of the deepwater pondsnail were found in the limited searches that were conducted. Other species that were collected include *Cameloma decisum*, *Elimia livescens*,

*Lymnaea stagnalis*, *Physa* sp. *Stagnicola elodes*, and *Stagnicola* sp. Identification of the *Stagnicola* specimens to species is pending.

**Table 1. Bird Species Recorded During Migration Point Counts on Beaver Island and Garden Island, Charlevoix County, Michigan, 1998.**

Common Name	Scientific Name	Beaver Island	Garden Island
<b>Long-distance Migrants:</b>			
Merlin	<i>Falco columbarius</i>	X	
Spotted Sandpiper	<i>Actitis macularia</i>	X*	
Veery	<i>Catharus fuscescens</i>		X
Gray-cheeked Thrush	<i>Catharus minimus</i>		X*
Least Flycatcher	<i>Empidonax minimus</i>	X	
Great Crested Flycatcher	<i>Myiarchus crinitus</i>	X*	
Eastern Kingbird	<i>Tyrannus tyrannus</i>	X*	
Gray Catbird	<i>Dumatella carolinensis</i>	X	X
Red-eyed Vireo	<i>Vireo olivaceus</i>	X	X
Tennessee Warbler	<i>Vermivora peregrina</i>		X
Nashville Warbler	<i>Vermivora ruficapilla</i>	X	X
Northern Parula	<i>Parula americana</i>	X	
Yellow Warbler	<i>Dendroica petechia</i>	X	
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	X	X
Magnolia Warbler	<i>Dendroica magnolia</i>	X	X

Common Name	Scientific Name	Beaver Island	Garden Island
<b>Long-distance Migrants continued:</b>			
Cape May Warbler	<i>Dendroica tigrina</i>		X*
Black-throated Blue Warbler	<i>Dendroica caerulescens</i>	X	X
Black-throated Green Warbler	<i>Dendroica virens</i>	X	X
Blackburnian Warbler	<i>Dendroica fusca</i>	X	X
Palm Warbler	<i>Dendroica palmarum</i>	X*	
Black-and-white Warbler	<i>Mniotilta varia</i>	X	X
American Redstart	<i>Setophaga ruticilla</i>	X	X
Ovenbird	<i>Seiurus aurocapillus</i>	X	X
Common Yellowthroat	<i>Geothlypis trichas</i>		X
Wilson's Warbler	<i>Wilsonia pusilla</i>		X
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	X	X
Indigo Bunting	<i>Passerina cyanea</i>		X*
Chipping Sparrow	<i>Spizella passerina</i>	X	X
Baltimore Oriole	<i>Icterus galbula</i>	X	
<b>Short-distance Migrants:</b>			
Common Loon	<i>Gavia immer</i>	X*	
Great Blue Heron	<i>Ardea herodias</i>	X	
Common Merganser	<i>Mergus merganser</i>	X*	
Turkey Vulture	<i>Cathartes aura</i>	X	
Sandhill Crane	<i>Grus canadensis</i>	X*	
Common Snipe	<i>Gallinago gallinago</i>		X*
Killdeer	<i>Charadrius vociferus</i>	X	
Caspian Tern	<i>Sterna caspia</i>	X	
Brown Creeper	<i>Certhia americana</i>	X*	
Winter Wren	<i>Troglodytes troglodytes</i>	X	X
Ruby-crowned Kinglet	<i>Regulus calendula</i>	X	X
Hermit Thrush	<i>Catharus guttatus</i>	X	
American Robin	<i>Turdus migratorius</i>	X	X
Yellow-rumped Warbler	<i>Dendroica coronata</i>	X	X
Eastern Towhee	<i>Pipilo erythrophthalmus</i>	X	
Savannah Sparrow	<i>Passerculus sandwichensis</i>	X	
Song Sparrow	<i>Melospiza melodia</i>	X	X
White-throated Sparrow	<i>Zonotrichia albicollis</i>	X	X
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>	X	
Red-winged Blackbird	<i>Abelais phoenixus</i>	X	X *
Eastern Meadowlark	<i>Sturnella magna</i>	X	
Brown-headed Cowbird	<i>Moluthrus ater</i>	X	
American Goldfinch	<i>Carduelis tristis</i>	X	
<b>Residents:</b>			
Bald Eagle	<i>Haliaeetus leucocephalus</i>		X*
Ruffed Grouse	<i>Bonasa umbellus</i>	X*	

Common Name	Scientific Name	Beaver Island	Garden Island
<b>Residents continued:</b>			
Wild Turkey	<i>Meleagris gallopavo</i>	X	
Hairy Woodpecker	<i>Picoides villosus</i>		X*
Blue Jay	<i>Cyanocitta cristata</i>	X	X
American Crow	<i>Corvus brachyrhncos</i>	X*	
Black-capped Chickadee	<i>Parus atricapillus</i>	X	X
Red-breasted Nuthatch	<i>Sitta canadensis</i>	X	X*
White-breasted Nuthatch	<i>Sitta carolinensis</i>	X	
Evening Grosbeak**	<i>Coccothraustes vespertinus</i>	X	

\* Species observed outside the 50-meter radius circle or observed after the point count.

\*\* Winter resident only.

## Discussion of Animal Surveys

Results from our 1998 survey of spring migratory birds on Beaver and Garden islands can only be regarded as preliminary. Ideally, multi-year surveys would be needed to evaluate total bird use and use of various habitats, as well as consistency of that use from year to year with varying weather patterns. Based on our first year's work, survey results indicate that Beaver and Garden islands provide important stopover habitat for spring migratory birds. It is interesting to note that spring migrants bypassed many traditional stopover sites on the Michigan mainland in 1998 because of unfavorable weather conditions. Yet, an abundance and diversity of migrating birds were observed on both Beaver and Garden islands. Factors that likely contribute to the distribution of migratory birds using these islands as stopover sites include weather conditions, human use patterns, abundance of potential prey, predation pressure, and the composition, structure, and successional stage of the vegetation. It is noteworthy that swarming insects were observed in some beach areas during point counts. Emerging aquatic insects along the shoreline may provide migratory birds a significant food resource in the spring when terrestrial insects may be more scarce. Trees and shrubs lining the shoreline may provide an excellent foraging substrate for neotropical migratory birds feeding on these

insects. Further surveys are needed to determine which habitats on the islands are most critical to migrating birds.

The black-throated blue warbler (*Dendroica caerulescens*) which was observed on both Beaver and Garden Island has been ranked by the bird conservation organization, Partners in Flight (PIF), as a species of moderately high priority for conservation action due to its very restricted wintering range. The PIF watch list includes those birds of the continental United States not already listed under the Endangered Species Act that warrant conservation attention. It will be important to determine whether the black-throated blue warbler nests on these islands and to identify critical stopover and/or breeding habitat for this species.

The state threatened merlin (*Falco columbaris*) was noted both singly and in pairs, hunting at four different locations on Beaver Island both in the spring and late summer. It is unclear whether these observations were of migrating merlins homing in on an abundant source of avian prey in the form of trans-lake migrants, or whether these sightings include nesting pairs. It is not known whether the state threatened common loon and bald eagle (*Haliaeetus leucocephalus*), observed during spring surveys, remained to nest on Beaver or Garden Island. One additional listed bird, the

state threatened Caspian tern (*Sterna caspia*), was noted during surveys on Beaver Island. This species has apparently nested continuously in the Beaver Island complex since at least early settlement times (Barrows 1912).

Surveys for the aweme borer moth are inconclusive due to the limited sampling effort and the less than optimal survey conditions. Although this species has not been reported in seventy-three years and may well be extinct on Beaver Island, more intensive surveys are needed. Additional surveys of high quality dune habitats on other islands and along the eastern shoreline of Lake Michigan would further clarify this species' status in Michigan.

Six of the eight new sites for the Lake Huron locust are located on the western or southern sides of the island. The western shoreline of the island has more vertical structure, higher dune ridges, and more dune blowouts than the eastern side of the island, which is lacking this vertical structure. The western and southern coasts of the island are subject to the prevailing winds from the southwest. This may result in shifting sands, which helps to keep the dunes open, thus maintaining habitat for the locust.

It is extremely significant to find so many new populations of the Lake Huron locust on Beaver Island. The high quality, large dune complexes at McFadden Point and Cable Bay North are especially noteworthy. The survey conducted in the open dune community at Little

Sandy Bay, a historical site for this species, was disappointing with only a very small population noted. This survey was done late in the day and it is possible that search conditions were not optimal. Although it is uncertain how long these populations can persist in small isolated pockets, remnant dune areas located in the midst of development can still provide critical habitat for this species.

Future research should include surveys for this species on the north side of the island, which has not been studied. The dune community at Iron Ore Bay, where a new population was discovered this year, requires further exploration. In addition, the CMU Biological Station, where this species was last observed in 1975, should be resurveyed. It would be informative to map locations of Lake Huron locust populations and determine the degree to which occupied sites are interconnected. This may help to determine whether the various locations should be considered one site or whether they should be viewed as a metapopulation. This analysis is essential in developing management and conservation strategies for the species.

More intensive surveys are needed to determine whether the deepwater pondsnail still occurs on Beaver Island, particularly at Barneys Lake which had a diverse snail assemblage. Survey techniques that target live specimens within the lake should be implemented in the future.

## Methods for Plant Surveys

Islands selected for plant field inventories were identified following examination of the Natural Heritage Biological and Conservation Database (BCD) and consultation with MNFI staff ecologists and other scientists. As in previous studies (Penskar et al. 1993, Penskar et al. 1997), our high priority targets were Great Lakes endemic plant species, most of which are associated with shoreline areas and natural communities such as open dunes, coastal rich conifer swamps, bedrock beaches, alvar, and

forest dune-swale complexes. However, emphasis was also placed on delineating notable interior natural communities. This was done both to identify significant potential rare plant habitats as well as to conduct a preliminary assessment for high quality community remnants for subsequent evaluation by MNFI ecologists. For the first year of island studies, our focus areas were identified as the Beaver Island archipelago and the Garden Peninsula islands. From these areas, we selected Beaver



and Garden islands (Charlevoix County) for targeted botanical surveys and reconnaissance (Figures 2 and 3). From the Garden Peninsula group, St. Martin, Poverty, Summer, and Little Summer islands (Delta County) were identified principally for detailed floristic studies. The latter group was selected to collaborate with similar inventories being conducted concurrently on the adjacent Door Peninsula islands in Wisconsin. Poverty and Summer

islands, and to some extent Little Summer Island, have been the focus of previous MNFI coastal zone inventories for targeted rare plants, rare animals, and high priority natural communities such as globally rare alvars (Albert et al. 1995). Conducting floristic investigations on these islands was thus determined to be the most useful effort at this time to assist in comprehensive biogeographic analyses of the Door Peninsula to Garden Peninsula region.

### ***Beaver and Garden Islands***

Copies of all occurrence records were compiled, and then location points and other data, such as precision codes and last observed dates, were transcribed onto USGS 7.5 minute topographic quadrangles for reference during field inventories. Occurrence records and maps were studied to identify significant gaps warranting survey, with a focus on shoreline regions. In general, gaps were considered to be areas displaying no records that appeared to have suitable habitat to support rarities. Occurrence records were also studied for their last observation date, location precision, sufficiency of population status information, and other relevant conservation data. Vaguely located occurrences, historical and relatively dated records, and populations for which there existed few data on extent, condition, and status were highlighted for inventory. Following compilation of the databases, black and white prints of MDNR 1:24,000 color infrared (CIR) aerial photos were gathered for field reference, ongoing interpretation, and ground-truthing. Complete CIR aerial photo flight lines for both islands were examined briefly in MDNR's remote sensing lab via stereoscope. Because the majority of our inventories were anticipated as taking place along shorelines, and our emphasis was on reconnaissance, detailed photo interpretation and community delineation were not felt to be necessary initially.

Early and late season field surveys were conducted from June 21-26 and August 16-21, 1998, by P. Higman and M. Penskar. On Beaver Island, early season inventories focused initially on reconnaissance to optimize coverage of the island and become familiarized with the range

of various habitats. Potential significant natural community sites, such as mature interior forest stands and high quality open dune areas, were tentatively identified for further evaluation in collaboration with staff ecologists. We also identified public access areas or private sites for which access could be sought.

Following initial reconnaissance efforts, a systematic inventory of the shoreline of Beaver Island was begun, emphasizing identified survey gaps and poorly known populations. When rare plant occurrences were located, standard MNFI field forms were initiated. Information was gathered concerning associated species, threats, the presence of exotic species, the extent of available habitat, and artificial disturbance features, such as evidence of off-road-vehicle (ORV) use. The extent of all areas surveyed and the specific locations of rare plant populations were marked on field topographic maps. Where appropriate, photographs were taken of representative areas, and when necessary, occasional plant specimens were taken for determination. Manuals consulted for identification, taxonomy, and nomenclature were primarily Voss (1996, 1985, 1972) and Holmgren (1998), the latter a companion guide for use with Gleason & Cronquist (1991). Garden Island was accessed via charter boat for a single field day in June and another in August, the latter day in the company of MNFI staff ecologists. June surveys on Garden Island focused on broad coverage of the northern half of the island via trails and mountain bikes. Representative areas of shoreline were walked and potentially significant natural community sites were delineated for subsequent review with MNFI ecologists. Late

season surveys in August focused on continuing systematic shoreline surveys and evaluating potentially high quality natural community sites on both islands with MNFI ecologists. These inventories were conducted in coordination with R. Corner and M. Kost. Natural community forms were initiated when a high quality community was identified.

Following field surveys, inventory data (MNFI field forms, field notes, photos, and topographic map notations) were compiled, reviewed, and summarized. New plant records were evaluated, given an element occurrence rank<sup>1</sup>, and then transcribed for mapping and

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<sup>1</sup> “Element occurrence rank”, noted basically as A, B, C, or D, is a natural heritage evaluation of the quality of the occurrence; an A-ranked occurrence is considered an exemplary, viable population, whereas

entry into the statewide heritage database. Known occurrences for which new status information was obtained were updated, ranked, and processed for the heritage database. Assistance was also provided to ecologists during the processing of natural community data. These data will eventually be exported to update the statewide MIRIS (Michigan Resource Information System) and CIWPIS (Coastal Inland Water Permit Information System) databases.

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D-ranked occurrences are those that are generally small, vulnerable to obvious threats and/or occur in degraded sites, and are not considered to be viable.

### ***Garden Peninsula Islands***

Floristic inventories of Poverty, Summer, and Little Summer islands were conducted from May 26-29, 1998 by E. Judziewicz. Despite considerable effort and negotiation, access to St. Martin Island -- the island most in need of inventory -- was ultimately denied for the purposes of this project<sup>2</sup>. However, despite this denial, data for St. Martin Island were sought during the compilation of information on this island group. Knowledge of previous floristic work conducted in this island group by such investigators as Fuller (1927) and Forzley et al. (1993), in addition to data obtained by MNFI during alvar surveys (Albert et al. 1995) indicated that spring surveys had strong merit. Because it was not possible to conduct multiple visits for each island, surveys in late-May were anticipated to provide the most data to augment previous work. Prior to surveys, information was compiled detailing the taxa documented for each island, based largely on specimens

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<sup>2</sup> With the exception of approximately 40 acres of federal property comprising the lighthouse grounds, the more than 1200 acre island is privately owned, the vast majority held by a group of Wisconsin residents identified as the St. Martin partnership.

deposited in Wisconsin and Michigan herbaria<sup>3</sup>. Species identified in various reports and publications, but apparently unsupported by voucher specimens, were also noted for potential documentation. Surveys on Poverty Island were conducted on May 26, for Summer Island from May 26-28, and on Little Summer Island on May 29.

Surveys were performed by meander searches of representative and targeted habitats, such as shorelines, mesophytic forests, limestone and dolomite outcrops including scarps, cliffs and alvars, shoreline glades, beach ridge and swale complexes, swamps, and mixed hardwood-conifer forests. In addition, disturbed areas were also highlighted to document exotic taxa as well as potential rare plant species such as climbing fumitory (*Adlumia fungosa*) that respond favorably to artificial disturbance. When new species were encountered, voucher specimens were obtained and placed in a plant press, with pertinent location and collection

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<sup>3</sup> The floristic survey of Michigan islands was conducted as part of a larger study by E. Judziewicz entitled “Flora and Vegetation of the Grand Traverse Islands (Lake Michigan), Wisconsin and Michigan”, manuscript in progress.

information recorded in a field notebook. Specimens that could not be identified in the field, such as some grasses and sedges, were selected for keying and subsequent herbarium determination where necessary. Surveys were also conducted to better ascertain the status and distribution of several listed species discovered in prior inventories. Locations of listed species were noted on copies of topographic maps, and information was recorded for completing MNFI

field forms for eventual transcription and data processing. Following field inventories, voucher specimens were tallied, determined as appropriate, and then labeled for accessioning at the University of Wisconsin Herbarium (WISC). Finally, a catalog of all vascular plants documented was compiled in a spreadsheet for comparison to several other Michigan and Wisconsin islands (Judziewicz, in prep).

## Results of Plant Surveys

### *Beaver and Garden Islands*

Results of rare plant surveys conducted on Beaver and Garden islands are presented in Tables 2 and 3. A total of 22 known rare plant occurrences representing six species (Pitcher's thistle, dwarf lake iris, Lake Huron tansy, Michigan monkey-flower, butterwort, and water shore-grass) were re-documented and substantively updated during early and late season inventories. Twenty-one of these occurrences were observed on Beaver Island. An occurrence of Michigan monkey-flower in St. James Harbor, where its specific location was well-known, was presumed to be extirpated based on the apparent destruction and modification of its habitat. For many occurrences that were relocated, significant expansions of their previously

known extent were recorded. In addition, population data were compiled such that the viability of all of these occurrences could be reliably evaluated and ranked. A total of nine new rare plant occurrences representing four species (Pitcher's thistle, English sundew, Lake Huron tansy, and Pumpell's brome grass) were documented, with all but two found on Beaver Island. In collaboration with MNFI staff ecologists, a total of eight new natural community occurrences representing four types (open dunes, northern fen, boreal forest, and mesic northern forest) were identified. Three community occurrences, each representing a different natural community type, were identified on Garden Island (Table 2).

### *Garden Peninsula Islands*

Surveys of Poverty, Summer, and Little Summer islands resulted in significant additions to their documented flora. For Poverty Island, the smallest island surveyed, 47 vascular plant species were added to the 173 reported by Forzley et al. (1993), representing a considerable increase in the known flora of this relatively small island. In addition, the well known alvar community occurring along the eastern shore of Poverty Island was thoroughly searched, resulting in a detailed mapping of several new colonies of Richardson's sedge (*Carex richardsonii*), a rare sedge known previously from only a limited area on the island. Summer Island, the largest island of the Garden

Peninsula group, was surveyed over portions of three days. Of the 390 documented number of plant species now known for the island, approximately 50-60 new species were tallied during this survey. Notable finds included the documentation of the grass *Trisetum melicoides* and striped maple (*Acer pensylvanicum*). Although neither species is included on the State list of threatened and endangered plants in Michigan, they occur on Summer Island at essentially their western range limit. No new rare plant species were documented for the island. However, intensive surveys during this floristic study resulted in the identification of a significant new area of alvar at the northern end

of the island. In addition, updated location and population information were obtained for the federal and state threatened dwarf lake iris and the state special concern beauty sedge (*Carex concinna*). For Little Summer Island, Judziewicz collected or observed 174 plant species, estimated to represent about two-thirds of the total flora of the island. Surveys were concentrated on the shoreline and within the block of state land in the island's center, where a rich mesic forest was found with notable spring ephemerals. Two new rare plant popula-

tions were documented during the floristic survey. On the eastern shore along the state land boundary, a small population of dwarf lake iris was discovered. In addition, a large population of the state special concern climbing fumitory (*Adlumia fungosa*) was found in disturbed dolomitic gravel along a new perimeter road near the state boundary, where artificial disturbance apparently unearthed a seed bank.

**Table 2. Rare plant and natural community sites inventoried during 1998 surveys of Beaver island.**

Site name	Known occurrences relocated and updated	New occurrences documented
1. Lookout Point		<i>Bromus pumpellianus</i> <i>Cirsium pitcheri</i> <i>Tanacetum huronense</i> Open Dunes
2. St. James Harbor	<i>Cirsium pitcheri</i> <i>Mimulus glabratus</i> var. <i>michiganensis</i> <i>Tanacetum huronense</i>	
3. Sandy Bay North	<i>Cirsium pitcheri</i> <i>Tanacetum huronense</i>	
4. Sand Bay	<i>Cirsium pitcheri</i> <i>Tanacetum huronense</i>	Open Dunes
5. Cable Bay	<i>Cirsium pitcheri</i> <i>Tanacetum huronense</i>	Open Dunes
6. Lake Geneserath Hemlock Stand		Mesic northern forest
7. Iron Ore Bay	<i>Cirsium pitcheri</i> <i>Tanacetum huronense</i>	Open Dunes
8. SW Old-growth		Mesic northern forest
9. Cheyenne Point		<i>Cirsium pitcheri</i> <i>Tanacetum huronense</i>
10. French Bay	<i>Cirsium pitcheri</i> <i>Iris lacustris</i> <i>Tanacetum huronense</i>	
11. Greenes Bay – McFadden Point	<i>Cirsium pitcheri</i> <i>Tanacetum huronense</i>	Open Dunes

<b>12. Fox Lake</b>	<i>Littorella uniflora</i>	
<b>13. Lefts Point</b>		<i>Cirsium pitcheri</i> <i>Tanacetum huronense</i>
<i>Table 2 continued</i>		
<b>14. Bonners Lansing</b>	<i>Cirsium pitcheri</i> <i>Tanacetum huronense</i>	
<b>15. Barneys Lake</b>		
<b>16. Donegal Bay – McCauley Point</b>	<i>Cirsium pitcheri</i> <i>Tanacetum huronense</i>	
<b>17. Indian Point</b>	<i>Cirsium pitcheri</i> <i>Tanacetum huronense</i>	

**Table 3. Rare plant and natural community occurrences identified during 1998 surveys of Garden island.**

<b>Site name</b>	<b>Known occurrences relocated and updated</b>	<b>New occurrences documented</b>
<b>1. Garden Island West Boreal Forest</b>		Boreal forest
<b>2. Garden Red Oak</b>		Mesic northern forest
<b>3. Sweat lodge swale</b>	<i>Pinguicula vulgaris</i>	Northern fen <i>Cirsium pitcheri</i> <i>Drosera anglica</i>

## Discussion of Plant Surveys

### *Beaver and Garden Islands*

Relatively brief but intensive surveys of Beaver and Garden islands resulted in several significant records. The majority of new rare plant occurrences resulted from the systematic survey of shoreline gaps. Beaver Island is considered to be a well-studied area, and serves as the site of Central Michigan University's summer biological station. Nonetheless, Beaver Island is also a large Great Lakes island, and considering the logistics of performing island surveys, it is not unexpected that portions could remain substantially unexplored. Based on experience gained from previous inventories of Great Lakes islands and shorelines (Penskar & Ludwig

1981, Penskar et al. 1993, Penskar et al. 1997), it was anticipated that data gaps would be readily delineated, and from these several new plant occurrences would be discovered. A tally of the field routes annotated on topographic maps indicates that approximately 20 miles of shoreline were examined on Beaver Island alone, with another 3-4 miles of shoreline covered on Garden Island.

The vast majority of new occurrences we documented were found in association with sand dune communities. As these communities were identified, we realized that several were large

and sufficiently intact (evidenced in part by the presence of large, vigorous rare plant populations) to merit recognition as natural community occurrences. Several of these sites were subsequently examined by MNFI staff ecologists to corroborate them as qualifying occurrences for the statewide database. In addition to identifying several dune occurrences and their component rare species, a notable northern fen was discovered in a coastal interdunal wetland on Garden Island. Within this wetland we reconfirmed the presence of a known record for butterwort (*Pinguicula vulgaris*) and discovered a new record for English sundew (*Drosera anglica*), a species previously unknown on this island.

Although the vast majority of botanical survey efforts were dedicated to comprehensive shoreline inventories, interior sites were assessed as well, with a focus on identifying potentially high quality community occurrences. A mesic forest tract near the southern shore of Beaver Island (Southwest Old-Growth) was initially highlighted from the road due to its large trees and the presence of mature hemlock.

This tract appeared to be markedly different than most forests observed while driving across the island. When subsequently visited with staff ecologists and more thoroughly examined, we identified a high quality example of mesic northern forest possibly representing a very rare remnant on the island. Development of a “search image” for this community and its structure enabled us to study and identify similar types on Garden Island (e.g. Garden Red Oak stand), and will be used to conduct a more thorough aerial photo interpretation of Beaver Island prior to 1999 surveys. Boreal forest was a second type of forest community highlighted after the June reconnaissance of Garden Island. Inventory of this coastal conifer forest type in August with staff ecologists resulted in the identification of what is possibly one of the most exemplary occurrences known of this community type. Interpretation of aerial photos indicates that this Garden Island boreal forest tract is extensive, and thus will require further inventory in 1999 to fully characterize, evaluate, and map it.

### ***Garden Peninsula Islands***

The floristic knowledge of Poverty, Summer, and Little Summer island was enhanced considerably through targeted spring surveys. The significance of these islands with respect to their biodiversity can now be more reliably compared to other islands in the northern Lake Michigan region, such as the similar island group associated with the Door Peninsula in Wisconsin as well as the Beaver Island archipelago. Summer Island, the largest island of the Garden Peninsula group (891 ha) has 390 documented species, whereas Little Summer Island (225 ha) has 174 species. Interestingly, Poverty Island, which is only 78 ha in size, has 220 documented plant species. Despite its relatively small size, the diversity of Poverty Island is due in part to the presence of extensive areas of alvar, which characterize much of the east and south coasts. Wave-washed areas of exposed limestone/dolomitic bedrock form a

broad shelf, grading in some areas to drier, pocket-like glades or moist coastal cedar-fir thickets. Summer Island is also characterized by the presence of extensive areas of alvar on its east coast, and has an extensive, dry, alkaline cliff area in the interior that supports the state special concern slender cliff-brake (*Cryptogramma stelleri*) but little else. Summer Island and Poverty Island both have deer herds, which undoubtedly have an impact on floristic diversity and composition. The spring flora of Summer Island was observed to be particularly low in diversity, which may be due to the presence of a large white-tail deer herd. Plants that were observed to be impacted by deer included orchids, most plants in the lily family (*Liliaceae*) such as Indian cucumber (*Medeola virginiana*), and twisted stalk (*Streptopus amplexifolius*), Canada yew (*Taxus canadensis*), and grasses such as *Trisetum melicoides*.

## Methods for Natural Community Surveys

### *Beaver and Garden Islands*

Primary objectives of the 1998 natural community inventory were to determine priority communities and locate potential high quality examples on Beaver and Garden Islands (Figure 2 and 3). This was accomplished through reconnaissance surveys by MNFI staff botanists (see Methods for Plant Surveys). Reviews of MNFI's statewide Biological and Conservation Database (BCD), maps of historical (Comer et al. 1995b) and current vegetation (MIRIS 1978), and interpretation of color infrared (CIR) aerial photos and USGS 7.5 minute topographic maps were also used to refine target communities and potential locations.

Potential high quality occurrences of target natural communities were then visited on the ground. Site visits involved mapping the boundaries of each delineated community occurrence on topographic maps and collecting detailed biotic and abiotic data. Data collection included compiling comprehensive plant species lists with notations of relative abundance, describing structural information for the vegetation layers in each plant community, and recording information on the landforms and soils that characterized the site. Site-specific

information was also gathered related to signs of past human disturbance and land-use patterns immediately adjacent to the site. Insights into future protection and/or management activities if apparent during site visits were also recorded on field forms. High quality natural communities were defined according to the MNFI Natural Community Classification (MNFI 1989) and each natural community occurrence was given a grade based on its relative quality and condition compared to other known occurrences within the state<sup>4</sup>. Finally, information from field forms was transcribed and submitted for mapping and incorporation into the MNFI statewide database.

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<sup>4</sup> "Element occurrence rank", noted basically as A, B, C, or D, is a natural heritage evaluation of the quality of the occurrence; an A-ranked occurrence is considered an exemplary, viable population, whereas D-ranked occurrences are those that are generally small, vulnerable to obvious threats and/or occur in degraded sites, and are not considered to be viable.

### *Garden Peninsula Islands*

Poverty and Summer islands, and to some extent Little Summer Island, have been the focus of previous MNFI coastal zone inventories for targeted natural communities such as globally rare alvars (Albert et al. 1995). Hence, the survey focus on these islands during the

current study was on enhancing floristic data rather than targeting natural communities. However, any new significant natural communities that were discovered during the intensive floristic inventories were noted.

## Results of Natural Community Surveys

### *Beaver and Garden Islands*

Results of natural community surveys conducted on Beaver and Garden Islands are presented in Tables 2 and 3 (see **Results of Plants Surveys**). Ten new natural community occurrences representing four types were identified. Natural community occurrences included five records for open dunes (all on Beaver

Island), 3 records for mesic northern forest (two on Beaver and one on Garden Island), and single records for northern fen and boreal forest, both on Garden Island. Specific summaries of individual community occurrences are provided in the **site summary** section. A general overview

of the community types and their significance to broad-scale conservation in Michigan is

### ***Garden Peninsula Islands***

Although surveys on the Garden Peninsula Islands were primarily focused on plant invento-

presented in the following **discussion** section.

ries, one significant new area of alvar at the northern end of Summer Island was discovered.

## **Discussion of Natural Community Surveys**

While a variety of natural communities were found to occur on both Beaver and Garden Islands, for the first year of this project, inventory priorities focused on locating, describing, and mapping high quality examples of mesic northern forest, boreal forest, northern fen, and open dunes. **Mesic northern forests**, more commonly referred to as northern hardwood forests, are generally dominated by American beech, sugar maple, and in high quality occurrences, often contain a significant component of yellow birch, eastern hemlock, and/or white pine. When mesic northern forests contain a sufficient component of eastern hemlock in the overstory, they are commonly referred to as hemlock/hardwood forests. Mesic northern forests in presettlement Michigan consisted of vast, contiguous tracts with both complex species composition and forest canopy structure. Natural disturbances were rare and usually of relatively small-scale. Thus, old trees dominated forests with scattered younger individuals growing into forest canopy gaps caused by windthrow or the death of individual trees. Conifers such as hemlock and white pine occurred in groups or as scattered individuals throughout these forests. Further, there was a diversity of dead trees, both down and standing, of various size classes and in various stages of decomposition. The result was a very complex system with a large diversity of habitats and microhabitats.

Much of today's mesic northern forest occurs in small fragmented blocks and lacks the structural complexity of presettlement forests. Since most of Michigan's forests established following slash fires of the logging era, they tend to be relatively young and even-aged. Additionally, the conifer component, especially hemlock, is conspicuously absent from much of

its former range in today's northern hardwood forest systems. Thus, although mesic northern forest is a common natural community, it is quite rare when found in a structurally intact, high quality condition. The high quality examples of mesic northern forest discovered in this study, particularly on Beaver Island, are of significant conservation importance to Michigan.

**Boreal forests** are natural communities of the northern latitudes and occur where precipitation greatly exceeds evapotranspiration. On the North American continent, these forests extend from Alaska to Newfoundland. Conifers, primarily white spruce, tamarack, and northern white cedar, along with a smaller component of paper birch and trembling aspen dominate boreal forests.

Although this forest type is quite common globally, it is considered rare in Michigan, which is often mistakenly thought to be too far south to support boreal forests. The cool, moist, maritime environment of Michigan's islands appears to compensate for southern latitude, and one of the finest known occurrences of boreal forest in the state was identified on Garden Island. These forest types are intrinsically important and may also provide habitat for many rare plant species in Michigan, including such notable plants as ram's head lady's-lipper (*Cypripedium arietinum*, SC) and calypso orchid (*Calypso bulbosa*, T).

**Northern fens**, rare both globally and in Michigan, are floristically diverse, groundwater fed peatlands that are most often found along low slopes, streams, or shoreline where parent materials and bedrock are rich in calcium and magnesium. These natural communities, which in northern Michigan typically occur along Great Lakes shorelines in the Niagaran Escarp-



ment region, are usually dominated by a variety of grass-like sedges and rushes and provide habitat for a diverse array of plants and animals, some of which are also very rare. The substrate is usually marly, and often consists of an admixture of marl and limestone/dolomite cobble. Notable rare species occurring in this community type include butterwort (*Pinguicula vulgaris*, SC), English sundew (*Drosera anglica*, SC), Houghton's goldenrod (*Solidago houghtonii*, T), dwarf lake iris (*Iris lacustris*, T), and beauty sedge (*Carex concinna*, SC), among many others, including several rare animal species.

Fresh water **open dune** communities are quite rare especially when considered from a global perspective. These grass and shrub-dominated communities occur on wind-deposited sand formations along the shores of large, fresh water lakes and are strongly influenced by lake-driven winds. Due to intensive development pressure along shorelines of the Great Lakes, open dunes are among the most imperiled natural communities in Michigan. In addition to providing habitat for a large number of endemic

and rare plant and animal species, open dunes are among the most significant of Michigan's natural features. The islands surveyed during this part of the project provide some of the best remaining opportunities to view open dunes in an undeveloped, natural condition.

**Alvar** is a Swedish term for a type of natural community found on very thin soils over level limestone or dolomite bedrock. The thin soil, coupled with extreme seasonal fluctuations in available moisture, prevents trees from becoming established and maintains an open or glade like condition. Alvar communities support distinctive flora and fauna including several rare and interesting species (Lee *et al.* 1998). Recent work has demonstrated the ecological rarity and significance of these natural communities, both globally and in Michigan. Agriculture, forestry, recreation, residential development, and other human activities have degraded many acres of Alvar. Thus, high quality, undisturbed occurrences, such as the one located on summer Island during this study, are of significant conservation importance to Michigan.

## Site Summaries

As established in the format of several previous MNFI reports concerning coastal zone inventories, we provide here a summary description of the significant inventory sites. These descriptions are provided primarily for inventory sites covered by MNFI botanists and ecologists, as we have not attempted to catalogue this level of information for all sites assessed and inventoried during animal surveys or during the floristic work conducted on the Garden Peninsula group. However, MNFI zoologists inventoried several of these sites, and where necessary, relevant information is incor-

porated. Sites where bird point counts were conducted are noted. While a complete analysis requires multi-year data, areas rich in bird species are highlighted. The intention of this section is to provide a summary of each site in a relatively brief commentary format that can be used for meaningful future reference and consultation. Because sites are likely to be considered in a stand-alone sense, we are following our previous protocol of repeating scientific names for all species referenced in each summary.

## **Beaver Island Sites**

### **1. Lookout Point.**

Lookout Point comprises a stretch of shoreline on the northeast shore harboring a somewhat small but locally significant area of open dunes. These dunes, which also include well-developed interdunal wetlands, were identified as a significant survey gap and subsequently covered during early as well as late season surveys. East of Lookout Point, the dunes consist of a narrow foredune abruptly backed by forest, expanding to a much broader open dune community with interdunal wetlands near the Point. West of the Point, the foredunes are higher, backed by broad, flat, sandy-gravelly dune fields and a few interdunal wetland pockets. In one area the dunes grade up to a modest blowout below the forested bluff, where Pumpell's brome grass (*Bromus pumpellianus*) was discovered. Dominant and common species include such typical dune plants as dune grasses (*Ammophila breviligulata*, *Calamovilfa longifolia*), milkweed (*Asclepias syriaca*), sea rocket

(*Cakile edentula*), rock-cress (*Arabis lyrata*), bearberry (*Arctostaphylos uva-ursi*), beach pea (*Lathyrus japonicus*), and horizontal juniper (*Juniperus horizontalis*), as well occasional exotic species such as spotted knapweed (*Centaurea maculosa*), soapwort (*Saponaria officinalis*), and bluegrass (*Poa compressa*). Most exotic species did not appear to be a problem, with the exception of spotted knapweed, which was relatively invasive in the sandy-gravelly flats behind and near the Point. Significant populations of Pitcher's thistle (*Cirsium pitcheri*), Lake Huron tansy (*Tanacetum huronense*), and Pumpell's brome grass, in addition to the open dunes community, were catalogued as new occurrences for the statewide database. This site was not inventoried for Lake Huron locust (*Trimerotropis huroniana*), but the extent of the open dunes habitat suggests the species may be present and thus future survey is warranted (see animal discussion section).

### **2. St James Harbor.**

Within this largely developed bay, some open dune habitat occurs from approximately the public beach to Harbor Point. Portions with low foredune and a limited backdune area, mostly comprising the frontage of residences and seasonal homes, still provide habitat for modest populations of Pitcher's thistle (*Cirsium pitcheri*) and Lake Huron tansy (*Tanacetum huronense*). Typical dune species predominate on the foredune, including dune grasses (*Ammophila breviligulata*, *Calamovilfa longifolia*), beach pea (*Lathyrus japonicus*), starry false Solomon's seal (*Smilacina stellata*), and dune willows (*Salix* spp.), although owing to human activities and artificial disturbance the shoreline is somewhat weedy in areas, particularly near the public beach. Exotic species include soapwort (*Saponaria officinalis*), spotted knapweed

(*Centaurea maculosa*), and smooth brome (*Bromus inermis*). A well-known population of the federal and state endangered Michigan monkey-flower (*Mimulus glabratus* var. *michiganensis*) was sought in the south part of the harbor. This species occurred in cold, spring-fed pools at the base of a low hillside, and was observed to be extant in 1989 by M. Penskar. The shoreline hydrology was found to be drastically modified during the construction of a residential home, and as reported previously (J. Paskus, pers. comm.), the colony could not be located. Permission should be obtained to do a more thorough survey of this private parcel, although it does seem likely that one of the 15 known global populations of this Michigan endemic has been extirpated.

### **3. Sandy Point North.**

This site comprises an approximately one-mile portion of shoreline south of Little Sand Bay, the latter a well-known area including a nature preserve owned and managed by the

Little Traverse Conservancy. The shoreline was briefly inventoried from Sandy Point to the southern edge of Little Sand Bay, primarily to determine the presence of rare plant species

likely to continue from the north. In this site, the shoreline consisted of discontinuous and very limited stretches of beach and foredune, backed by abrupt lowland cedar and mixed conifer-hardwood forest. The dune stretches were interspersed with cobble shore and occasional limestone bedrock outcrops and small boulders. Small, low-diversity wetlands were found toward the south edge of Little Sand Bay. Modest numbers of Pitcher's thistle (*Cirsium pitcheri*) and Lake Huron tansy (*Tanacetum huronense*) were documented as extensions to the well-documented populations in Little Sand Bay. Three point counts for migratory birds

were conducted just to the north at the Little Traverse Conservancy Nature Preserve. Counts were conducted in old field, lowland cedar, and shoreline habitats. It is noteworthy that swarming insects were observed along the beach during the point counts. Emerging aquatic insects along the shoreline may provide migratory birds a significant food resource in the spring when terrestrial insects may be scarce. The cedar, spruce and tamarack trees as well as various shrubs lining the shoreline may provide an excellent foraging substrate for neotropical migratory birds feeding on these insects.

#### 4. Sand Bay.

Sand Bay consists of an approximately three-mile stretch of shoreline forming a gently curving, shallow bay from Conns Point south to about Point La Par. This area includes the well-known Central Michigan University Biological Station and a long string of residences, many of which are fairly large seasonal homes. This site was identified for inventory based on a nearly complete lack of status information for previously documented rare plant populations. As we surveyed this shoreline and tallied population numbers for Pitcher's thistle (*Cirsium pitcheri*) and Lake Huron tansy (*Tanacetum huronense*), we realized the open dunes community was contiguous and intact for a considerable portion of the shore, thus warranting recognition as a natural community occurrence. The dunes were found to consist of a relatively broad, well-developed foredune backed by a band of mostly flat backdunes between the foredunes and most homes. Although there is extensive development in this area, artificial disturbance by landowners in many cases was minimal, with the alteration of dune frontage consisting of little more than modest paths to the beach. Several had day use areas, but the general level of disturbance in many areas was fairly limited. South of the

Jordan River mouth, the dunes grade upward to a few low-sloping dune rises, where a few open lots were undeveloped.

Several thousand plants were estimated for both Pitcher's thistle and Lake Huron tansy, indicative in part of the collectively extensive and functional nature of the open dunes community. As is typical, marram or dune grass (*Ammophila breviligulata*) dominated on the foredune, with dune grass (*Calamovilfa longifolia*) occurring landward. Typical species included beach pea (*Lathyrus japonicus*), sea rocket (*Cakile edentula*), milkweed (*Asclepias syriaca*), rock-cress (*Arabis lyrata*), euphorbia (*Euphorbia polygonifolia*), poison ivy (*Toxicodendron radicans*), starry false Solomon's seal (*Smilacina stellata*), horizontal juniper (*Juniperus horizontalis*), and ground juniper (*Juniper communis*). Exotics included soapwort (*Saponaria officinalis*), smooth brome (*Bromus inermis*), bluegrass (*Poa compressa*), and spotted knapweed (*Centaurea maculosa*), with the latter observed to be somewhat invasive in backdune areas. One point count for migratory birds was conducted at the south edge of Sand Bay near the state forest campground just north of Point La Par.

#### 5. Cable Bay.

This site was identified primarily to gather status information for known populations of Pitcher's thistle (*Cirsium pitcheri*) and Lake

Huron tansy (*Tanacetum huronense*). The dunes were found to be of good quality and extensive enough to merit documentation. In the upper, or

northeast portion of Cable Bay, where public land provides access to the upper part of the bay, the dunes grade relatively high in topography, with one parabolic-like blowout area. Moderately-sized populations of Pitcher's thistle (*Cirsium pitcheri*) and Lake Huron tansy (*Tanacetum huronense*) were observed, as well as a standard assemblage of dune species, including marram grass and dune grass (*Ammophila breviligulata*, *Calamovilfa longifolia*), beach pea (*Lathyrus japonicus*), sea rocket (*Cakile edentula*), horizontal juniper (*Juniperus horizontalis*), hairy puccoon (*Lithospermum caroliniense*), milkweed (*Asclepias syriaca*), ground juniper (*J. communis*), poison ivy (*Toxicodendron radicans*), little bluestem (*Andropogon scoparius*),

dune willows (*Salix exigua*, *S. cordata*), jack pine (*Pinus banksiana*), northern white cedar (*Thuja occidentalis*), euphorbia (*Euphorbia polygonifolia*), and starry false Solomon's seal (*Smilacina stellata*). No particularly invasive exotics were observed. Animal surveys resulted in the documentation of a large population of Lake Huron locust (*Trimerotropis huroniana*) in the open sandy dunes and blowouts. Two point counts were conducted for migratory birds, one in the open dunes and the other in the adjacent interior forest. Both areas contain a fairly complex vegetational structure and were rich in bird species. The state threatened merlin (*Falco columbarius*) was observed hunting prey along the forested edge of the open dune area.

#### 6. Lake Geneserath Hemlock Stand.

A small stand of old-growth Eastern hemlock (*Tsuga canadensis*) was found along the southwest shore of Lake Geneserath. The one acre stand is located on gently sloping terrain with exaggerated pit-and-mound topography. The forest canopy is dominated by hemlock with lesser amounts of yellow birch (*Betula alleghaniensis*), sugar maple (*Acer saccharum*), and American beech (*Fagus grandifolia*). Sugar maple dominates the sub-canopy, shrub layer, and groundlayer. Other common shrub and ground layer species included balsam fir (*Abies balsamea*), striped maple (*Acer pensylvanicum*), ground-pine (*Lycopodium* sp.) and wild sarsaparilla (*Aralia nudicaulis*). Canada yew (*Taxa canadensis*) was found growing well protected under a large blowdown tangle within the thin

band of cedar which separates the hemlock stand from Lake Geneserath. Both Eastern hemlock and Canada yew are heavily browsed by white-tailed deer, which is likely the cause of their scarcity in the forest understory. No hemlock seedlings or saplings were observed within the stand or elsewhere on the island. Because the site is privately owned and borders Lake Geneserath, it is a prime development site. Within this general area, a point count for migratory birds was conducted along the south shore of the lake, in a different habitat dominated by cedar, birch and maple. This site is notable in that ten different bird species were recorded during the short interval of the point count.

#### 7. Iron Ore Bay.

A relatively extensive region of shoreline dunes occurs in the vicinity of the mouth of Iron Ore Creek, ranging from about 0.5 miles west of the creek mouth to more than one mile east. The gated, private portion in section 20, west of Iron Ore Bay proper, was not surveyed. The dunes near Iron Ore Creek are of good quality, consisting of a well-developed, relatively high foredune grading back into moderately steep dune hills, where there is some fragmentation due to the development of private residences on

the higher areas. Behind the public beach and foredune the coastal road runs through the lower portion of the dunes, where it is signed as a Public Beauty Road. The site is scenic but the road clearly fragments the dunes. The foredune is dominated by the pioneering marram grass (*Ammophila breviligulata*), with dune grass (*Calamovilfa longifolia*), as is typical, occurring primarily throughout the backdunes. Known populations of Lake Huron tansy (*Tanacetum huronense*) and Pitcher's thistle (*Cirsium*

*pitcheri*) were surveyed to obtain status and population information; both species were scattered through the dunes, with tansy occurring principally along the foredune areas.

Virtually no status information was known for these rarities prior to our survey. An exemplary assemblage of dune species was present, including wormwood (*Artemisia campestris*), milkweed (*Asclepias syriaca*), horizontal juniper (*Juniperus horizontalis*), bearberry (*Arctostaphylos uva-ursi*), jack pine (*Pinus banksiana*), white cedar (*Thuja occidentalis*), white camas (*Zigadenus glaucus*), dune willows (*Salix cordata*, *S. myricoides*), and hairy puccoon (*Lithospermum caroliniense*). A known population of the rare fascicled broom-rape (*Orobanche fasciculata*), an obscure

species last observed at this site in 1958, was sought during early and late summer field surveys but could not be relocated. However, wormwood, the obligate host plant of the parasitic broom-rape, is common in the Iron Ore Bay dunes, and thus it is likely that *Orobanche* persists within this still intact dune community. During animal surveys, a population of Lake Huron locust (*Trimerotropis huroniana*) was documented in Iron Ore Bay and in section 20 to the east. In addition, point counts for birds were conducted in forested habitat along Iron Ore Bay Creek and in the open dune community north of Iron Ore Bay. A pair of merlins (*Falco columbarius*) were observed perched in pine trees just 100 meters from the shore on two different occasions.

## 8. Southwest Old-Growth.

When MNFI botanists conducted reconnaissance in late June for potential natural community occurrences, this interior mesic forest stand was identified as having old-growth characteristics. Several individual trees were observed as rather large in both stature and diameter at breast height (DBH), and the forest contained a significant Eastern hemlock (*Tsuga canadensis*) component. The occurrence of large hemlocks is particularly noteworthy, as this species was once common throughout northern Michigan but because of high deer densities often fails to regenerate. The site was more thoroughly assessed with MNFI staff ecologists during late season surveys, resulting in the identification of an approximately 20-30 acre stand of high quality northern mesic forest

distinct from the surrounding matrix forest community. The stand is dominated by sugar maple (*Acer saccharum*) and yellow birch (*Betula alleghaniensis*), and contains several large Eastern hemlocks. One sugar maple measured 99 cm in DBH, with several other trees approaching this size. Additional species included American beech (*Fagus grandifolia*), paper birch (*Betula papyrifera*), and several examples of large red maple (*Acer rubrum*). The several large paper birch trees present are indicative of a disturbance regime that results in canopy gaps due to blowdowns, creating not only marked canopy gaps but also a structure of pit-and-mound microtopography on the forest floor, a typical feature of mesic northern forests.

## 9. Cheyenne Point.

This site spans several coves and sand spits along the southwest shoreline of Beaver Island just west of Iron Ore Bay. It is comprised of a narrow fringe of mostly cobble beach with numerous emergent/northern fen wetlands. Emergent grass and sedge species such as hardstem bulrush (*Scirpus acutus*), three-square bulrush (*S. americanus*), twig-rush (*Cladium mariscoides*), rush (*Juncus brachycephalus*) and bluejoint grass (*Calamagrostis inexpansa*) in standing water characterize the wetlands.

Clusters of colorful herbs such as Kalm's lobelia (*Lobelia kalmii*), Arkansas mint (*Calamintha arkansana*), purple gerardia (*Agalinis purpurea*), and Indian paintbrush (*Castilleja coccinea*) occur along the edges of the larger wetlands and in shallow depressions along the cobble beach. Four small clusters of Pitcher's thistle (*Cirsium pitcheri*), consisting of only a few individuals each were noted in sandy pockets along this stretch of shoreline. Associates included typical dune species such as

creeping and ground juniper (*Juniperis horizontalis*, *J. communis*), balsam poplar (*Populus balsamifera*), marram grass (*Ammophila*

*breviligulata*), wild rye (*Elymus glaucus*), and wheat grass (*Agropyron dasystachyum*).

#### 10. French Bay.

Accessed by foot trail, this site consists of a small distinct bay on the lower southwest shore of the island. Most of the immediate bay area is contained within state forest land, and the site is well-known locally for its scenic aspect and relatively secluded shoreline location. The bay forms the leading edge of a former post-glacial embayment. Approximately 0.25 east is a marked, post-glacial ridge. Between this Algonquin-age ridge and the shore, the land slopes downward over a series of successively lower beach ridges, grading from northern hardwood forest to mixed hardwood conifer forest and ultimately to a coastal conifer forest consisting of northern white cedar (*Thuja occidentalis*), balsam fir (*Abies balsamea*), and white spruce (*Picea glauca*). The cobbly-sandy beach within the bay is relatively narrow and

backed abruptly by the coastal forest. Status information was obtained for previously documented populations of Pitcher's thistle (*Cirsium pitcheri*), Lake Huron tansy (*Tanacetum huronense*), and dwarf lake iris (*Iris lacustris*). Pitcher's thistle and tansy occurred in modest numbers along the limited habitat on the shore, whereas dwarf lake iris was restricted to the shaded, moist coastal conifer forest, where it occurred in small to moderately-sized patches primarily in close proximity to the shore. Additional areas beyond those previously known were recorded for dwarf lake iris, extending the range of the occurrence slightly to the north. One point count for migratory birds was conducted near French Bay Road, approximately 0.5 miles east of the immediate shore.

#### 11. Greenes Bay – McFadden Point.

This site contains one of the highest quality sand dune systems occurring on Beaver Island, comprising perhaps the most intact and least fragmented example of open dunes. The site includes large blowout areas, well-developed topography and relatively high dune hills, and areas that are also densely forested. This site is rivaled somewhat by the large dunes associated with Donegal Bay. However, the latter site is highly fragmented with numerous residences and lacks the broad expanse of dune fields and blowouts that remain in this site. The broadest expanse of open dunes occurs in the middle of section 25 just below McFadden Point. The shoreline is fronted by a relatively high, well-developed foredune and broad beach strand. The foredune is dominated by marram grass (*Ammophila breviligulata*), and includes such species as sea rocket (*Cakile edentula*), milkweed (*Asclepias syriaca*), dune willows (*Salix cordata*, *Salix myricoides*), agropyron (*Agropyron dasystachyum*), beach pea (*Lathyrus japonicus*), sand cherry (*Prunus pumila*), and occasional clones of Lake Huron tansy (*Tanacetum huronense*). Pitcher's thistle (*Cirsium pitcheri*)

was observed on the foredune but also was found frequently throughout the open dunes, whereas Lake Huron tansy tended to occur along the foredune and in general closer to the shore. A previously documented population of fascicled broom-rape (*Orobanche fasciculata*) last observed in 1958 was sought but not relocated, although this obscure species likely persists in this large dune complex.

Landward the dunes form a broad, open, slightly undulating dune field, with many portions having a considerable amount of cobble strewn in the sand. The northern portion of the dunes near the point are platted for sale by real estate companies, and there is local disturbance in this area by vehicles straying from the current entry road, possibly including off-road-vehicle (ORV) use. This is the most disturbed portion of the open dunes, as evidenced by the presence of such exotics as spotted knapweed (*Centaurea maculosa*) and bladder campion (*Silene vulgaris*). The backdune areas are typified by a standard assemblage of dune plants such as little bluestem (*Andropogon scoparius*), which forms large patches, horizontal juniper (*Juniperus*

*horizontalis*), ground juniper (*Juniperus communis*), wormwood (*Artemisia campestris*), hairy puccoon (*Lithospermum carolinense*), white camas (*Zigadenus glaucus*), bearberry (*Arctostaphylos uva-ursi*), jack pine (*Pinus banksiana*), northern white cedar (*Thuja occidentalis*) and numerous other typical species. The dune field grades to relatively high dune hills with parabolic blowouts, and the adjoining forest forms an abrupt boundary along the border. In the southern portion of Greenes Bay in section 36, the dunes narrow markedly to a broad beach strand and foredune, backed by a limited area of open dunes bordered by forest and interspersed with seasonal homes. The intactness of this high quality dune system is threatened by what appears to be imminent development near McFadden Point. As noted above, much of the private portion has been platted for sale and eventual residential development, and this will undoubtedly lead to further degradation of this dune landscape, both through the direct effects of habitat modification and indirect effects caused by the further introduction of exotic species.

During animal surveys, a large population of Lake Huron locust (*Trimerotropis huroniana*) was documented on the open dunes near McFadden Point. Large patches of little bluestem were swept for red-legged spittlebug (*Prosapia ignipectus*), which was not found, and blacklighting was conducted in this same area in an unsuccessful attempt to detect the aweme borer moth (*Papaipema aweme*), a very rare moth previously documented in dunes on Beaver Island. During late August surveys, merlins (*Falco columbarius*) were observed near McFadden Point, although it was not known if they represented nesting birds or merely fall migrants. Greenes Bay is a documented site for the federal and state endangered piping plover (*Charadrius melodus*), and although suitable habitat appears to exist, the species has not been observed at this site since 1988. Lastly, three point counts for migratory birds were conducted in the general vicinity of Greenes Bay, one just north of McFadden Point and the others in section 36 and the adjoining section 31.

## 12. Fox Lake.

With the exception of a small public access site for boat launching, this site is contained within private land. This pothole lake is relatively shallow, sandy-bottomed, and ringed with a mostly narrow sandy beach whose width fluctuates markedly with changes in lake level. The entire western and southern shores were searched for a known population of water plantain (*Littorella uniflora*) last observed when it was collected in 1980. This species was readily relocated just south of the public boat access, where the receding sandy shoreline revealed locally dense colonies of plants. Associated plants included those typical of softwater lake habitats, such as water-milfoil (*Myriophyllum tenellum*), rush (*Juncus pelocarpus*), lance-leaved violet (*Viola lanceolata*), arrowhead (*Sagittaria* sp.), bulrush (*Scirpus americanus*),

and creeping spearwort (*Ranunculus reptans*). In addition, approximately one-half of the shoreline of the lake was searched for snail shells to determine the possible presence of the deepwater pondsnail (*Stagnicola contractus*), a species documented at this site in 1939. Although surveys of the shoreline failed to detect any snail shells whatsoever, this limited inventory is inconclusive at best, and further work with the appropriate deepwater sampling will be required to ascertain the status of this rare invertebrate. A large open bog occurrence contiguous with the northeast shore of the lake was not prioritized for survey and thus not covered, although this community may be scheduled for assessment in 1999. One point count for migratory birds was conducted along the northern shore of the lake.

### 13. Lefts Point.

North of the high quality dune complex at McFadden Point, the foredune constricts to a narrow shoreline band consisting of a mixture of cobble and sand beach with occasional pockets of northern fen. This mile or so stretch of shoreline that extends approximately ½ mile north and south of Left's Point contains three clusters each of Pitcher's thistle and Lake Huron tansy. For the most part these clusters are rather sparsely populated, reaching their greatest density of 50 or so individuals just south of Left's point where the greatest extent of sandy foredune occurs. Common associates include typical dune species such as marram grass (*Ammophila breviligulata*), wheat grass (*Agropyron dasystachyum*), and wormwood (*Artemisia campestris*). Exotic species such as soapwort (*Saponaria officinalis*), bluegrass (*Poa*

*compressa*), spotted knapweed (*Centaurea maculosa*) and yarrow (*Achillea millefolium*) were common in several areas along this stretch. A northern fen occurs on Left's Point itself, dominated by grass and sedge species such as twig-rush (*Cladium mariscoides*), sedge (*Carex aquatilis*), bluejoint grass (*Calamagrostis inexpansa*), hardstem bulrush (*Scirpus acutus*), and rushes (*Juncus balticus* and *J. brachycephalus*). Illustrative of the diversity of this community were the numerous herbaceous species in flower during the time of survey. These included small fringed gentian, (*Gentianopsis procera*), cardinal flower (*Lobelia cardinalis*), Kalm's lobelia (*L. kalmii*), ladies'-tress orchids (*Spiranthes* sp.) and grass-of-Parnassus (*Parnassia glauca*). One point count for migratory birds was conducted along the road just inland from the point.

### 14. Bonners Landing.

This site extends along several miles of the west shore of Beaver Island just south of Barneys Lake. It continues from Left's point to the south as a narrow shoreline band consisting primarily of cobble and sand beach, interspersed with occasional emergent marsh and northern fen communities. In this region, it encompasses numerous small coves and rocky spits that extend out into the lake and is dotted with well set-back private cottages. Species typical of open dunes dominate the sandy portions of the site including such species as ground juniper and horizontal juniper (*Juniperus communis* and *J. horizontalis*), marram grass (*Ammophila breviligulata*), Canada rye grass (*Elymus canadensis*), agropyron (*Agropyron dasystachyum*), wormwood (*Artemisia campestris*), and goldenrod (*Solidago simplex* var. *gillmanii*). Several clusters of Pitcher's thistle (*Cirsium pitcheri*) and a single cluster of Lake Huron tansy (*Tanacetum huronense*) were found scattered in the sandier coves, thus increasing the southward extent of previously known occurrences from this site. However, along much of the more rocky and narrower regions, exotic species such as soapwort

(*Saponaria officinalis*), yarrow (*Achillea millefolium*), and bluejoint (*Poa compressa*) have a significant presence. The wetter portions of the shoreline included species typical of northern fens and interdunal wetlands, such as purple gerardia (*Agalinis purpurea*), silverweed (*Potentilla anserina*), rush (*Juncus balticus*), gentian (*Gentianopsis procera*), Kalm's lobelia (*Lobelia kalmii*), and grass-leaved goldenrod (*Euthamia graminifolia*). To the north, the site gradually widens to a broad sandy foredune just west of Slop Town Road, where it is popularly known as Bonners Landing, a relatively secluded beach and picnic site. Only the southern portion of the sandy foredune area was explored and Pitcher's thistle was found to be fairly abundant while Lake Huron tansy, although not abundant, was more common than further south. The open dune continues northward eventually merging with an extensive forested dune complex. This area will be a priority for 1999 survey work. In addition to assessing the status of the thistle and tansy populations, attempts will be made to relocate and assess an occurrence of Pumpell's brome grass that was documented in 1958.



### 15. Barneys Lake.

The north shore of this lake was surveyed briefly to detect the presence of any shells of deepwater pondsnail (*Stagnicola contractus*), which was documented and last observed here in 1940. A small portion of the northern shore was inventoried by MNFI botany staff, who collected several snail shells for assessment by staff zoologists and other experts. Numerous snail shells were found, and this lake was observed to be markedly different from Fox Lake, with its mucky-peaty substrate and several indications of more alkaline conditions. No specimens of deepwater pondsnail were confirmed from the snail shells obtained. Portions of the northern shore supported fen species, such as Indian paintbrush (*Castilleja*

*coccinea*), and groundwater seeps and springs were observed. The shoreline was also unsuccessfully surveyed for a rare buttercup (*Ranunculus cymbalaria*) last observed here when it was first documented in 1957. Because of the brief nature of the aforementioned surveys, further inventories are warranted for both the deepwater pondsnail and the rare buttercup in 1999 to determine their status. During an early evening survey of the Barneys Lake Nature Preserve along the shore, in old field habitat and in an orchard, zoologists recorded thirteen bird species including the state threatened caspian tern (*Sterna caspia*) which was observed fishing in the lake.

### 16. Donegal Bay - McCauley Point.

The Donegal Bay area has one of the island's largest dune complexes, yet the site is highly fragmented with numerous homes and cottages scattered throughout. Little of the accessible areas were inventoried, although several of the site's well known rare species were observed, including Pitcher's thistle (*Cirsium pitcheri*) and Lake Huron tansy (*Tanacetum huronense*). These species appear to persist well in the intact local stretches of dunes, which are known to support several other rarities, including Pumpell's brome grass (*Bromus pumpellianus*), fascicled broom-rape (*Orobanche fasciculata*), butterwort (*Pinguicula vulgaris*), and Houghton's goldenrod (*Solidago houghtonii*). Several interdunal depressions and low flats were investigated for Houghton's goldenrod. Although good habitat was present, only the related, common Ohio goldenrod (*Solidago ohioensis*) was observed. A large vigorous colony of butterwort was observed in an interdunal area. Animal surveys at

McCauley Point resulted in the documentation of a new occurrence of the Lake Huron locust (*Trimerotropis huroniana*). Large patches of little bluestem were swept for red-legged spittlebug (*Prosapia ignipectus*), which was not found, and blacklighting was conducted in this same area in an unsuccessful attempt to detect the aweme borer moth (*Papaipema aweme*), a very rare moth previously documented in sand dunes on Beaver Island. Two migratory bird counts were conducted just inland from McCauley Point in mature beech-maple habitat. A new occurrence of the Lake Huron locust was also documented in the Mt. Pisgah and Donegal Bay Park areas, which both contain back dunes that finger up and grade into mixed northern forest. Blacklighting surveys did not detect the rare aweme borer moth in the vicinity of Mt. Pisgah.

### 17. Indian Point.

From the north end of Donegal Bay, the shoreline contains locally extensive interdunal wetlands and flats, which are dominated primarily by herbaceous plants, including several rush (*Juncus*) and sedge (*Carex*, *Scirpus*) species. The wet sand flats include

such species as Ohio goldenrod (*Solidago ohioensis*), grass-leaved goldenrod (*Euthamia graminifolia*), sedge (*Carex viridula*), three-square (*Scirpus americanus*), butterwort (*Pinguicula vulgaris*), and nodding ladies'-tress orchid (*Spiranthes cernua*). Further north the

shoreline grades into broad areas of cobble shore with marshy flats. There were occasional short stretches of sand dune, that despite their limited extent and occasionally weedy nature were observed to support small colonies of Pitcher's thistle (*Cirsium pitcheri*) and Lake Huron tansy (*Tanacetum huronense*). Tansy was also observed occasionally growing on cobble shores, which is not atypical. Just south of Indian Point there are small openings with Great Lakes barrens vegetation, with such species as ground juniper (*Juniperus communis*), bearberry (*Arctostaphylos uva-ursi*), horizontal juniper (*J. horizontalis*), and various

conifer species. The sandy openings near the Point were also found to be relatively weedy, with most invaded by spotted knapweed (*Centaurea maculosa*). East of the Point, the shoreline becomes very narrow and limited, consisting of a cobbly-sandy shore backed abruptly by forest. Animal surveys for the Lake Huron locust (*Trimerotropis huroniana*) were unsuccessful in documenting the species in this area. Further surveys are needed to determine whether they occur here. Two point counts for migratory birds were conducted in the vicinity of the point.

## **Garden Island sites**

### **1. Garden Island West Boreal Forest.**

An extensive (approximately 600 acre) tract of boreal forest was located along the western shore of Garden Island on shallow organic soil over limestone cobble (Figure 3). The natural community was characterized by well developed pit-and-mound microtopography and single and group tree windthrow; characteristics indicative of mature forest with the natural disturbance regime intact. Overstory species were predominantly northern white cedar (*Thuja occidentalis*) and white spruce (*Picea glauca*) with lesser but significant amounts of balsam fir (*Abies balsamea*), paper birch (*Betula papyrifera*), and balsam poplar (*Populus balsamifera*). The forest sub-canopy, generally sparse but dense locally, was dominated by balsam fir with lesser amounts of white cedar and white ash (*Fraxinus americana*). Shrub layer species included mountain maple (*Acer spicatum*), beaked hazelnut (*Corylus cornuta*), round-leaved dogwood

(*Cornus rugosa*), and American fly honeysuckle (*Lonicera canadensis*). The understory, sparse with extensive areas of exposed soil and duff, included creeping rattlesnake plantain (*Good-yera repens*), Menzies' rattlesnake plantain (*G. oblongifolia*), twin flower (*Linnaea borealis*), goldthread (*Coptis trifolia*), large round-leaved orchid (*Platanthera orbiculata*), blue-bead lily (*Clintonia borealis*), and various species of Violets (*Viola* sp.) and sedges (*Carex* sp.). No human disturbance, e.g. timber harvests, stumps, trails, or other clearings, was noted within the forest. This site is among the largest and highest quality tracts of boreal forest described in Michigan to date. Further, there is some chance that several rare orchids, including ram's head lady's slipper (*Cypripedium arietinum*) and calypso orchid (*Calypso bulbosa*), may occur within this natural community.

### **2. Red Oak Garden.**

A forested track of mature red oak (*Quercus rubra*) occurs within southern portions of the islands interior forest. The site is included here because of its significance as a possible artifact of presettlement Native American land use. The General Land Office surveyors of the mid 1800's noted this area as having been "cleared by fire" and "burned". Today the site is completely dominated by large red oaks with few sugar maples and white ash (*Fraxinus*

*americana*) reaching the canopy. It is likely that the native people inhabiting Garden Island in presettlement times regularly burned this area to keep it open for agriculture, berry picking, and hunting. Because of its ability to persist in a shrub-like condition where fires are common, red oak rapidly assumed dominance at this site once Native American land use patterns changed. However, sugar maple, the dominant species throughout the islands' mesic forests

will soon regain its place in this site's canopy as it currently dominates the forest's understory. Other common understory species include ironwood (*Ostrya virginiana*), and hazelnut

### 3. Sweat lodge swale.

A small, high quality northern fen occurs approximately 30 meters inland from the island's northwest shore. The swale is bordered by an extensive boreal forest to the south and a thin band of cedar glade separating the northern fen from Lake Michigan. The long, narrow fen is distinctly different at each end. The marly, eastern portion of the fen contains a diverse array of calcium loving species including English sundew (*Drosera anglica*) and butterwort (*Pinguicula vulgaris*), both species of special concern, Ohio goldenrod (*Solidago ohioensis*), Kalm's lobelia (*Lobelia kalmii*), grass-of-Parnassus (*Parnassia glauca*), sedges

(*Corylus americana*), a fire-adapted shrub. Common groundlayer species include wild sarsaparilla, sedges (*Carex pensylvanica* & *C. pedunculata*), and sugar maple.

(*Carex viridula* & *C. flava*) and false asphodel (*Tofieldia glutinosa*). In contrast the western portion of the fen was dominated by sedge (principally *Carex lasiocarpa*) and contained little plant species diversity. Within the limestone rich cedar glade to the north of the swale several Native American, traditional sweat lodges have been erected and although empty, were in good repair. The sandy and limestone cobble shoreline bordering the cedar glade contained several dozen, scattered Pitcher's thistle (*Cirsium pitcheri*), constituting a small new occurrence for the island.

## Preliminary Identification of Significant Biodiversity Areas

### Beaver and Garden Islands

The first year of inventory on Beaver Island resulted in the identification of significant shoreline areas, consisting primarily of coastal sand dune communities providing important habitat for several Great Lakes endemics and other rarities. Notable species observed included the federal and state threatened Pitcher's thistle (*Cirsium pitcheri*), the state threatened Lake Huron tansy (*Tanacetum huronense*), the state threatened Lake Huron locust (*Trimerotropis huroniana*), and the state threatened Pumpelly's brome grass (*Bromus pumpellianus*). In addition, a number of these dune systems were recognized and documented as high quality natural communities for the MNFI statewide database, including Greenes Bay – McFadden Point, Cable Bay, Iron Ore Bay, Lookout Point, and Sand Bay. No open dunes community types were recognized on the island prior to our survey. Several of these sites also have well-known records for previously documented natural features, which in addition to the above include such species as the federal and state threatened Houghton's goldenrod

(*Solidago houghtonii*), the state and federal threatened dwarf lake iris (*Iris lacustris*), the federal and state endangered Michigan monkey-flower (*Mimulus glabratus* var. *michiganensis*), the federal and state endangered piping plover (*Charadrius melodus*), the state special concern aweme borer moth (*Papaipema aweme*), the state threatened fascicled broom-rape (*Orobanche fasciculata*), and communities such as boreal forest. Thus, Beaver's shorelines clearly harbor the majority of the biodiversity for the island. The coastal areas also support the vast majority of the island's globally significant species and communities. In the interior, important habitats observed included Barneys Lake and Fox Lake, which deserve further investigation for selected rare species and natural communities, especially the state threatened deepwater pondsnail (*Stagnicola contractus*). Several forested areas, which will receive further attention in 1999, were identified as significant with regard to migratory songbirds. In particular, forested areas bordering shorelines with narrow cobble beaches may serve to

concentrate migratory birds that feed on swarms of emerging aquatic insects in the spring. Finally, a highly significant old-growth remnant of mesic northern forest was identified near the southern shore. This indicates the potential for delineating other remnants of this type elsewhere on the island and in the Beaver archipelago, and provides a signature that will assist in the recognition and of such important tracts.

Despite only cursory surveys on Garden Island, significant natural communities were identified. These include a small but diverse northern fen on the north shore of the island, a mesic forest tract in the southern portion of the island, and an extremely large, exemplary occurrence of boreal forest comprising much of the northern half of the island. Identification of the northern fen indicates that this community may occur in more extensive areas on the southern

portion of the island, which will be examined in 1999. A small but interesting mesic northern forest tract was observed to be co-dominated by red oak, and may be an artifact of an abandoned Native American agricultural site, similar to those found in this region on the mainland (Albert & Minc 1987). The large region of boreal forest delineated over much of the northern portion of the island may be one of the most extensive and highest quality examples of its type. All three of these areas will be highlighted for more detailed field investigation in 1999. A rich assemblage of bird species was recorded during spring surveys, reflecting the diversity of habitats present on the island. Future work will attempt to define those habitats most critical to migrating birds and determine which birds remain to set up territories and nest.

### ***Garden Peninsula Islands***

Poverty Island, where natural communities were well documented during bedrock shoreline surveys (Albert et al. 1995), is known to support significant natural communities and several rare plant species. The species, consisting of the federal and state threatened dwarf lake iris, the state special concern Richardson's sedge (*Carex richardsonii*) and the state special concern beauty sedge (*Carex concinna*), were all found in association with a globally rare alvar community comprising most of the eastern shore of the island. A high quality boreal forest dominates the interior. The entire island comprises a significant biodiversity site.

Summer Island, the largest of the Garden Peninsula group, is notable for its extensive east shoreline of a globally rare alvar community, which also supports the same set of species noted above for Poverty Island, albeit in collectively larger populations. An area of alvar not identified during 1995 bedrock shore surveys was discovered along the northwest shore, where additional colonies of dwarf lake iris and beauty sedge were also found. Relatively low

diversity mesic forests characterize the interior of the island. A large outcrop of limestone bedrock forms a low cliff in the southern portion of the island, supporting a large colony of the state special concern slender cliff-brake (*Cryptogramma stelleri*), a species not known from adjacent islands.

Little Summer Island was found to be undergoing locally extensive land clearing due to construction of a small aircraft landing strip. However, a large colony of the state special concern climbing fumitory (*Adlumia fungosa*) and a small colony of the federal and state threatened dwarf lake iris were newly documented along the boundary of state forest land. A small but significant example of mesic forest was found within a block of state forest land, where numerous mesic forest species not observed on the nearby and significantly larger Summer Island were documented. In addition, a possible high quality example of a coastal wetland community type (rich conifer swamp/northern fen) was identified along the east shore of the island.

## Projected Island Work for 1999

### *Natural community surveys*

Within the Beaver Island archipelago, Beaver and Garden islands are targeted for the completion of inventory, including detailed aerial photo interpretation prior to field surveys. High and Hog islands are potential priority sites and may be visited in 1999, pending the ability to incorporate these islands into the field schedule. Bois Blanc Island in northern Lake Huron is a priority site for the assessing the extent and condition of old-growth forest and additional communities. For the Garden Peninsula group, Poverty, Summer, and Little Summer islands (and possibly St. Martin Island) will be evaluated for inventory work, including community sampling and floristic survey.

### *Botanical surveys*

Beaver and Garden islands are targeted for the completion of shoreline surveys and selected interior communities for priority plant species. Surveys will continue to highlight Great Lakes endemics, occurrences for which poor data exist, and markedly dated to historical records. Where possible, inventory will be coordinated with staff ecologists to assist in community identification and lessen the need for multiple or separate surveys. Bois Blanc Island may be visited to conduct reconnaissance with ecologists. In the Les Cheneaux Islands, Marquette and the La Salle islands are targeted for spring surveys as access is permitted via private landowners. For Drummond Island, the poorly surveyed eastern shore has been identified for spring reconnaissance for possible alvar and limestone cliff habitats.

### *Animal surveys*

Within the Beaver Island archipelago, Beaver and Garden islands have been prioritized for migratory as well as breeding bird surveys. These islands will also be inventoried to complete insect inventories, including the examination of coastal sites for Lake Huron locust (*Trimerotropis huroniana*), with another attempt to black-light and more definitively assess the status of the very rare aweme borer moth (*Papaipema aweme*). North or South Fox island may be accessed for migratory bird surveys, pending access. Bois Blanc Island has been prioritized for surveys for migratory and breeding birds, insects, and possibly massasauga rattlesnake (*Sistrurus catenatus catenatus*). Drummond Island is prioritized for breeding bird surveys.

### *Aquatic surveys*

Aquatic zoology investigations, not conceptualized in the original workplan, will be implemented to study the status of fish, mollusk, and benthic organisms via exploratory surveys. Initial focus areas will include Beaver and Garden islands, with the potential to expand this work to northern Lake Huron and possibly the Garden Peninsula chain as resources permit.

### *Landowner contact*

Landowner contact will be implemented to initiate the conservation planning phase of the project. This will consist of organizing focus groups and other island stakeholders to determine the most effective methods for disseminating and employing natural features information. For 1999, this effort will take place on Beaver Island.





**Sugar maple blowdown in Southwest Old-growth, showing formation of tip-up mound, Beaver Island.**

**Mature sugar maple in Southwest Old-growth, Beaver Island.**



**Forest perspective of largest sugar maple in Southwest Old-growth, Beaver Island.**





**Cobble shore and storm beach ridge on north shore of Garden Island.**

**Cobble glade near Sweat Lodge Swale, with Native American sweat lodge in distant background.**



**Colony of common twayblade (*Listera*) orchids growing in cold spring of cedar swamp, Beaver Island.**

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