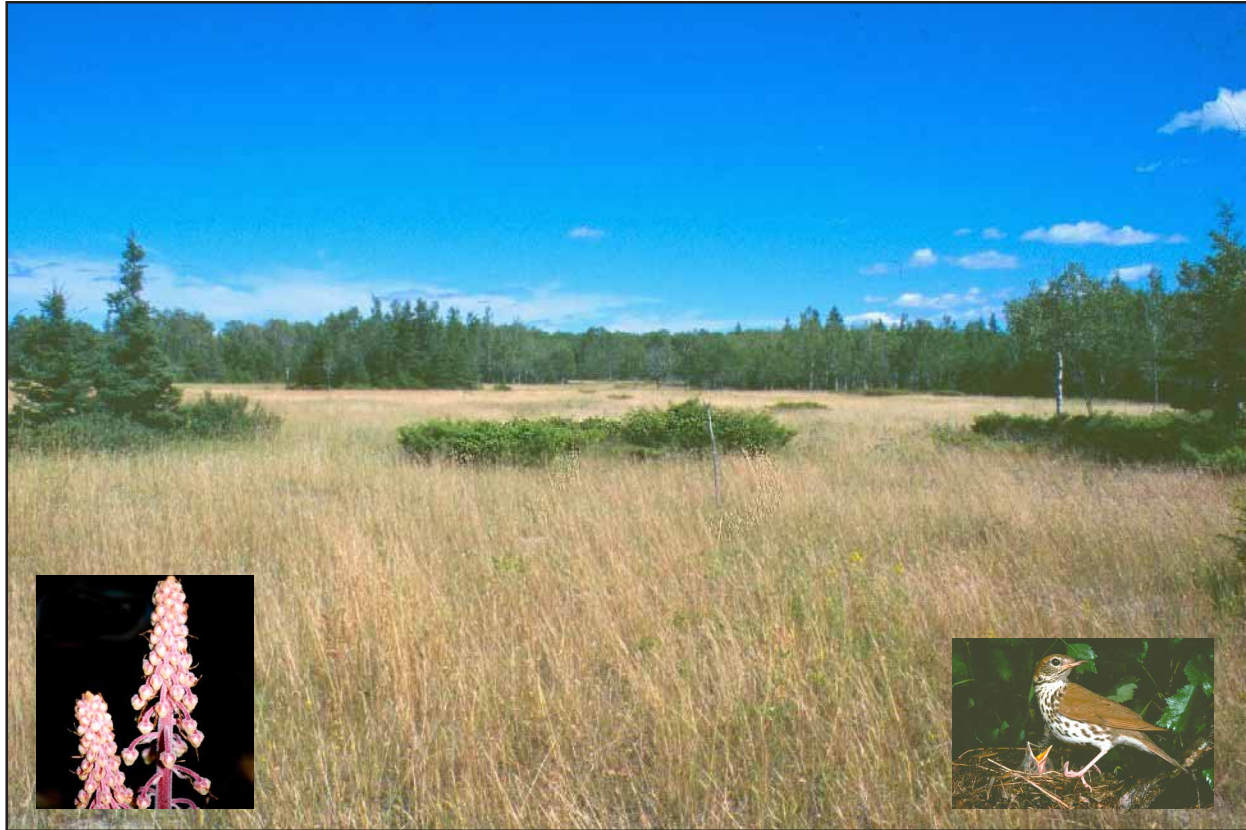

Biological Inventory for Conservation of Great Lakes Islands: Year 2001 Progress Report



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Michigan Coastal Management Program
Land and Water Management Division
Coastal Management Program Grant #01-309-10

Submitted September 30, 2002

Report Number 2002-21



MICHIGAN STATE
UNIVERSITY
EXTENSION



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, compile comprehensive information on natural features and significant biodiversity areas, and then convey this information in the most useful form for landowner education and conservation planning purposes. The first year of the project focused on several biological inventories in the Beaver Island archipelago and a selective floristic survey of several islands within the Garden Peninsula group. In 1999, we continued inventories within the Beaver Island archipelago and also conducted inventory work in northern Lake Huron, focusing on Bois Blanc Island, selected islands within the Les Cheneaux chain, and portions of Drummond Island. In addition, a prototype conservation planning workshop was held on Beaver Island for residents and other island stakeholders. In 2000, the third year of the study, inventories were continued in northern Lake Huron, highlighting Bois Blanc Island, Drummond Island, and selected islands within Potagannissing Bay. Preliminary work was also completed for preparation of a conservation planning workshop to be held in 2001 for Drummond Island. Analysis of the work completed to date was conducted to assess the status of the project and its future direction.

In 2001, the fourth year of this study, we conducted inventories on Drummond Island, the second largest island in Michigan. In addition to biological inventories for natural communities, rare plants, and rare animals, all natural features data for Drummond Island were digitized for management within the Michigan Natural Features Inventory (MNFI) GIS systems. A conservation outreach workshop was also held with residents and stakeholders following the field season, following preliminary work completed in 2000 and building upon the format used for an initial island workshop on Beaver Island.

Animal Surveys: Inventories were conducted to complete a two-year census of migratory and breeding birds, and a targeted insect survey was performed for the federal and state endangered Hine's emerald dragonfly. For the bird survey, 113 species were recorded overall, with 94 species observed during spring migration and 97 species observed during the summer breeding season. Forty-four species were classified as long distance migrants, 50 were classified as short distance migrants, and 19 species were considered residents. Mean bird abundance and species richness were calculated and compared during migra-

tion and breeding season. Mean bird abundance during migration was 8.3 birds per station, whereas species richness was 6.4 species per station. During the breeding season, mean bird abundance was 9.9 birds per station, and species richness was 7.3 birds per station. A qualitative assessment of habitat use by birds was conducted, comparing shoreline sites, inland sites, and inland water sites during both the migration and breeding seasons. Five important bird migration sites and six important bird breeding sites were identified. Nine new rare bird occurrences and two known rare bird occurrences were documented during surveys. For insect surveys, four sites identified during 2000 surveys were searched for Hine's emerald dragonfly. No Drummond Island locations could be documented, and it was concluded that the potential is low for this species, though there may be additional habitat of merit for further surveys, which may also identify other listed dragonflies.

Plant Surveys: Rare plant surveys were conducted in conjunction with all natural community surveys. Comprehensive inventory was conducted in the Maxton Plains complex, on Marblehead, and in selected areas along and near the southern coast. Nine new plant occurrences were documented from a total of six sites, and 18 previously known occurrences from a total of seven sites were located and updated.

Natural Community Surveys: Natural community surveys resulted in the identification of one new high quality occurrence for alvar and significant updated information for six previously known communities. Data were gathered highlighting ecological processes, natural and artificial disturbance, the presence of invasive exotic species, and spatial extent of communities. Site summaries were prepared for significant survey targets.

Digitization of Island Data: Digitizing was completed for all Drummond Island natural features data, incorporating the results of 2001 surveys. An explanation of the digitizing process within the context of heritage data methodology is provided. Over the four years of the island project a total of 430 occurrences have been digitized, representing nearly 4% of the MNFI statewide natural features database.

Conservation Outreach: A conservation outreach workshop, based on the previous format for Beaver Island, was prepared and held for Drummond Island residents and stakeholders in the fall of 2001. Preliminary planning for this workshop occurred in the fall of 2000 and the winter of 2001. Organization of the workshop included collaboration with The Nature Conservancy (TNC) Northern Lake Huron Bioreserve

Office and key full-time island residents. A total of 22 residents attended the workshop, and relationships were developed with key people of the Drummond Island community. After this workshop, an evaluation was prepared assessing and comparing the results of the outreach workshops held for Beaver Island and Drummond Island. The original goal of conservation outreach workshops was to test what types and levels of natural resource information are desired by island communities. However, while collaborating with partners and community leaders, conservation planners learned to focus less on testing which information is desired by communities while becoming more directed to designing effective methods for conveying this information. Further evaluation of conservation

outreach workshops will follow the final year of the island project, which includes an outreach workshop for Bois Blanc Island in the Straits region.

Identification of Significant Biodiversity Areas: Several areas were briefly highlighted, including the Maxton Plains, Huron Bay, Big Shoal Cove, and Marblehead Peninsula.

Projected Work for 2002: Efforts for the fifth and final year of the island project will include plant and natural community surveys of Bois Blanc Island, selected areas to complete inventories in the Les Cheneaux Islands, a comprehensive massasauga inventory of Bois Blanc Island, and Hine's emerald surveys on Bois Blanc Island and targeted areas in the Les Cheneauxs.

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Introduction

This progress report presents the results of year four of a five-year project to conduct systematic inventories of selected Great Lakes islands and island groups, followed by selected conservation planning workshops. As noted previously (Penskar et al. 1999), a considerable portion of the biological diversity unique to the Great Lakes region is found on islands. Soule (1993) stated that “nowhere else does the combination of vast, interconnected, mid-continental bodies of freshwater and such a number of variety of islands occur.” Thus, the nearly 600 islands contained within Michigan’s borders comprise a critically important part of this freshwater landscape, owing to their richness in variety of geography, geological origin, indigenous and non-indigenous human history, and biodiversity.

Over the past two decades Michigan Natural Features Inventory (MNFI) has surveyed numerous natural communities and rare species found on or allied with Great Lakes islands. This extensive work was described in part by Soule (1993) and was detailed in previous years’ progress reports (Penskar et al. 1999, 2000, and 2001). Conducting comprehensive biological inventories on Great Lakes islands is both timely and crucial to the conservation of biodiversity, as reflected in the findings and recommendations of The State of the Great Lakes Island Report (Vigmostad 1999). This report comprises the proceedings of a 1996 U.S.-Canada Great Lakes islands workshop convened by the Great Lakes Island Project (Depart-

ment of Resource Development, Michigan State University) to determine the state of Great Lakes islands and elucidate potential conservation strategies. Among the three fundamental findings of the workshop was a recommendation for governments and other entities to support island and archipelago conservation, and to that end, to base conservation planning on sound scientific information. Comprehensive inventories are thus critical to building the strong base of scientific knowledge upon which conservation strategies are dependent.

In this compilation of our efforts for the fourth year of the project, we provide the results of biological inventories conducted by zoologists, botanists, and ecologists on Drummond Island, which at the eastern border of the Upper Peninsula comprises the second largest island within the state of Michigan. As in the three prior progress reports, important biodiversity areas are briefly highlighted at the end. We also provide a summary of digitizing work initiated to convert all island natural feature occurrences into spatial data for management within MNFI’s Geographic Information System (GIS). Lastly, brief descriptions of inventory targets for the 2002 field season are given in addition to a brief overview of planning for a conservation outreach workshop scheduled to be held on Bois Blanc Island during late summer of 2002.

Organization of Report

This report has been organized according to the various components of the project: biological inventories and site summaries, data digitizing, conservation outreach, identification of significant biodiversity areas, and projected fifth-year work.

Biological inventories in year 2001 consisted of the following types: 1) animal surveys, with an emphasis on migratory birds, breeding birds, and selected rare invertebrates, 2) plant surveys, focusing on Great Lakes shoreline endemics, alvar and other limestone bedrock sites, and the identification of intact coastal and interior habitats, and 3) natural community surveys, emphasizing the delineation and assessment of high quality natural communities, with an emphasis on Great Lakes

alvar communities, as well as interior communities such as boreal forest, mesic northern forest, and conifer swamps. Methods, results, and discussion are provided separately for each of the aforementioned components. Survey results are followed by site summaries for significant areas covered in botanical and natural community inventories. A discussion of the digitizing process for island data is then provided, and then a section with a detailed account of the conservation outreach workshop prepared and given for Drummond Island residents and other stakeholders. The report concludes with an assessment of significant biodiversity areas and a brief description of our projected work for 2002 surveys.

The Study Area

The study site for the third year of island inventory was Drummond Island, Michigan's second largest island, which occurs on the eastern end of the Upper Peninsula in northern Lake Huron (Figure 1). Drummond Island is exceeded in size only by Isle Royale within the State of Michigan, and comprises the

easternmost point of the Upper Peninsula along the Canadian border. The island covers more than 83,000 acres and forms approximately 130 miles of Great Lakes shoreline. A significant portion of Drummond Island lies within Lake Superior State Forest.

Methods for Animal Surveys

Animal surveys on Drummond Island focused on assessing the abundance and richness of migratory and breeding birds, and in particular Neotropical migratory songbirds. Targeted inventories for red-shouldered hawk (*Buteo lineatus*) and wetland birds were also conducted on both islands. Surveys were initiated on Drummond Island for the federally endangered Hine's emerald dragonfly (*Somatochlora hineana*).

The MNFI 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, landcover maps, and by consulting with individuals knowledgeable about the islands' flora and fauna. MNFI ecologists and botanists also assisted

in identifying potential survey sites via their site inventories.

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 groups and are described in the following sections. Incidental observations of listed species, which have been designated under the federal Endangered Species Act and/or state endangered species legislation as endangered or threatened were noted by all project staff when they occurred. Special concern species were also sought and recorded. 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 statewide BCD. All birds species observed during spring and summer island visits were noted and recorded.

Justification for Animal Target Selection

The importance of stopover sites to migratory birds, which travel great distances between their wintering and breeding grounds, has only recently been addressed (Moore and Simons 1992, Moore et al. 1993). Migration is one of the most energy-demanding processes in a bird's life, resulting in a weight loss of approximately one-percent per hour of flight (Alerstam 1990). The risks that migratory birds face in seeking to replenish their energy reserves while avoiding predators and adverse weather conditions in unfamiliar habitats have been well documented (Lindstrom 1989, 1990, Aborn 1993, Wiedenfield and Wiedenfield 1995). Since birds spend as much as half of the year or more en route between breeding grounds and wintering areas, the habitats they depend on during this period are critical links in their survival. Defining the characteristics of suitable stopover habitat, and determining how development and land-use affect their distribution and quality is an important issue that must be addressed. Degradation or elimination of suitable stopover habitats has the potential to increase mortality, reduce reproduc-

tive potential, and contribute to overall population declines of migratory birds.

The Great Lakes shorelines serve as important migration corridors for large concentrations of migrant land birds (Beebe 1933, Perkins 1964, Hussel 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 (1996) suggested three possible reasons that Great Lakes islands are attractive to Neotropical birds as well as short distance migrants including: 1) nocturnal migrants that find themselves over open water at dawn seek the nearest land, 2) islands often represent northward extensions of the mainland and are included in the flight-path north by internal orientation mechanisms of birds and stochastic events of weather patterns, 3) islands are the intended destination of migratory species that regularly nest on the islands.

In their 1993 study, Ewert and Hamas (unpubl. data) documented the importance of the immediate shoreline along the northern shore of Lake Huron as

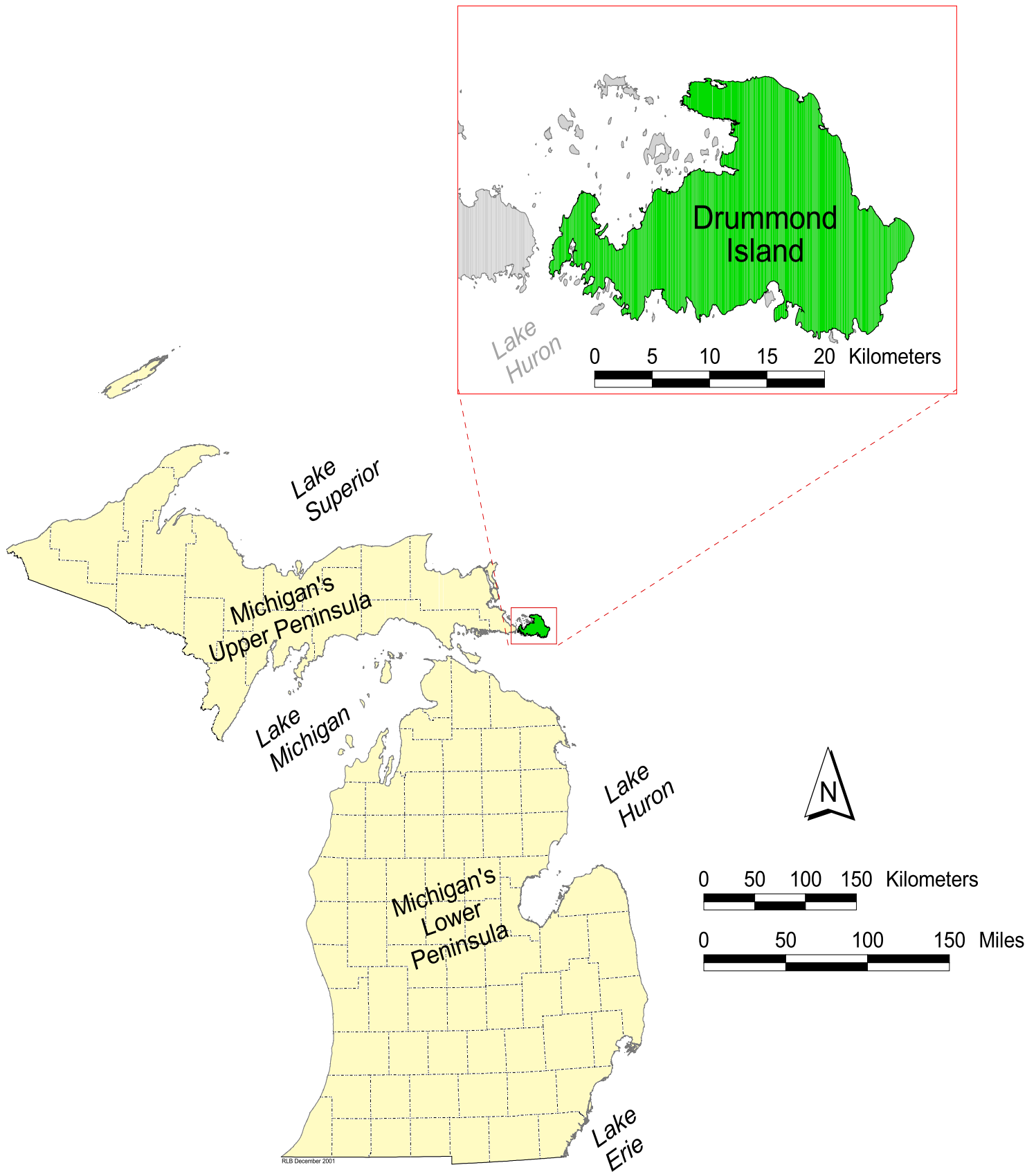


Figure 1. The study area in northern Lake Huron.

critical stopover habitat for Neotropical migratory birds. They found that this shoreline habitat provides an important food source, in the form of aquatic midges (Chironomidae), to spring migrants that arrive before terrestrial insects are abundant. It would thus seem logical that Bois Blanc Island, located just southwest of this study area, and Drummond Island located to the east, with similar shoreline habitats, might also provide important stopover sites for migratory songbirds.

The state threatened red-shouldered hawk (*Buteo lineatus*) has experienced declines in Michigan due to loss of its preferred nesting habitat. It nests in floodplain forests or extensive mature deciduous or mixed forest complexes. Typically these forest complexes have wetland habitats nearby or wetlands interspersed among these forested habitats (Cooper 1999). Red-shouldered hawks have not been well documented on Bois Blanc or Drummond Island although suitable habitat exists on both of these islands.

Due to the abundance of wetland habitat on Bois Blanc and Drummond Island, rare wetland birds were targeted for surveys. These include the state endangered

yellow rail (*Coturnicops noveboracensis*), which is only known from three locations in Michigan, including one on Drummond Island, the state threatened least bittern (*Ixobrychus exilis*), and the state special concern American bittern (*Botaurus lentiginosus*).

The Hine's emerald dragonfly is an extremely rare dragonfly that was listed as federally endangered in January 1995 (DOI 1995). This species is currently known from northern Michigan, northeastern Illinois, Door County in northeastern Wisconsin, and one site in the Missouri Ozarks (D. Cuthrell pers. comm.). Historically, the species was known to occur in three areas of Ohio, and from one site in Indiana. In addition, one specimen has been collected in northern Alabama. The Hine's emerald dragonfly was first documented in Michigan in 1997. Since this time, three distinct populations have been found in Michigan in the Upper Peninsula, northern Lake Huron (Bois Blanc Island), and along the northern Lower Peninsula shoreline. The Hine's emerald dragonfly is thought to be restricted to wetland habitats characterized by thin soils over dolomite bedrock with marshes, seeps, and sedge meadows (U.S. Fish and Wildlife Service 1999).

Birds

Bird counts using the point count method were conducted using standard methodology as outlined by Ralph et al. (1993, 1995). All birds heard or seen within a 50-meter radius were tallied for 5 minutes during spring migration (May) and for 10 minutes during the breeding season (June). Birds heard or observed outside the 50-meter radius circle were also noted. Point counts were conducted at 41 stations (or sites) on Drummond Island (Figure 2). Each station was visited once in May and once in June. Spring bird counts were conducted between sunrise and 1200 hr on 16-20 May 2001. Breeding bird counts were conducted between sunrise and 1100 hr on 14-18 June 2001. All counts were conducted when there was no precipitation and little or no wind. Surveys began immediately after the observer arrived at the location. Point counts were conducted at least 250m apart to ensure that each bird was counted only once. Standard field forms for point counts were used. Ten major habitat types were sampled for migratory and breeding birds. They included:

- Four forest habitats: mixed coniferous, white cedar-dominated areas, northern hardwoods, and aspen/birch sites;
- Four wetland habitats: sedge meadow adjacent to lakes or rivers, northern fen adjacent to lakes, Great Lakes Marsh, and scrub/shrub wetland;
- Two open habitats: alvar and old field;

- Shoreline survey sites were either classified as bedrock, cobble and/or sandy shoreline.

Overall mean bird abundance was calculated by dividing the total number of birds observed within 50m at each of the point count stations by the total number of stations censused (forty-one). Species richness was calculated by dividing the total number of species recorded at each of the point count stations by the total number of stations censused. These means were calculated with a 95% confidence level. Dominant species were identified by calculating the total number of observations for each species at each of the point count stations by the total number of stations censused.

An informal assessment of habitat use by migratory and breeding birds was conducted. Habitats were categorized as shoreline, interior, or inland water sites. Shoreline sites were those points located between the shoreline and 0.4km (0.25mi) inland. Interior sites were greater than 0.4km (0.25mi) from the shoreline. Inland water sites were greater than 0.4km (0.25mi) from the shoreline. Mean bird abundance and species richness was calculated for shoreline, interior, and inland water sites. Of the 41 point count stations on Drummond Island, 15 were designated as shoreline, 16 were designated interior, and 10 were designated inland water sites.

Surveys for wetland birds were conducted in accessible and appropriate habitats. Taped American

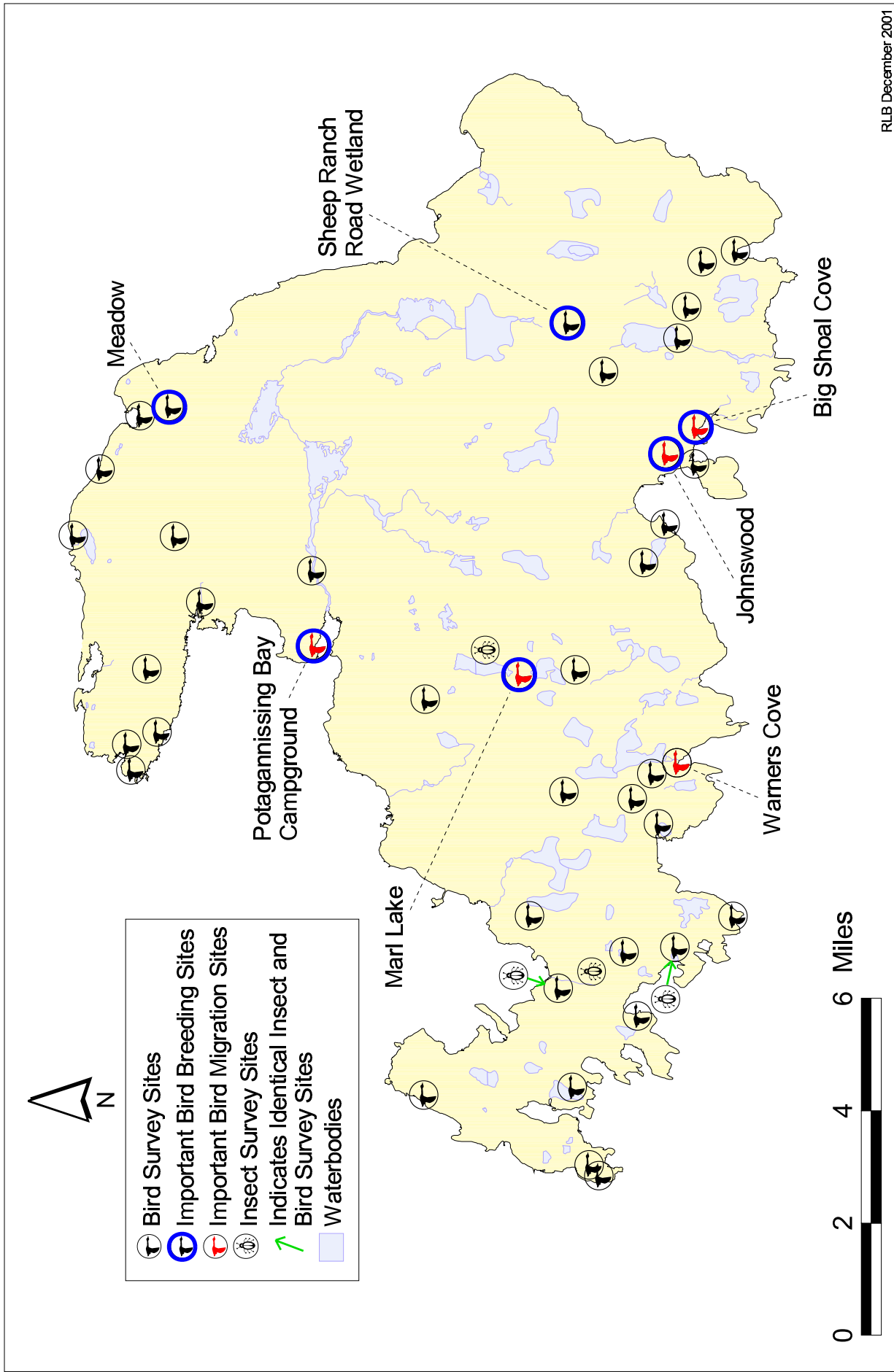


Figure 2. Bird and insect sampling sites on Drummond Island.

bittern (*Botaurus lentiginosus*) calls were broadcast with a predator caller at a number of wetlands on Drummond Island. The state threatened common loon (*Gavia immer*) is known to occur on Drummond

Island. Observations with binoculars or a spotting scope were made at inland lakes on these islands to determine if loons were feeding or nesting at these locations.

Insects

Meander surveys were conducted for the Hines emerald dragonfly by walking through suitable habitat during the appropriate time of year on Drummond Island on 17-19 July 2001 around Marl Lake, Pigeon Cove Wildlife Flooding, Pigeon Cove Creek, and Isaacson Lake (Figure 2). Adult dragonflies in the

genus *Somatochlora* were caught with an aerial net, identified, and then released. In addition, close-focusing binoculars were used to observe dragonflies that were perched higher up in the trees and those that were flying over the open water.

Results of Animal Surveys

Birds

One hundred thirteen bird species were recorded during both spring migration and the summer breeding season in 2001 on Drummond Island (Table 1). Ninety-four species were recorded separately during spring migration and 97 species during the breeding season. Forty-four species are classified as long distance migrants (birds that winter south and breed north of the Tropic of Cancer). Fifty species are classified as short distance migrants (birds that winter in the southern U.S. and northern Mexico and breed in the U.S. and Canada). Nineteen species are considered residents (birds that winter and breed in the same region). Species data gathered in 2000 is provided as a between year comparison.

Mean bird abundance during the 2001 spring migration was calculated as 8.3 birds per station (Table 2). Species richness during spring migration was 6.4 species per station. The three most common bird species encountered during migration point counts were the black-throated green warbler (*Dendroica virens*), Nashville warbler (*Vermivora ruficapilla*), and ovenbird (*Seiurus aurocapillus*).

Mean bird abundance during the summer breeding season in 2001 was calculated as 9.9 birds per station (Table 3). Species richness during the summer breeding season was 7.3 species per station. The black-throated green warbler, American redstart (*Setophaga ruticilla*), and red-eyed vireo (*Vireo olivaceus*) were the most common species encountered during breeding season point counts.

A qualitative assessment of habitat use by migratory and breeding birds on Drummond Island was conducted. The 41 bird survey stations were divided into one of three categories: shoreline site, inland site, or inland water site. Of the 41 survey stations, 17 were classified as inland sites, 9 were classified as inland

water sites, and 15 were classified as shoreline sites. Shoreline sites are defined as being within 0.4 km (0.25 mi) of the high water mark. Inland and inland water sites are greater than 0.4 km (0.25 mi) from the high water mark.

There was little difference between mean bird abundance at inland (8.4 birds), shoreline (8.3 birds) and inland water (8.1 birds) sites during migration (Figure 3). During the breeding season, bird abundance was highest at inland water (10.4 birds) and shoreline sites (10.3 birds), followed by inland sites (9.3 birds). Bird abundance during the breeding season had a similar trend in 2000.

Species richness during migration was highest at shoreline sites (6.8 species), followed close by inland sites (6.4 species) and finally, inland water sites (5.7 species) (Figure 4). Species richness during the breeding season was highest at shoreline sites (7.7 species), followed by inland water (7.4 species) and finally inland sites (6.9 sites). Most of these results differ from last year's findings (2000), when shoreline sites were not registering as high as inland and inland water sites. A pattern of use at shoreline, inland and inland water sites is not evident, especially during migration. This may be due to the short time period in which the bird surveys took place. The surveys were designed to provide a "snapshot" picture of bird use on the island, which they did provide. A long term study of migrating and breeding bird use on the island may elucidate a more significant trend than what was undertaken here.

Bird survey results from the individual 41 point count stations were compiled and an analysis over the two-year study period was conducted. Individual stations with nine or more birds (bird abundance) recorded during migration and/or the breeding seasons were identified. Individual stations with seven or more

Table 1. Bird Species Recorded During Migration (M) and Breeding Seasons (B) in 2000 and 2001 on Drummond Island. State listed and special concern species are in bold type.

Common Name	Scientific Name	2000	2001
Long Distance Migrants:			
Pied-billed Grebe	<i>Podilymbus podiceps</i>	M, B	M, B
Blue-winged Teal	<i>Anas discors</i>	B	M
American Widgeon	<i>Anas americana</i>	B	
Osprey (T)	<i>Pandion haliaetus</i>	M, B	M, B
Broad-winged Hawk	<i>Buteo platypterus</i>	M, B	M, B
Merlin (T)	<i>Falco columbarius</i>	B	B
Solitary Sandpiper	<i>Tringa solitaria</i>	M	
Spotted Sandpiper	<i>Actitis macularia</i>	M, B	M, B
Common Snipe	<i>Gallinago gallinago</i>		M, B
Caspian Tern (T)	<i>Sterna caspia</i>	B	B
Common Tern (T)	<i>Sterna hirundo</i>	B	M, B
Black Tern (SC)	<i>Chlidonias niger</i>	B	M, B
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>		M
Chimney Swift	<i>Chaetura pelagica</i>	B	
Ruby-throated Hummingbird	<i>Archilochus colubris</i>	M	M, B
Eastern Wood-pewee	<i>Contopus virens</i>	B	M, B
Alder Flycatcher	<i>Empidonax alnorum</i>	B	B
Willow Flycatcher	<i>Empidonax traillii</i>	B	
Least Flycatcher	<i>Empidonax minimus</i>	M, B	M, B
Great Crested Flycatcher	<i>Myiarchus crinitus</i>	M, B	M, B
Eastern Kingbird	<i>Tyrannus tyrannus</i>	M, B	M, B
Purple Martin	<i>Progne subis</i>	M, B	M, B
Bank Swallow	<i>Riparia riparia</i>	B	
Cliff Swallow	<i>Hirundo pyrrhonata</i>	M, B	
Barn Swallow	<i>Hirundo rustica</i>	B	
Veery	<i>Catharus fuscescens</i>	M, B	M, B
Swainson's Thrush	<i>Catharus ustulatus</i>	M, B	M, B
Wood Thrush	<i>Hylocichla mustelina</i>	B	M, B
Gray Catbird	<i>Dumatella carolinensis</i>	B	M, B
Blue-headed Vireo	<i>Vireo solitarius</i>	M, B	M, B
Warbling Vireo	<i>Vireo gilvus</i>	B	
Red-eyed Vireo	<i>Vireo olivaceus</i>	M, B	M, B
Tennessee Warbler	<i>Vermivora peregrina</i>	M	
Nashville Warbler	<i>Vermivora ruficapilla</i>	M, B	M, B
Northern Parula	<i>Parula americana</i>	B	M, B
Yellow Warbler	<i>Dendroica petechia</i>	M, B	M, B
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	M	M, B
Magnolia Warbler	<i>Dendroica magnolia</i>	M, B	M, B
Black-throated Green Warbler	<i>Dendroica virens</i>	M, B	M, B
Blackburnian Warbler	<i>Dendroica fusca</i>	M	B
Palm Warbler	<i>Dendroica palmarum</i>		M
Black-and-white Warbler	<i>Mniotilta varia</i>	M, B	M, B
American Redstart	<i>Setophaga ruticilla</i>	M, B	M, B
Ovenbird	<i>Seiurus aurocapillus</i>	M, B	M, B
Northern Waterthrush	<i>Seiurus noveboracensis</i>	M	M, B
Mourning Warbler	<i>Oporornis philadelphia</i>	B	B
Common Yellowthroat	<i>Geothlypis trichas</i>	M, B	M, B
Canada Warbler	<i>Wilsonia canadensis</i>		B

Common Name	Scientific Name	2000	2001
Scarlet Tanager	<i>Piranga olivacea</i>	M	M
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	M, B	M, B
Indigo Bunting	<i>Passerina cyanea</i>	B	B
Chipping Sparrow	<i>Spizella passerina</i>	M, B	M, B
Baltimore Oriole	<i>Icterus galbula</i>		M
Short distance migrants:			
Common Loon (T)	<i>Gavia immer</i>	M, B	M, B
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	M, B	M, B
American Bittern (SC)	<i>Botaurus lentiginosus</i>	M, B	M, B
Great Blue Heron	<i>Ardea herodias</i>	M, B	M, B
Canada Goose	<i>Branta canadensis</i>	M, B	M, B
Wood Duck	<i>Aix sponsa</i>	M, B	B
Green-winged Teal	<i>Anas crecca</i>	M	
American Black Duck	<i>Anas rubripes</i>	B	
Northern Pintail	<i>Anas acuta</i>	B	
Gadwall	<i>Anas strepera</i>	B	
Hooded Merganser	<i>Lophodytes cucullatus</i>		M
Common Merganser	<i>Mergus merganser</i>	M, B	M, B
Red-breasted Merganser	<i>Mergus serrator</i>	M	M, B
Turkey Vulture	<i>Cathartes aura</i>	M, B	M
Northern Harrier (SC)	<i>Circus cyaneus</i>	B	B
Sharp-shinned Hawk	<i>Accipiter striatus</i>		M
Red-shouldered Hawk (T)	<i>Buteo lineatus</i>		B
Red-tailed Hawk	<i>Buteo jamaicensis</i>	M	
American Kestrel	<i>Falco sparverius</i>	B	M
Sandhill Crane	<i>Grus canadensis</i>	M, B	M, B
Killdeer	<i>Charadrius vociferus</i>	M, B	M, B
American Woodcock	<i>Scolopax minor</i>		M
Mourning Dove	<i>Zenaida macroura</i>	M, B	M, B
Belted Kingfisher	<i>Ceryle alcyon</i>	M, B	M, B
Yellow-bellied Sapsucker	<i>Sphyrapicus varius</i>	M, B	M, B
Northern Flicker	<i>Colaptes auratus</i>	M, B	M, B
Eastern Phoebe	<i>Sayornis phoebe</i>	M, B	M
Tree Swallow	<i>Tachycineta bicolor</i>	M, B	M, B
Brown Creeper	<i>Certhia americana</i>		B
House Wren	<i>Troglodytes aedon</i>		M, B
Winter Wren	<i>Troglodytes troglodytes</i>	M, B	M, B
Sedge Wren	<i>Cistothorus platensis</i>		B
Golden-crowned Kinglet	<i>Regulus satrapa</i>	M, B	M, B
Ruby-crowned Kinglet	<i>Regulus calendula</i>	M	B
Eastern Bluebird	<i>Sialia sialis</i>	M, B	M, B
Hermit Thrush	<i>Catharus guttatus</i>	M, B	M, B
American Robin	<i>Turdus migratorius</i>	M, B	M, B
Northern Mockingbird	<i>Mimus polyglottos</i>		M
Brown Thrasher	<i>Toxostoma rufum</i>	M, B	M, B
American Pipit	<i>Anthus rubescens</i>	M	
Myrtle Warbler	<i>Dendroica coronata</i>	M, B	M, B
Pine Warbler	<i>Dendroica pinus</i>	M, B	B
Eastern Towhee	<i>Pipilo erythrophthalmus</i>		B
Field Sparrow	<i>Spizella pusilla</i>	B	
Vesper Sparrow	<i>Pooecetes gramineus</i>	M	B
Savannah Sparrow	<i>Passerculus sandwichensis</i>	M, B	M, B

Common Name	Scientific Name	2000	2001
Le Conte's Sparrow	<i>Ammodramus leconteii</i>	M, B	M
Song Sparrow	<i>Melospiza melodia</i>	M, B	M, B
Swamp Sparrow	<i>Melospiza georgiana</i>	M, B	M, B
White-throated Sparrow	<i>Zonotrichia albicollis</i>	M, B	M, B
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>	M	M
Red-winged Blackbird	<i>Abelais phoeniceus</i>	M, B	M, B
Eastern Meadowlark	<i>Sturnella magna</i>	M, B	B
Common Grackle	<i>Quiscalus quiscula</i>	M, B	M, B
Brown-headed Cowbird	<i>Moluthrus ater</i>	M, B	M, B
Pine Siskin	<i>Carduelis pinus</i>	M	M
American Goldfinch	<i>Carduelis tristis</i>	M, B	M, B
Residents:			
Mallard	<i>Anas platyrhynchos</i>	M, B	M, B
Common Goldeneye	<i>Bucephala clangula</i>	B	B
Bald Eagle (T)	<i>Haliaeetus leucocephalus</i>	M, B	M, B
Ring-necked Pheasant	<i>Phasianus colchicus</i>	M, B	M, B
Ruffed Grouse	<i>Bonasa umbellus</i>	M, B	M, B
Sharp-tailed Grouse	<i>Tympanuchus phasianellus</i>	M	
Ring-billed Gull	<i>Larus delawarensis</i>	M, B	M, B
Herring Gull	<i>Larus argentatus</i>	M, B	M, B
Rock Dove	<i>Columba livia</i>	B	
Barred Owl	<i>Strix varia</i>	B	B
Downy Woodpecker	<i>Picoides pubescens</i>	M	M, B
Hairy Woodpecker	<i>Picoides villosus</i>	M, B	M, B
Pileated Woodpecker	<i>Dryocopus pileatus</i>	M, B	M, B
Blue Jay	<i>Cyanocitta cristata</i>	M, B	M, B
American Crow	<i>Corvus brachyrhynchos</i>	M, B	M, B
Common Raven	<i>Corvus corax</i>	M, B	M, B
Black-capped Chickadee	<i>Poecile atricapillus</i>	M, B	M, B
Red-breasted Nuthatch	<i>Sitta canadensis</i>	M	M, B
European Starling	<i>Sturnus vulgaris</i>	M, B	M, B
Cedar Waxwing	<i>Bombycilla cedrorum</i>	B	M, B
Purple Finch	<i>Carpodacus purpureus</i>	M, B	M
Evening Grosbeak	<i>Coccothraustes vespertinus</i>	M	
TOTAL			
M=MIGRATION		90	94
B=BREEDING		99	97
Total # species recorded		118	113
(T) = State Threatened			
		6	7
(SC) = State Special Concern			
		3	3

Table 2. Mean bird abundance, species richness and dominant species recorded during spring migration in Year 2001 and 2000 on Drummond Island. Calculations include a confidence interval of 95%.

	Year 2001	Year 2000
Mean Bird Abundance (Mean No. birds per point count station)	8.3 ± 1.1	5.0 ± 0.9
Mean Species Richness (Mean No. species per point count station)	6.4 ± 0.9	4.0 ± 0.7
Dominant Species (In order of abundance)	Black-throated Green Warbler Nashville Warbler Ovenbird Myrtle Warbler Black-capped Chickadee	Black-throated Green Warbler American Redstart Nashville Warbler Black-and-white Warbler Ovenbird

Table 3. Mean bird abundance, species richness and dominant species recorded during summer breeding season in Year 2001 and 2000 on Drummond Island. Calculations include a confidence interval of 95%.

	Year 2001	Year 2000
Mean Bird Abundance (Mean No. birds per point count station)	9.9 ± 1.1	6.6 ± 1.1
Mean Species Richness (Mean No. species per point count station)	7.3 ± 0.7	4.5 ± 0.6
Dominant Species (In order of abundance)	Black-throated Green Warbler American Redstart Red-eyed Vireo White-throated Sparrow American Robin	Cedar Waxwing American Redstart White-throated Sparrow Black-throated Green Warbler Song Sparrow

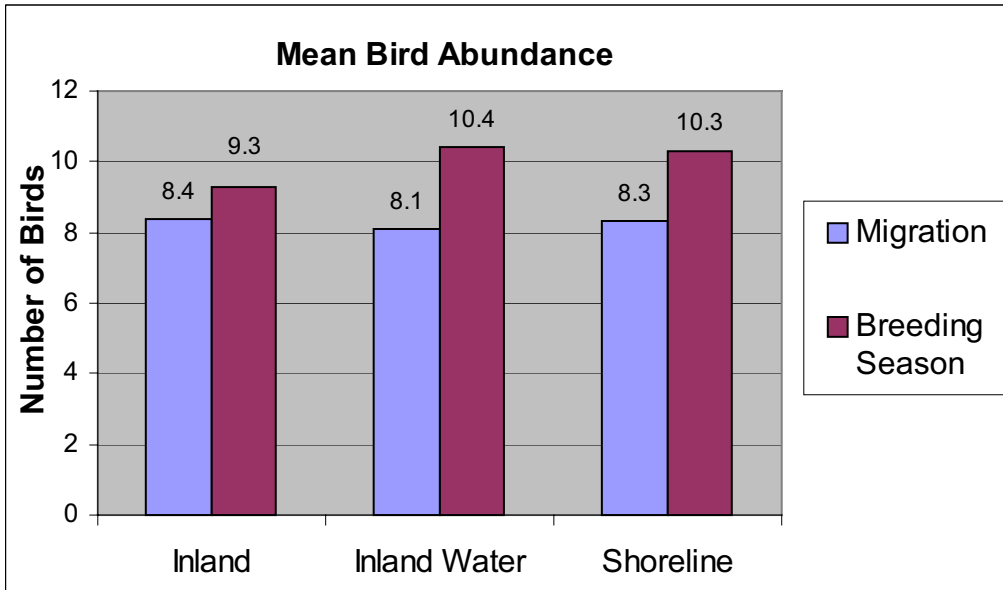


Figure 3. Distribution of birds on Drummond Island in 2001.

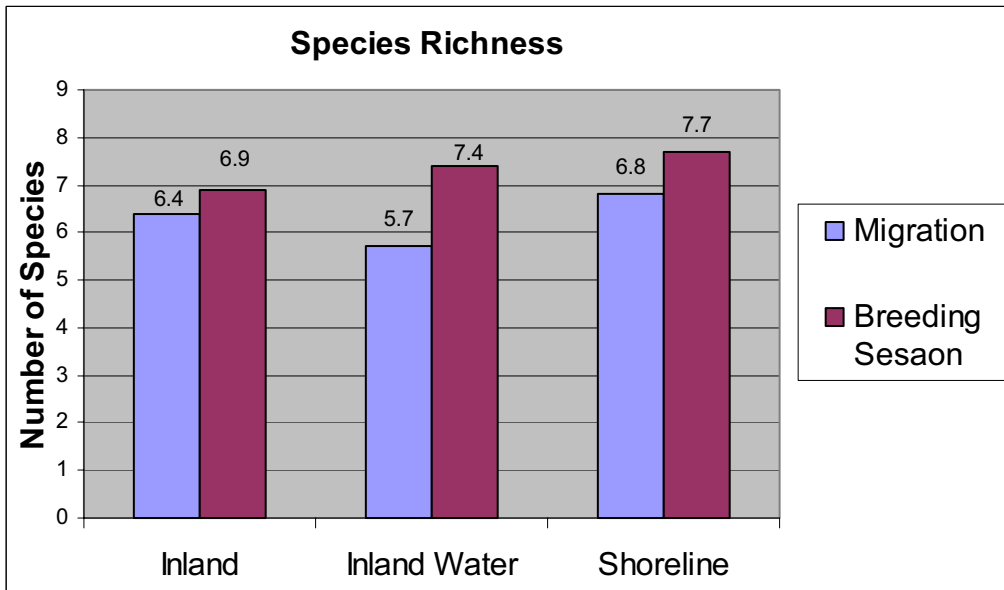


Figure 4. Distribution of bird species on Drummond Island in 2001.

species (species richness) recorded during migration and/or the breeding seasons were identified. Results from 2000 and 2001 were overlaid. Sites on Drummond Island that had high bird use over the two-year study period are shown in Figure 2. The following five sites are identified as having high bird numbers and/or species numbers during migration (shown in red bird icon):

- Warner’s Cove
- Big Shoal Cove
- Johnswood
- Marl Lake
- Potagannissing Bay Campground

The following six sites were identified as having high bird numbers and/or species numbers during the breeding season (shown with a heavy blue circle):

- Big Shoal Cove
- Johnswood
- Sheep Ranch Road Wetland
- Marl Lake
- Potagannissing Bay Campground
- Meadow

Three of the seven sites identified in the figure are along the shoreline, two are inland sites and two are inland water sites. The habitat varies at each site, with white cedar being dominant at Big Shoal Cove, aspen/birch at Johnswood, scrub/shrub wetland at Sheep Ranch Road wetland, mixed coniferous forest at Warner’s Cove, sedge meadow at Marl Lake, old field and Great Lakes Marsh at Campground, and old field

at Meadow. Four of the seven sites were identified as having high bird use during both the migration and breeding season. Those four sites are: Big Shoal Cove, Johnswood, Marl Lake and the Campground. The variety of habitats, location (shoreline, inland, inland water) use and identification of important bird sites during both seasons supports the hypothesis that Drummond Island as a whole provides critical stopover and breeding habitat required by birds.

State threatened and special concern birds were observed on Drummond Island in 2001 (Table 4).

Some noteworthy observations include:

- ❖ a new common tern (*Sterna hirundo*) nesting colony on a small shoal near Rogg Island
- ❖ an update to a previously known common tern nesting colony on Harbor Island Reef
- ❖ a new American bittern (*Botaurus lentiginosus*) nesting occurrence at Pigeon Cove
- ❖ a new American bittern nesting occurrence at Marl Lake
- ❖ a new northern harrier (*Circus cyaneus*) nesting occurrence at Pigeon Cove

Other rare species that were observed but were not confirmed nesting include common loons (*Gavia immer*), red-shouldered hawk (*Buteo lineatus*), bald eagles (*Haliaeetus leucocephalus*), osprey (*Pandion haliaetus*), merlin (*Falco columbarius*), and black terns (*Chlidonias niger*). The two years of bird surveys have provided eight new element occurrences and three updates to known occurrences.

Table 4. Rare bird nesting occurrences documented during 2001 and 2000 surveys of Drummond Island. Occurrences documented during 2000 are highlighted in blue.

Site name	Known occurrences-relocated and updated	New occurrences documented
Shoal near Rogg Island		Common Tern (T)
Harbor Island Reef	Common Tern (T)	
Pigeon Cove		American Bittern (SC)
Marl Lake		American Bittern (SC)
Pigeon Cove		Northern Harrier (SC)
Scott Bay	Black Tern (SC)	
Snively Road		Merlin (T)
Potagannissing River Wildlife Flooding		American Bittern (SC)
Bruce Point Marsh		American Bittern (SC)
Dickenson Lake		American Bittern (SC)
Rabbit Bay		Osprey (T)

Insects

Surveys conducted for the Hine's emerald dragonfly on Drummond Island failed to locate any new populations. However, another emerald species was located at Pigeon Cove Creek. A total of four brush-tipped emerald dragonflies (*Somatochlora walshii*) were aerial net captured and released. Habitat appar-

ently exists for emeralds at this site. Other sites surveyed this year may also reveal emerald occurrences. Further surveys are needed to determine the presence of Hine's emerald dragonflies on Drummond Island.

Discussion of Animal Surveys

Birds

The diversity and abundance of birds documented on Drummond Island is impressive and illustrates the important role that islands play in providing critical stopover and breeding habitat for birds. The previous bird list for Drummond Island was compiled in 1993 from observations made from 1981 to 1993 which focused on The Nature Conservancy's Maxton Plains Preserve (Stephenson 1993). Observations were made during the spring, summer and early autumn months and most observations were made incidental to alvar grassland research activities occurring on the preserve. Over the 13 year time span 101 species were considered breeding and 35 species were migratory and not known as breeding populations. Surveys conducted in 2000 and 2001 on Drummond Island document a high of 99 birds during the breeding season (2000) and 94 species during migration (2001).

Differences in bird numbers among islands. Bird surveys have been conducted two years consecutively on Beaver Island, Garden Island, Bois Blanc Island and Drummond Island, from 1998 to 2001. With the exception of Beaver and Garden Island having only a migrating bird survey in 1998, the first year of our survey efforts, all other islands had both migratory and breeding bird surveys conducted. Drummond had the highest total number of species recorded during both migration and the breeding season, with 118 species in 2000 and 113 species in 2001. Beaver Island is next with 108 species in 1999, followed by Bois Blanc with 98 species in 1999 and Garden Island with 83 species in 1999 (Table 5). It is difficult to draw significant conclusions based on these numbers with only two years of data. Although, some factors to consider include: size of island (Drummond is the largest of the four), distance from mainland (Drummond is closest to mainland), habitats surveyed (Drummond had the widest variety), weather patterns during surveys (varied between years) and timing surveys to migration (varies year to year).

Mean species richness during migration was

basically equal among three of the islands. Drummond Island had a mean average of 6.4 (± 0.9) species per survey site in 2001; Beaver Island averaged 6.4 (± 0.9) species in 1999; and Bois Blanc averaged 6.3 (± 0.9) species in 1999. The near equality of species richness on these three islands may indicate that they are equally important to species as stop over sites during migration. A long term bird study on these islands may support or reveal other important trends.

Bois Blanc Island had the highest mean number of species during the breeding season in 1999, calculated as 8.1 (± 1.1) species per survey site. Following Bois Blanc Island in this category are three lower, but similar results for Drummond, Beaver and Garden Islands. Drummond Island averaged 7.3 species per survey site in 2001; Beaver Island had 7.2 species per site in 1999 and Garden Island, 7.0 species per site in 1999. It is interesting to note that Bois Blanc is the leader in species richness during the breeding season even though Drummond Island had the highest number of species recorded during the breeding season overall (99 species on Drummond compared to the Bois Blanc high of 74 species). As noted in the 2000 Island Report, Bois Blanc's high bird means may be explained by several factors. The small size of Bois Blanc Island compared to Drummond Island (approx. 24,000 acres versus 83,000 acres) may concentrate species. Bois Blanc is located just east of the Straits of Mackinac, which is the narrowest waterway between the Lower Peninsula and Upper Peninsula. The relatively large size of Bois Blanc Island in the Straits area may provide an advantageous stopping point as birds funnel up the Lower Peninsula shoreline and cross the water towards the Upper Peninsula. Finally, nearly half of Bois Blanc Island lies within state ownership. The lack of development on Bois Blanc may provide many species with a place to breed, undisturbed. A large portion of Drummond Island also lies within state ownership and is therefore undeveloped. Much of this area was not surveyed for birds due to its inaccessibil-

Table 5. Number of species recorded during the migration and breeding season on four islands. Total number of species recorded in both seasons is highlighted in blue.

Year	Drummond Island	Bois Blanc Island	Beaver Island	Garden Island
1998			52 species (May)	33 species (May)
1999		78 species (May) <u>74 species (June)</u> 98 species (May & June)	76 species (May) <u>89 species (June)</u> 108 species (May & June)	63 species (May) <u>58 species (June)</u> 83 species (May & June)
2000	90 species (May) <u>99 species (June)</u> 118 species (May & June)	77 species (May) <u>68 species (June)</u> 87 species (May & June)		
2001	94 species (May) <u>97 species (June)</u> 113 species (May & June)			

ity. Future bird surveys should focus on this largely undisturbed area.

Distribution of birds. Factors that likely contribute to the distribution of migratory birds using islands as stopover sites include: weather conditions, human use patterns, abundance of food items, predation pressure, and the composition, structure, and successional stage of the vegetation. In their 1993 research (unpubl.) Ewert and Hamas note that spring migrants often arrive in Michigan before the leaves on trees have fully emerged. Consequently, lepidopteran larvae, which are a primary source of food for migrants in areas south of Michigan, are not yet abundant. Migratory birds instead take advantage of the swarms of emerging aquatic insects, such as chironomid midges (Family: Chironomidae), that are concentrated along Great Lakes beaches, and along inland streams, lakes, and wetlands. Spiders are also proving to be important food for migrating birds (Smith, pers. comm.). Trees and shrubs in close proximity to the shoreline and interior riparian and wetland areas provide an excellent foraging substrate, along with shelter, for migratory birds feeding on these insects.

Based on two years of data on Drummond Island there does not seem to be an association of migratory birds with inland water or shoreline sites as Ewert and Hamas (1993) found. This may be due to the lack of long-term data on Drummond Island needed to make such conclusions and/or possibly the difference in shoreline substrate at study sites. The majority of the Drummond Island shoreline is characterized as bedrock substrate, with a few areas of cobble and sand. The northern Lake Huron shoreline west of Drummond Island is characterized by cobble shoreline, as is the Bois Blanc Island shoreline, where associations between migrating birds, midges, and cobble shoreline have been documented. Midges may be less available where substrate is sand or bedrock, making birds search out other locations for protein sources.

Another explanation for the lack of association of migratory birds to shoreline or inland water sites on Drummond Island may be the habitats surveyed at shoreline, inland and inland water locations. Habitats were not controlled for in this study. Some habitats are represented within each category while others are unique to the category. For instance, shoreline habitats include cedar dominated, mixed conifer forests, Great Lakes Marsh, old field, northern fen, aspen/birch forest. Inland water sites included: sedge meadow, scrub/shrub wetland, aspen/birch forest, northern fen, mixed conifer forest, and cedar dominated forest. Inland sites included beech/maple forests, cedar dominated forests, mixed conifer forests, alvar grassland, old field, and aspen/birch forest. Each of these

habitats has a particular “suite” of birds associated with them and it is not clear whether the distribution of birds is due to the habitat type or the proximity to shoreline.

Alvar habitat may be providing a food source that has not yet been identified. At this time we are uncertain of the role alvar habitat may play in providing early food sources to migrating birds. Closer evaluation of birds in alvar habitat may provide answers to what this food source may be.

This informal analysis of the abundance and distribution of migrating and breeding bird species on Drummond Island is interesting and provides a good foundation for future work. It is important to understand that these data are not the result of a highly controlled research study and conclusions should not be casually inferred. Rather, these bird counts provide a “snapshot” of bird use on Drummond Island and suggest its relative importance in providing habitat to migrating and breeding birds.

Important bird areas. The Great Lakes and Michigan offices of The Nature Conservancy initiated an ecoregion planning program for birds (Ewert 1999). Information from field ornithologists, including representatives of private and public organizations that work in the Great Lakes region, contributed to the identification of primary focus bird species, important breeding sites for primary focus species and important stopover and wintering sites in the Great Lakes ecoregion. Avian species of primary focus have a global Partners in Flight (PIF) score of 20 or more, or a Nature Conservancy global rank of G1-G4. Species with small ranges, low abundance, fluctuating populations, and long-term, relatively large population declines are those of highest priority. Where identifiable, the working group also noted 10 sites with 25 or more breeding pairs for each primary focus species, and important stopover and wintering sites for landbirds, raptors, shorebirds, and waterbirds in the Great Lakes ecoregion. Scott’s Marsh on the northwest shore of Drummond Island has been identified as an important stop over site for waterfowl, meeting the criterion of 10,000 birds/site/migration season. Besides being an important stop over site for waterfowl, Scott’s Marsh has been identified as one of 10 sites in the Great Lakes ecoregion that provides breeding habitat for two primary focus bird species. The American bittern and LeConte’s sparrow (*Ammodramus leconteii*) were identified as primary focus species having greater than 25 breeding pairs consistently using Scott’s Marsh during the breeding season. Our point count surveys on Drummond Island did reveal LeConte’s sparrows using Scott’s Marsh, but we did not document American bittern occupying the site. It should be noted that Scott’s Marsh is very large, wet

and vast. We conducted our point count surveys from the gravel road and did not venture off the road. We could have easily missed the unusual and often muffled call of the American bittern at this site. Further survey work focusing specifically on wetland birds on Drummond Island would likely reveal several new occurrences for rare and declining species. Many of the large wetland complexes on Drummond Island are difficult to access. Adequate time, equipment and resources would be required to complete an adequate survey of these areas.

Declining bird species. There are two migratory bird species that were recorded during bird surveys that are worth noting, since there is evidence that they are declining in all or part of their range. The wood thrush (*Hylocichla mustelina*, see photo plate) was recorded during migrating and breeding bird surveys on Drummond Island in 2001 and during breeding surveys in 2000. This species is one of 105 species currently on the National Audubon Society, WatchList (Muehter 1998). The WatchList identifies North American bird species that are faced with population declines, limited geographic range, and/or threats such as habitat loss on their breeding and wintering grounds. The WatchList is compiled by Partners in Flight, a coalition of state, federal, and private sector conservationists working together to protect the birds of the western hemisphere. The wood thrush has a Conservation Priority Score of 20 (Partners In Flight Bird Prioritization Technical Committee 1998). Scores range between 18 (moderate priority) and 30 (the highest priority). Criteria used to score species include: relative abundance, breeding distribution, winter distribution, threats to breeding range, threats to non-breeding range, and population trends. The wood thrush generally prefers dense mesic woodlands with small streams and springs associated with a thick understory. This species has undergone a decline in the Midwest due to forest thinning and fragmentation, loss of wetlands on the wintering grounds and heavy cowbird parasitism in some areas (Pinkowski 1991). Drummond Island appears to provide suitable habitat for the wood thrush and its forests should continue to support breeding pairs, as long as they are managed to minimize fragmentation and to enhance forest maturity.

The northern parula, observed during both migration and the breeding season on Drummond Island in 2001 and during the breeding season in 2000, is another species worth noting. Although this species is not on the WatchList, it is considered a habitat specialist on its breeding grounds. In Michigan, this warbler is found primarily in northern coniferous forest, particularly areas with hanging *Usnea*, a stringy epiphytic lichen appropriately named "old man's beard". This

lichen is a crucial component for supporting the warbler's pendant nest, and thus widespread loss of *Usnea* is a suspected cause for substantial population declines of parulas in portions of their breeding range. Humid areas in mature eastern hemlock or balsam fir forests are optimal habitats for *Usnea* and the northern parula. Northern hardwood forest, northern white cedar swamps, mesic mixed forests, and wet coniferous areas with black spruce and tamarack are also used by the northern parula (Evers 1991). Over the two year study northern parula's were noted at the following locations: Barbed Point Peninsula (cedar-dominated forest), Cream City Point (mixed coniferous forest), Fossil Formation (mixed coniferous forest) and Helen Lake (mixed coniferous forest).

Observations of rare birds. A new colony of state threatened nesting common terns (*Sterna hirundo*) was observed on a small shoal near Rogg Island, just off shore from Yacht Haven Marina in June, 2001. Boat traffic in and out of the marina passes close to the shoal. The terns seem to have habituated to some level of disturbance at this site. Future success will likely depend upon water levels and the level of disturbance. An update to a previously known common tern nesting colony on Harbor Island Reef was also documented. The shoal was dominated by nesting ring-billed gulls (*Larus delawarensis*), but the northern 1/3 of the shoal was occupied by nesting common terns. Future success at this site will depend upon ring-billed gull numbers and water levels.

The discovery of two new American bittern (species of special concern) records on Drummond Island in 2001 brings the total of new occurrences for American bitterns to five, over the two year study period. The five sites are as follows:

- Pigeon Cove Wildlife Flooding
- Marl Lake
- Dickenson Lake
- Potagannissing River Wildlife Flooding
- Bruce Point marsh

The American bittern inhabits marshes and the edges of lakes and ponds where cattails, sedges and bulrushes are plentiful. Habitat appears to be abundant along many of the inland lake edges and shoreline marshes that were surveyed. It is likely that this species occurs at additional locations on the island. Preserving the marshes and protecting them from human alteration and disturbance will be important if this species is to remain a part of the island's fauna.

One adult male northern harrier (species of special concern) was observed hunting over the Pigeon Cove Wildlife Flooding, capturing prey, and delivering prey items on four instances to same spot in the flooding complex. The male flew below the line of site (ground

level) and back up without the prey. Northern harriers prefer open landscapes such as meadows, inland and coastal marshes, cultivated and uncultivated fields, and prairies. Pigeon Cove Wildlife Flooding could be classified as an inland marsh. Nests are constructed on

Potential habitat for the federally endangered Hine's emerald dragonfly was surveyed at four locations on Drummond Island. The marshy, northern fen habitat along the southern and eastern margin of Marl Lake appeared suitable habitat for the dragonfly based on its presence in similar habitat in the Upper Peninsula of Michigan. Other areas of potential habitat included the Pigeon Cove Wildlife Flooding, the margins of Pigeon Cove Creek, and Isaacson Lake. Brush-tipped emerald dragonflies were found at Pigeon Cove Creek indicating at least suitable habitat for emerald species on Drummond Island. The summer of 2001 was a very dry year on Drummond Island and subsequently much of the habitat at these sites was less

the ground in association with shrubs. The female northern harrier was assumed to be feeding young on the nest, although visual confirmation of a nest was not undertaken due to the risk of nest abandonment and increased predation.

Insects

than optimal. For example, Pigeon Cove Wildlife Flooding and Isaacson Lake were almost dry during the Hine's emerald dragonfly survey period. Additional surveys should be conducted in the future to determine if the Hine's emerald dragonfly occurs on the island. Given the difficulty in surveying invertebrates, especially for such high-flying and deft aerialists as dragonflies, several days should be spent on the island at these sites. However, no future surveys are targeted for 2002 in these areas; however, inventory of this group will continue in likely habitats delineated on Bois Blanc Island and in the Les Cheneaux Islands, all of which are targeted for survey during the 2002 field season.

Methods for Plant Surveys

Prior to field surveys on Drummond Island, the statewide Biological and Conservation Database (BCD) was examined for previously known element occurrences. MNFI staff ecologists were also consulted regarding particular natural features and sites. Information from recent surveys of the island was compiled and studied to delineate the areas of highest merit for inventory based on the relatively limited time allocated for fieldwork. Unlike island surveys conducted from 1998-2000 (Penskar et al. 1999, 2000, 2001), our inventories were largely directed to interior sites, focusing on alvar (limestone pavement) and several rare plant species known to be associated with this globally rare natural community type. The principal species sought included prairie dropseed (*Sporobolus heterolepis*), flattened spike-rush (*Eleocharis compressa*), bulrush sedge (*Carex scirpoidea*), Richardson's sedge (*Carex richardsonii*), Hill's thistle (*Cirsium hillii*), false pennyroyal (*Trichostema brachiatum*), prairie smoke (*Geum triflorum*), and Cooper's milk-vetch (*Astragalus neglectus*), all of which are well documented alvar rarities.

As in previous island and Great Lakes shoreline studies (Penskar et al. 2001, Penskar et al. 2000, Penskar et al. 1999, Penskar et al. 1997, and Penskar et al. 1993), our high priority targets were Great Lakes endemic species such as dwarf lake iris (*Iris lacustris*), Houghton's goldenrod (*Solidago houghtonii*), Pitcher's

thistle (*Cirsium pitcheri*), and Michigan monkey-flower (*Mimulus glabratus* var. *michiganensis*), all of which are federal and state listed. Additional target taxa included such well-known coastal rarities as calypso orchid (*Calypso bulbosa*), English sundew (*Drosera anglica*), butterwort (*Pinguicula vulgaris*), Alaska orchid (*Piperia unalascensis*), ram's head orchid (*Cypripedium arietinum*), and several other potential species known in this region of the state. These taxa are strongly associated with shoreline areas, where they occur in such natural communities as open dunes, coastal rich conifer swamps, bedrock beaches, alvar, cedar glades, northern fens, boreal forests, and wooded dune and swale complexes.

As for all previous island inventories, emphasis was also placed on delineating notable natural community occurrences. 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 and possible transcription by MNFI ecologists. All plant inventories were conducted in collaboration with the project's community ecologist, who provided the primary evaluation of potential natural community occurrences and also assisted in rare plant surveys.

The specific botanical survey methods, which essentially consisted of meander searches, closely follow those used during the previous three years of island inventories. These have been presented in detail

by Penskar et al. (1999) and thus will not be presented again here. Because most of the field inventories were conducted jointly with a staff ecologist, aerial photo interpretation and site selection were completed in

collaboration and thus not duplicated. Sites were thus highlighted for field inventory based on their potential for both natural community and rare plant occurrences.

Results of Plant Surveys

Botanists and ecologists jointly conducted rare plant and natural community surveys, and therefore the results of these surveys are combined in Table 6. Natural community results are discussed more thoroughly in the community section below. Nine new rare plant occurrences were collectively documented from six sites during our surveys, consisting of four occurrences of state special concern *Carex richardsonii* (Richardson's sedge), three occurrences of state special concern *Cirsium hillii* (Hill's thistle), one occurrence of state special concern *Piperia unalascensis* (Alaska

orchid), and one occurrence of state special concern *Sporobolus heterolepis* (prairie dropseed).

In addition to the discovery of new occurrences, we identified 18 previously known rare plant occurrences over a total of seven sites. Significant new status information was obtained for these species, including more detailed data on spatial extent, population and site condition, artificial and natural disturbances, and potential threats such as off-road-vehicle (ORV) use and the presence of invasive exotic species.

Discussion of Plant Surveys

The extensive alvars of Drummond Island are well known, especially those that comprise the Maxton Plains in the north and along portions of the southern shore. Although the nine new rare plant occurrences were all state special concern species, comprising the lowest category of rarity, their discovery is notable given the number of previous surveys in these areas. These occurrences were documented by combining very intensive surveys with a wide coverage of sites, and by focusing on specific microhabitats. Our surveys were also facilitated by previous experience with certain species and the ability to reliably recognize them in sterile condition (e.g. vegetative colonies of *Carex richardsonii*). Sites were systematically and comprehensively meander-searched, targeting known microhabitats, such as upland-wetland transition zones where certain species are to be expected. *Carex richardsonii*, for example, tends to occur along the periphery of alvar areas in close proximity to *Juniperus communis* (ground juniper) colonies, indicating microsites of somewhat higher microtopographic relief along the upland edges. These areas were carefully traversed, resulting in a detailed mapping of the spatial extent of new occurrences as well as previously documented rare species occurrences for these sites.

Many of the known occurrences that were updated were identified during surveys of several discrete alvar

openings in the Maxton Plains and such well known sites as Huron Bay and Big Shoal Cove on or in close proximity to the southern coast. An opportunity was also provided to explore the cliffs and bedrock exposures of the Marblehead Peninsula, a remote portion of the island difficult to access. The Marblehead cliffs were examined very briefly during an exploration of the eastern shoreline via boat in 1999 (Penskar et al. 2000). During the 1999 survey, it was discovered that the cliff faces observed from Lake Huron were in fact only a portion of a series of cliff exposures that extended inland. We thus returned in 2001 to access the area from an inland route. The series of smaller inland cliff faces and escarpments were examined more carefully, and resulted in the discovery of a new population of *Piperia unalascensis* (Alaska orchid). *Pterospora andromedea* (pinedrops), which was previously documented in this area, was observed in flower in a small colony well inland from the shore, and it is thus now known that it is not as local as observed originally. Unfortunately, no GPS (geographic positioning system) equipment was available for this survey, and thus our specific coverage of this site is poorly known. The cliffs were inventoried as well as possible, yet it remains evident that this complex and remote site requires additional inventory and characterization.

Table 6. Rare plant and natural community sites inventoried during 2001 surveys of Drummond Island (Chippewa County).

Site name	Known occurrences relocated and updated	New occurrences documented
Marblehead Peninsula	Dry non-acid cliff <i>Asplenium ruta-muraria</i> <i>Pellaea atropurpurea</i> <i>Pterospora andromeda</i>	<i>Piperia unalascensis</i>
Maxton Plains East (Site A)	Alvar <i>Sporobolus heterolepis</i> <i>Eleocharis compressa</i>	<i>Carex richardsonii</i> <i>Cirsium hillii</i>
Maxton Plains East (Site B)	Alvar <i>Sporobolus heterolepis</i> <i>Eleocharis compressa</i>	<i>Carex richardsonii</i> <i>Cirsium hillii</i>
Maxton Plains Middle (Site C)	Alvar <i>Carex richardsonii</i> <i>Carex scirpoidea</i> <i>Eleocharis compressa</i> <i>Sporobolus heterolepis</i>	<i>Cirsium hillii</i>
The Rock North		<i>Carex richardsonii</i> <i>Sporobolus heterolepis</i>
Huron Bay Road	Alvar <i>Cirsium hillii</i>	<i>Carex richardsonii</i>
Big Shoal Cove	<i>Carex richardsonii</i> <i>Cirsium hillii</i>	Alvar
Huron Bay	Limestone Pavement Lakeshore <i>Carex richardsonii</i> <i>Carex scirpoidea</i> <i>Cirsium hillii</i> <i>Pellaea atropurpurea</i>	



Plate 1. Alvar glade near Huron Bay, southern shore of Drummond Island. Photo by M. Kost



Plate 2. Purple cliff-brake (*Pellaea atropurpurea*) in alvar glade, Huron Bay. Photo by M. Kost



Plate 3. Wood thrush (*Hylocichla mustelina*), a long distance Neotropical migrant. Photo by Mike Hopiak for the Cornell Laboratory of Ornithology.



Plate 4. Outer cliffs of Marblehead Peninsula, northeast Drummond Island. Photo by M. Kost

Plate 5. State endangered wall-rue (*Asplenium ruta-muraria*), known only from Marblehead in Michigan. Photo by M. Kost



Plate 6. Pinedrops (*Pterospora andromedea*) at Marblehead, just prior to full bloom. Photo by M. Kost



Methods for Natural Community Surveys

The natural community surveys on Drummond Island were organized to provide additional information on several sites that had been identified during prior inventories (Albert et al. 1994). Natural community surveys were conducted in coordination with rare plant surveys from July 9 through July 14, 2001. Preparation for the surveys involved conducting aerial photo interpretation, prioritizing inventory sites, and studying site records for potential and previously identified element occurrences.

Site visits involved mapping the boundaries of each delineated natural 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 sites. Site-specific information was also gathered related to signs of past human disturbance and land-use activities. Insights into future protection and/or management activities if apparent during site visits were also recorded. High quality natural communities were defined according to the MNFI Natural Community Classification (MNFI 1989). Each natural community occurrence was given a grade based on its relative quality, condition, and landscape context compared to other known occurrences within the state and Great Lakes region. Finally, information from field forms was transcribed and submitted for mapping and incorporation into the MNFI statewide database.

Results of Natural Community Surveys

Natural community inventories resulted in the identification of one new high quality natural community and significantly updated information on six previously identified natural communities and (Table 6). A new occurrence of alvar was discovered northeast of Big Shoal Cove (Figure 5). The community is a relatively small alvar glade that contains two rare species, Hill's thistle and Richardson's sedge. The site rises with distance from Lake Huron in a series of low, exposed limestone ledges. Deep grykes (natural cracks or fissures) within the exposed limestone/dolomite bedrock were found to occur throughout the site. This natural community occurrence was assigned a B rank because it was found to be relatively pristine, undisturbed, and surrounded by natural habitat.

Updated communities includes one dry non-acid cliff (Marblehead), one limestone pavement lakeshore (Huron Bay), and three globally significant alvar occurrences (Maxton Plains East, Maxton Plains Middle, and Huron Bay Road) (Table 6, Figure 5), the latter forming part of a large landscape complex comprising much of the northern portion of Drummond Island.

The survey of Marblehead resulted in several new plant records (see above) and provided additional insight into the complex topographical nature of the site. A successively smaller set of new cliff faces were discovered farther inland, indicating that extensive, still

unexplored habitat for rare plants exists in this specific area of the island.

Huron Bay surveys resulted in updated information for several rare plants (see above) and revealed the need to increase protection efforts at this A-ranked occurrence of limestone pavement. Several undeveloped lots along the Lake Huron shoreline in this vicinity were being advertised for sale at the time of our surveys¹.

Overall, the Maxton Plains alvar sites we surveyed are among the largest expanses of alvar grassland in Michigan, and are comparable to those occurring in New York and southern Ontario. Several new occurrences of rare plants were discovered during the surveys (see above). In addition to obtaining information on natural communities and rare plant species, we compiled data on artificial disturbance and the presence of invasive plant species. Table 7 provides a list of the principal exotic plants observed within the Maxton Plains alvar complex during our community and rare plant surveys.

¹ Following our surveys The Nature Conservancy (TNC) Northern Lake Huron office was notified of the advertised properties.

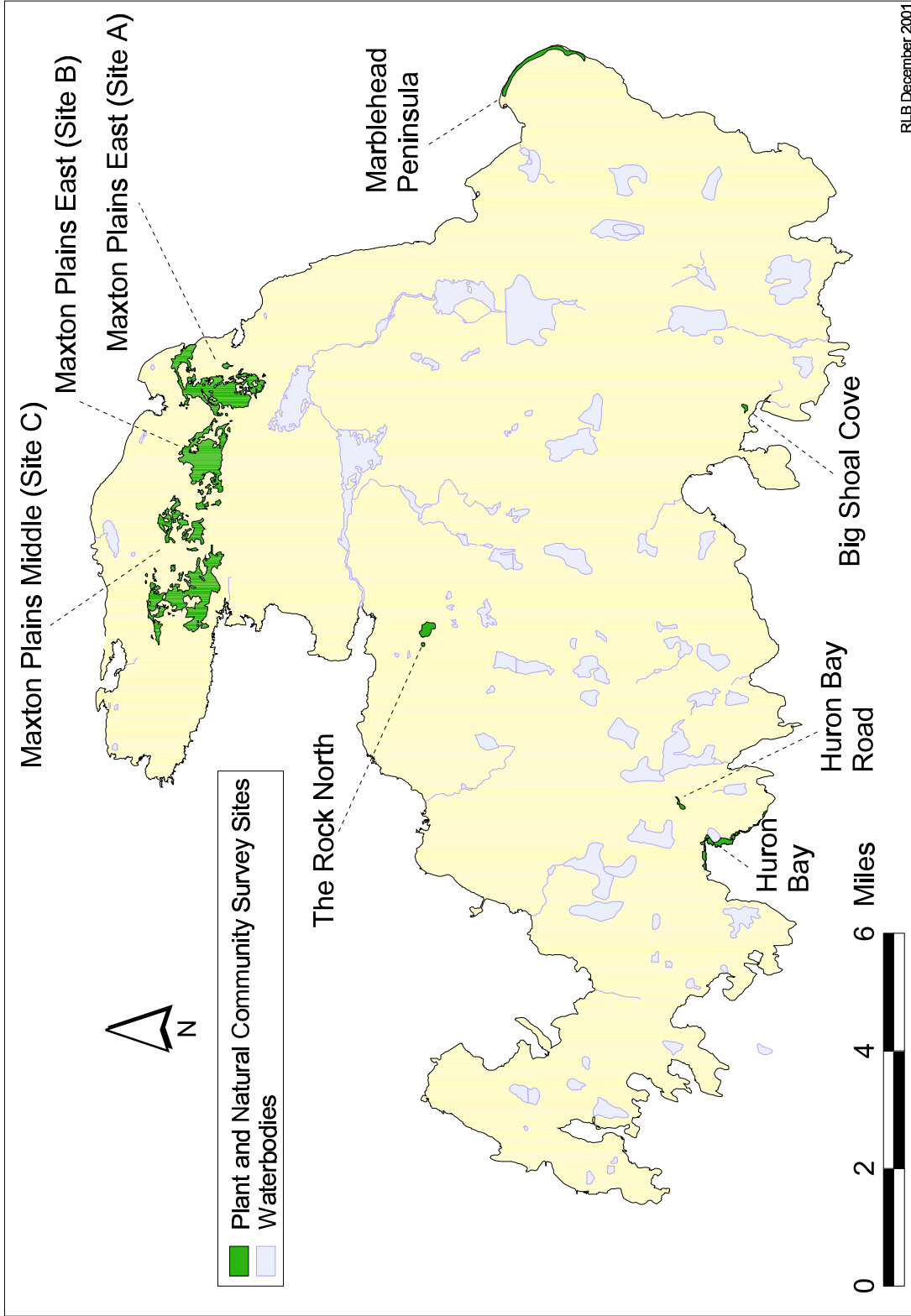


Figure 5. Natural community survey sites.

Discussion of Natural Community Surveys

The statewide database contains 20 records for alvar, including the alvar glade identified near Big Shoal Cove during this study. Six of the 20 known state alvar occurrences are ranked as A and AB, and seven are B ranked. The Big Shoal Cove alvar glade was classified as a B-ranked occurrence. The site is a relatively small but is significant because of its close proximity to a large occurrence of limestone pavement lakeshore at Big Shoal Cove and it is in very good condition, with only one invasive plant species, ox eye daisy, noted during our survey. Long-term protection of the site will require either land acquisition or a land easement to prevent development of this desirable lakeview property.

The Maxton Plains East site is ranked as a B occurrence of alvar and Maxton Plains Middle is ranked as an A occurrence (Figure 5). Both of these represent some of the largest alvar grasslands in the Great Lakes region. These communities are well adapted to extreme weather events and natural disturbances such as drought, growing season frost, seasonal flooding, high winds, grazing, and wildfire. However, they are not likely to adapt well to the influence of highly invasive plant species such as spotted knapweed (*Centaurea maculosa*) and common St. John's-wort (*Hypericum perforatum* and *H. punctatum*). These invasive species compete with native plants and can negatively impact species diversity and community and ecosystem function. At present, the invasive species occur predominately along the roadsides in this area but are likely to spread further unless actively managed. Some control of invasive species should also be implemented at the Huron Bay Road alvar glade and elsewhere.

Huron Bay is an expansive, A-ranked occurrence of limestone pavement lakeshore, and represents one of only 13 occurrences for this rare community type in the state. It is the largest area of dolomite beach on Drummond Island and possibly within the entire state (Albert et al. 1994). It also has more special plants (10 species) than any other site on the island (Albert et al. 1994). Nestled along the rocky northern Lake Huron shoreline, the site is one of the most picturesque places in Michigan. Invasive plants represent a minimal problem here at present; however, development pressure along the Lake Huron shoreline is seriously threatens the site. We recommend that conservation measures such as land acquisition and land easements be pursued to protect this high priority site.

Marblehead is one of only 10 known occurrences for dry non-acid cliff in Michigan. This A-ranked site is extremely difficult to survey because of its remote location and exceptionally uneven topography. While we succeeded in identifying several new plant occurrences at the site, more survey work will be needed before the site can be considered as adequately inventoried. Photo interpretation of the site reveals the existence of inland escarpments (some of which were explored during this survey) and possibly alvar glade (Albert et al. 1994). Marblehead is within the Lake Superior State Forest. Because it is primarily forested with aspen and northern hardwoods, periodic forest management could impact potential areas of alvar glade. Further survey work for alvar glade should be conducted in the near future so that more accurate information on the site's natural features can be utilized for management planning.

Table 7. Invasive plants occurring within alvar communities of the Maxton Plains, Drummond Island.

Scientific Name	Common Name
<i>Agropyron repens</i>	quack grass
<i>Centaurea maculosa</i>	spotted knapweed
<i>Chrysanthemum leucanthemum</i>	ox eye daisy
<i>Daucus carota</i>	Queen Anne's lace
<i>Hieracium aurantiacum</i>	orange hawkweed
<i>Hypericum perforatum</i>	common St. John's-wort
<i>Phleum pratense</i>	timothy
<i>Poa compressa</i>	Canada bluegrass
<i>Poa pratensis</i>	Kentucky bluegrass
<i>Rumex crispus</i>	curly dock
<i>Tragopogon dubius</i>	goat's-beard
<i>Trifolium hybridum</i>	alsike clover
<i>Trifolium pratense</i>	red clover

Site Summaries

As established in the format of several previous MNFI reports concerning coastal zone inventories, we provide here a description of our inventory areas. These site summaries are presented for inventory sites covered by MNFI botanists and community ecologists. Nearly all of the sites surveyed on Drummond Island are well known areas, including several nominated natural areas, such as the extensive Maxton Plains alvar complex. In addition, some areas have been summarized in previous reports (e.g. Marblehead Peninsula), thus the summaries provided below are relatively brief, emphasizing the new information obtained for these sites (Albert et al. 1994, Penskar et al. 1999).

Marblehead Peninsula. Marblehead is an A-ranked, natural community occurrence for dry non-acid cliff that was identified during surveys of Drummond Island in 1999. The site consists of an extensive series of tall (3m – 5m) limestone cliffs located along the east shore of the island. A rare fern, the state endangered wall rue (*Asplenium ruta-muraria*), grows directly on the cliff faces along with poison ivy (*Toxicodendron radicans*) and several other fern species. Populations of two other rare plants, the state threatened pinedrops (*Pterospora andromedea*) and the state special concern Alaskan orchid (*Piperia unalascensis*), were located further inland, above the cliffs.

Maxton Plains East (Site A). Maxton Plains East Site A is extensive open grassland that was previously identified as an alvar element occurrence and assigned a B rank. A gravel road bisects the site. The rare grass species, state special concern prairie dropseed (*Sporobolus heterolepis*), dominates large areas of the site. Other rare plants identified at the site include the state threatened flattened spike-rush (*Eleocharis compressa*) and new occurrences of the state special concern Hill's thistle (*Cirsium hillii*) and the state special concern Richardson's sedge (*Carex richardsonii*). Common juniper (*Juniperus communis*) and creeping juniper (*Juniperus horizontalis*) occur sporadically growing on thin soil over bedrock along the edges of the site, slightly elevated above the extensive open grassland. The small rise between the juniper and grassland areas provides evidence of the grassland's history as an ancient lakebed. A small, abandoned mine occurs within the site north of the road. Numerous invasive species occur along the roadside and should be removed to prevent their spread. These pernicious species included spotted knapweed (*Centaurea maculosa*), common St. John's-wort (*Hypericum perforatum*), quack grass (*Agropyron repens*), ox-eye daisy (*Chrysanthemum leucanthemum*), orange hawkweed (*Hieracium aurantiacum*), and timothy (*Phleum pratense*).

Maxton Plains East (Site B). Maxton Plains East Site B is extensive open grassland that occurs mostly north of the road that runs through the site. The site was previously identified, along with Site A (above), as an alvar occurrence and assigned a B rank. Rare species identified at the site included prairie dropseed, flattened spike-rush and new occurrences of Hill's thistle and Richardson's sedge. Many of the same invasive species mentioned above occur along the roadside and should be removed to prevent their spread.

Maxton Plains Middle (Site C). Maxton Plains Middle is a well known site previously identified and assigned an A rank. The site consists of several large alvar grassland openings that are bordered by small areas of alvar glade. Rare plants identified during surveys of the site included the state threatened bulrush sedge (*Carex scirpoidea*), prairie dropseed, flattened spike-rush, Richardson's sedge and a new occurrence of Hill's thistle. Numerous rock cairns had been assembled in the western portions of the alvar. These cairns were built by removing pieces of exposed bedrock, which is detrimental to the ants and other invertebrates that live under the loose dolostone. Invasive plants found growing mainly along the roadside and which should be removed to prevent their further spread include spotted knapweed, ox-eye daisy, orange hawkweed, timothy, alsike clover (*Trifolium hybridum*), and red clover (*Trifolium pratense*).

The Rock North. This site, which lacks a distinctive landmark, is named for its relatively close proximity to a well-known Drummond Island lodge and golf course facility. The site consists of a small roadside opening in which prairie dropseed was observed. The small localized colony is markedly south of the Maxton Plains alvar complex, which lies more than three miles to the north. This population thus presumably occupies a small, disturbed alvar remnant. Interestingly, as dominant as prairie dropseed is within the Maxton Plains proper, it is nearly absent in the southern portion of the island, as is prairie smoke.

Huron Bay Road. The Huron Bay Road site consists of a small alvar glade located along Huron Bay Road in the southwest portion of the Drummond Island. The site was previously identified and assigned a C rank. Areas of exposed dolostone with deep grykes (cracks) occur throughout the site. Two rare species were identified at the site, Hill's thistle and Richardson's sedge. During our surveys we discovered small populations of two invasive plant species, spotted knapweed and ox-eye daisy. An effort should be made to control these species before they become widespread throughout the site.

Big Shoal Cove. Our surveys at Big Shoal Cove identified a B-ranked alvar located north of a previously known limestone pavement lakeshore occurrence. The site consists of an alvar glade with many low (1m – 2m), limestone cliffs that support maiden-hair spleenwort (*Asplenium trichomanes*), a common fern that is an indicator of high quality outcrop habitats. The site gradually rises in elevation with distance from Lake Huron, and the low cliffs form a complicated network of terraced steps. Flat areas of exposed limestone with deep grykes are also common throughout the site. Large, scattered white pine (*Pinus strobus*) and red pine (*P. resinosa*), along with white spruce (*Picea glauca*), northern white cedar (*Thuja occidentalis*) and common juniper (*Juniperus communis*) give the site a savanna appearance. Two rare

plants, Hill's thistle and Richardson's sedge were discovered at the site.

Huron Bay. Huron Bay is a previously identified, A ranked, natural community occurrence of limestone pavement lakeshore located along the southeast shore of Lake Huron. The site consists of large expanses of exposed limestone with deep grykes, and scattered northern white cedar, horizontal juniper, and common juniper. Several rare plants occurrences that had previously been found at the site were relocated, including the state threatened purple cliff-brake (*Pellaea atropurpurea*), bulrush sedge, Hill's thistle, and Richardson's sedge. Several parcels of land within the alvar were being advertised for sale at the time of our surveys.

Digitization of Island Data

An important component of island inventories has included preparing field information for use within MNFI's new, Geographic Information System (GIS) based data platform. A GIS system allows the known spatial extent of an occurrence to be represented. This spatially represented data is far more useful for resource managers, land-use planners, scientists, and the general public than a traditional natural heritage database. Figure 6 shows a selected set of Drummond Island natural features data depicting how these occurrences are displayed and managed within our GIS system.

Before the advent of GIS, occurrences were recorded with an estimated lat/long point and a mapping precision. Three types of precision were used: second (S), minute (M), and general (G). "Second" precision means the location was known exactly. "Minute" precision means the location was known to within a mile. "General" means that the location is only known to the township level.

Now, with GIS, the known spatial extent of an occurrence can be digitally represented. Data best represented by a point (i.e. single plants, small populations, etc.) are represented with a small, approximately six-meter radius circle. Older, pre-GIS records are represented spatially by applying a buffer to the estimated lat/long point. The buffer size is based on the mapping precision of the occurrence. Second precision records are assigned a 100 meter diameter buffer, minute precision records are assigned a 2,000 meter buffer, and general records are assigned an 8,000 meter buffer.

During the islands inventory project, new natural features data were transcribed and entered with respect

to heritage data standards developed for the spatial representation of element occurrences. Heritage data standards and methodology are defined by the organization called NatureServe (www.natureserve.org). Under heritage methodology, only the known extent of an occurrence may be digitized. For example, if the only information known about an occurrence is that it occurs within a specific legal section, with no more precise spatial information, the section boundary becomes the extent of the occurrence.

In addition to digitizing data obtained during the 2001 island inventory, existing natural features information was carefully reviewed, and where possible circular buffers replaced with a digitized spatial extent. This digitizing effort entailed closely examining source information for previously documented records, including field forms and any associated maps indicating the specific locations and the spatial extent of the records. The result of the digitizing effort is a natural features data set that supplies more precise and useful information than either a stand-alone database or circular spatial extents derived solely from a mapping precision protocol. Figure 7 depicts the changes in the number of occurrences per legal section as a result of replacing the circular buffers with a digitized spatial extent for the occurrences.

This process was used to systematically examine all natural features information recorded for Drummond Island, resulting in the digitizing of 220 natural feature occurrences. In addition to Drummond Island, 161 natural feature occurrences have been digitized for the entire Beaver island archipelago (Beaver, Garden, High, Hog, Whiskey, Trout, Gull, Squaw, and associated smaller islands), 43 for Bois

Geographic Representation of Animal, Plant, and Community Occurrences on Drummond Island

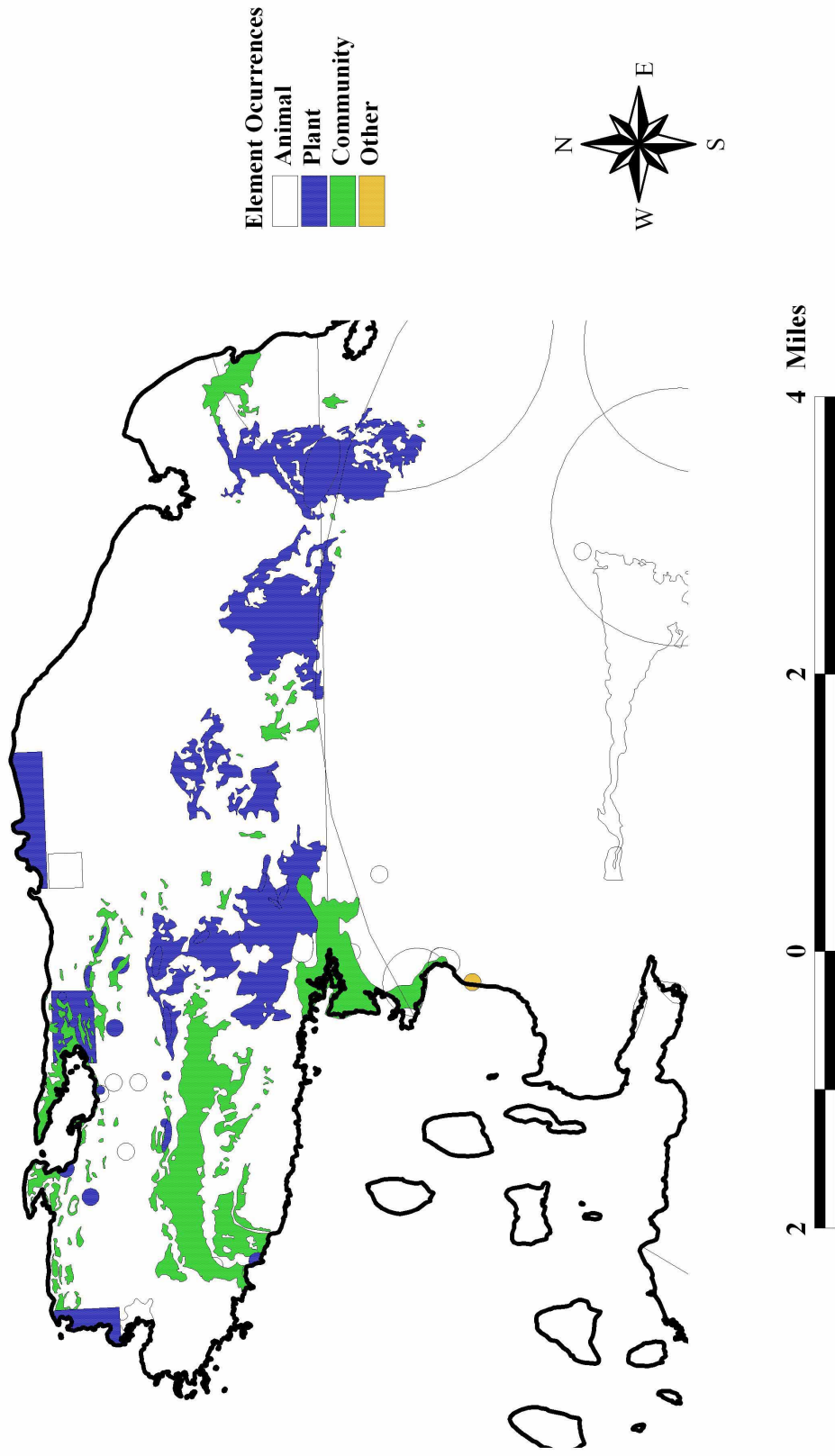


Figure 6. Natural features as depicted in MNFI GIS database.

Changes in the Number of Element Occurrences per PLSS Section as a Result of Digitizing Drummond Island Element Occurrences

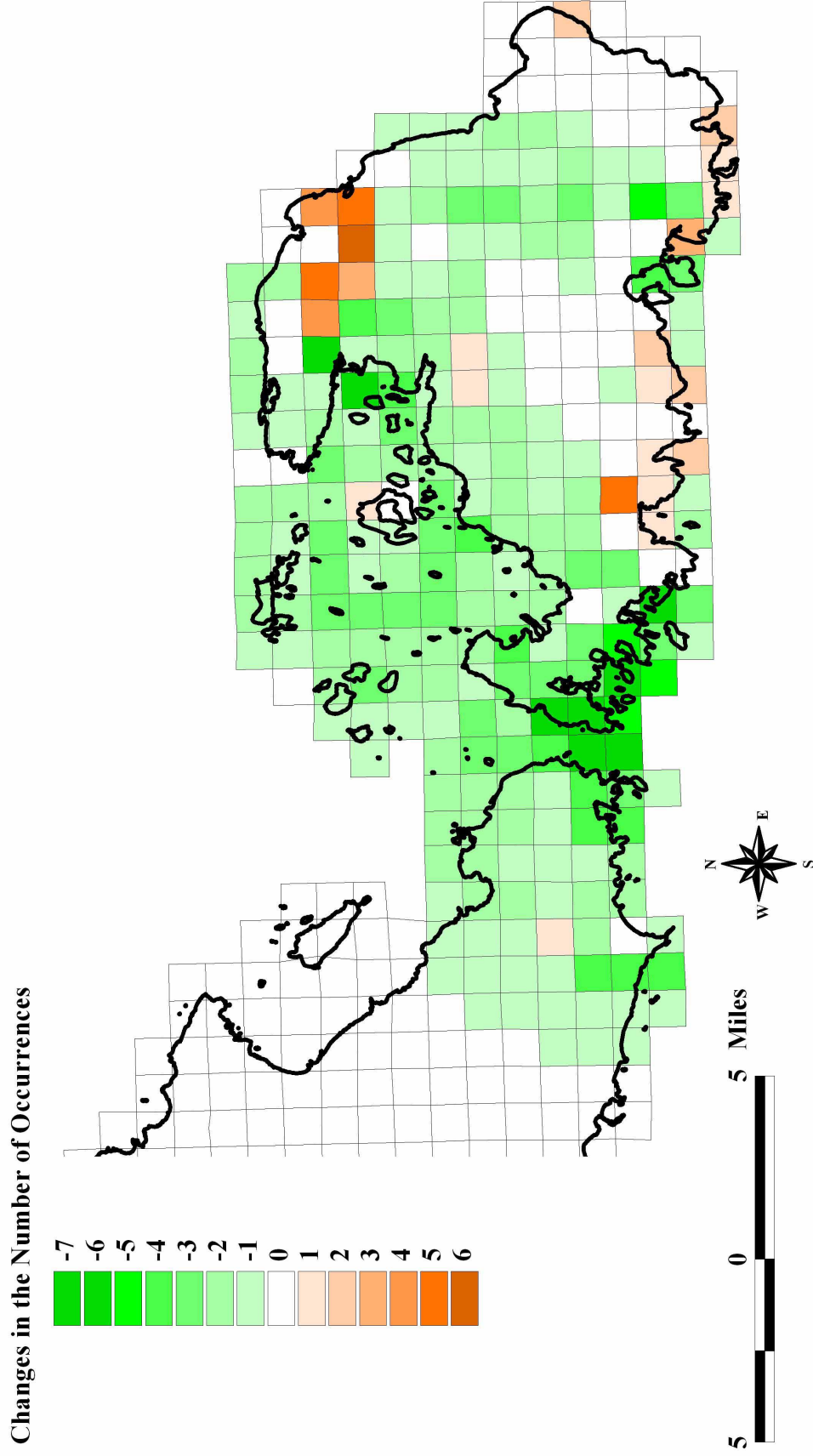


Figure 7. Changes in number of occurrences after digitizing.

Blanc Island, and 6 for Burnt and Harbor islands in Potagannissing Bay. A total of 430 occurrences have been digitized during the four years of the project

(1998-2001), representing nearly 4% of the MNFI statewide natural features database.

Conservation Outreach for Drummond Island

Background

The conservation outreach portion of this year's project on Drummond Island was built on the conservation outreach activities previously developed for the Beaver Island community during the summer of 1999 (Penskar et al. 2000). For Beaver Island, one presentation was given at an annual meeting of a local organization, followed by a workshop. This first workshop, which was developed and conducted with the assistance of a consultant, was designed to be interactive and open to the whole community. The goals of that workshop were to: 1) initiate community discussion about the natural resources and community character of the Island, and 2) determine the natural features that island residents value most. Important outcomes of the workshop were realizing the high value the community placed on natural features of Beaver Island and obtaining several strong recommendations to protect

these unique natural features, such as integrating the information into both townships' comprehensive master land-use plans. The success of the Beaver Island workshop provided a strong foundation for the design of the Drummond Island workshop. For example, MNFI's goals for the Drummond Island workshop reflected what was found to be the most meaningful to the Beaver island residents, namely to: 1) initiate a discussion about the unique natural resources and community character of the island, 2) determine the natural features which both residents and MNFI consider the most significant, and 3) provide an opportunity for interested residents to determine how to ensure the viability of these unique natural features in the long-term.

Preparation

Preliminary planning was conducted in the fall of 2000 and winter of 2001 for conservation outreach efforts on Drummond Island. This planning was initiated by contacting The Nature Conservancy (TNC) Northern Lake Huron Bioreserve Director, Jesse Hadley, to discuss strategies. Jesse expressed strong interest in MNFI's outreach activities. She agreed to identify and contact key stakeholders, and promote MNFI's outreach activities. Jesse believed the Bioreserve project would benefit tremendously from conservation outreach on Drummond Island, and that it was a very high priority for her program. It was subsequently determined that TNC would assist MNFI by notifying key contacts and participating as appropriate in the outreach effort. Jesse proceeded to build a core volunteer committee by contacting community leaders. During the fall and winter months, information regarding current and past natural features data, landcover changes, landscape patterns, and distribution of known rare species and natural communities was reviewed and synthesized to prepare for the upcoming outreach workshop.

The agenda for the workshop was developed during a meeting in August involving John Paskus, Conservation Planner for MNFI, Jesse Hadley, and four full-time residents (Cathi Shaul, Sune Buck, Ken

Walker, and Skip Bailey). The meeting was held at the White Pine Bed and Breakfast, a lodging facility on Drummond Island owned by Cathi Shaul. The group was supportive of holding an interactive workshop on the island, and prepared a plan to build support for and interest in the workshop, and decided on a date, time, and place for the workshop. They also decided that the workshop should focus on sharing information and data about the natural features of the island, and to initiate interest in a potential follow up meeting to discuss next steps. Unlike the Beaver Island workshop, the committee did not want this workshop to include a lengthy discussion about recommendations on improvements and preservation efforts or next steps. The agenda for the workshop included: 1) introduction and greetings, 2) summary of MNFI and the significance of Great Lakes Islands, 3) an ice breaker exercise (list favorite thing about Drummond Island), 4) interactive exercise with break-out groups entitled "crayon your community", 5) overview of significant natural features on Drummond Island including special presentation on migratory and breeding bird data, 6) overview of threats to these natural features, and 7) a short discussion on possible next steps which included information about related activities in nearby communities. All Island residents were welcome, and key community

stakeholders were identified and personally invited by members of the workshop committee. Advertisements for the workshop were displayed at key locations throughout the Island. In addition, an article about the workshop was written and placed in the Drummond Island Digest. The workshop was entitled, Conserving

the Natural Resources and Community Character of Drummond Island. A total of 22 residents attended the workshop, and relationships were developed with key people in the community. (A copy of the workshop agenda is provided in Appendix II).

Presentation

Educational materials that were provided included: 1) a bird list for Drummond Island, 2) a species list for Maxton Plains, 3) an alvar booklet, 4) an alvar poster, 5) a natural areas poster, 6) species and community abstracts, and 7) an element occurrence list of for Drummond Island. Three large wall-sized maps showing element occurrences with digitized natural communities over a digital elevation layer, 1978 landcover, and circa 1800 vegetation were displayed at the workshop and later provided to one of the local community leaders.

The agenda for the main presentation covered three topics: 1) description of MNFI, 2) the significance of Great Lakes shoreline and islands, and 3) results of biological surveys for Drummond Island. The significance of the Great Lakes shoreline and islands focused on interesting facts. For example, there are nearly 600 Great Lakes islands within Michigan's borders, and these islands harbor approximately 10% of the state's total known element occurrences tracked by MNFI. This section also included facts about Drummond Island such as its size, vegetation patterns, and landscape changes over time. For example, Drummond Island contains 130 miles of shoreline, and is approximately 87,000 acres in size making it the second largest island in Michigan (Isle Royale is the largest island in Michigan). The third topic, biological surveys, included 1) a summary of the natural community, plant, and animal targets, 2) a description, ecology, flora/fauna (with a focus on rare species, and highlights of alvar, 3) results of migratory and breeding bird surveys with a comparison to other Great Lakes islands, and 4) a summary of Great Lakes marsh and boreal forest surveys. The presentation ended with a map showing the most significant sites of the island, and a list of potential future survey work. The main presentation was followed by a presentation on the major threats to these unique natural features (please

refer to Appendix III for an example of the PowerPoint presentations). Similar to the Beaver Island workshop, the areas MNFI identified as the most significant sites on Drummond Island were also the same sites that the residents identified as important, namely: Maxton Plains, Marblehead, entire southern shoreline, and the islands in Potagannissing Bay.

The workshop ended with a brief discussion on potential next steps to follow the workshop. Jesse Hadley, now the former TNC Director for the Lake Huron Bioserve, described a current project taking place in the Les Cheneaux Islands area that seemed to have potential applications for Drummond Island. The project is focusing on building a sustainable ecotourism industry, such as kayak tours, to generate revenue for the community while protecting the fragile resources that define the region. A variety of other ideas, such as developing a master land-use plan for the island, were also discussed. Drummond Township has never adopted zoning laws, although there has been interest over the years. After the discussion, several participants expressed interest in forming a committee to explore potential next steps. One person in particular, Cathi Shaul, long time resident of the island and owner of the White Pine Bed and Breakfast, agreed to be the leader or chairperson of the committee until other arrangements are made. To date, Cathi has communicated via email several times a month with everyone interested in forming a committee, and organized and conducted a meeting in January, 2002. Cathi also attended a meeting organized by the Drummond Island Tourist Association (DITA) and presented information about the Les Cheneaux Island project. DITA requested additional information, and as a result she made plans to attend a subsequent Les Cheneaux Economic Forum meeting on December 10, 2002 in Cedarville.

Interactive Exercise

As part of the introduction for the workshop, participants were asked to list some of the things they appreciated about Beaver Island. Items varied widely and included such things as peacefulness, ruggedness, snowmobiling opportunities, and wolves. Of the 22
Great Lakes Islands 2001 Page-30

things mentioned, the majority focused on natural features and resources. Others were categorized as cultural or recreational. Based on the results, Drummond Island appears to be considered by most to be a rugged wilderness that can be enjoyed and appre-

ciated year round.

The purpose of the interactive exercise entitled ‘crayon your community’ was to generate mental maps of the participant’s community, and list the things that define Drummond Island as a unique place. Attendees were split into 5 groups made up of 4-5 people. At the end of the exercise, each break out group presented to the larger group and all items mentioned were broken into four categories: 1) commercial, 2) historic features, 3) natural features, and 4) cultural features. Similar to Beaver Island, the natural features category, with 31 items (10 of which had more than one vote) contained the most items. Next in line was historic features (5), followed by cultural features (4) and finally commercial (3). Of the items mentioned more

than once, Marblehead and Maxton Plains were mentioned by all 5 groups, and Potagannissing Flooding was mentioned 4 times. Further analysis showed that items mentioned in the natural features category could be placed into three additional categories: 1) renewable resources, 2) elements, and 3) places. Places, which had 25 items, was by far the largest category. Only two items were included under renewable resources: wild raspberries, and mushrooms at the “knobs” (a local place name). Items in the elements category included prairie smoke (a rare plant), unique rock formations, wolves, and moose (please refer to Appendix IV for a list of the results).

Discussion and Conclusions

Conservation outreach on both Beaver and Drummond islands represents our effort to explore how natural features data can be optimally used by island residents and decision makers to improve land-based decisions that influence the conservation of biodiversity. From our experience, we realize that there is a disconnect between scientific surveys and research and the day to day activities that occur in the communities throughout Michigan. Not only are people often largely unaware of the unique natural features in their area, they are also unaware of how their decisions and actions can impact the long-term viability of rare species, high quality natural communities, and other significant natural features.

Originally, the goal of the conservation outreach portion of the project was to test what types and levels of natural resource related information are desired by island communities. The basic premise was that natural features related information is either not accessible to local communities or in a format that is easily integrated into day to day decisions. While working with partners and community leaders to prepare for these workshops, however, the goal of conservation outreach became less focused on testing which information is desired by the island communities, and more focused on designing an effective method to convey the information. More specifically, the goal was to develop an effective method for: 1) sharing information with local residents and decision-makers about their islands unique natural features, 2) identifying natural areas and features that are highly valued by the community and recognized by MNFI as ecologically significant, and 3) catalyzing community-based efforts to conserve these unique natural areas and features.

Both Beaver and Drummond islands provided an

opportunity to work within well-established human communities located in isolated and well-defined geographic spaces. Both of these island communities are small and have a strong sense of place. They are small enough that everyone has an opportunity to know everyone else, and both islands have several families with long histories on the island, some dating back four to five generations. Each island consists of both seasonal and permanent residents, and each relies heavily on tourism as their primary source of employment and revenue. Neither island can be reached by car, and both offer ferryboat services, one that operates 9 months out of the year for Beaver Island, and one that operates year round for Drummond Island. Both islands also contain many high quality natural features and sites, as well as a relatively high percentage of public land. There are also a few noteworthy differences. Beaver Island, which is located 32 miles from Charlevoix, is much more remote than Drummond Island, which is only 5 miles from Detour. Drummond Island is much larger than Beaver Island, and more areas on Drummond are inaccessible. They each also have very different geomorphology, and as a result, different natural communities, plants, and animals characterize each island. Another difference is that Drummond Island is marketed more as a four-season “sportsman’s paradise,” while Beaver Island is marketed more as a summer destination for families with an emphasis on scenic views, sandy beaches, relaxation, and a friendly community.

Both workshops were designed to be interactive and community based, with an emphasis on sharing information, rather than an expert based model in which there is a one-way exchange of data. The design of the workshops was largely the result of working closely with the Land Information Access Association

(LIAA), as well as a few key members of the local community. The Drummond Island workshop was largely based on the success of the Beaver Island workshop with a few minor modifications. Despite the fact that there are distinct differences between these islands (as mentioned above), the results of the interactive workshops were very similar. On both Beaver and Drummond islands, natural features were highly valued. Items in the natural features category outnumbered items in other categories (cultural, historic, and commercial) by a factor of six or seven. Defined natural areas or landscapes, such as Iron Ore Bay on Beaver Island and Maxton Plains on Drummond Island, were an important part of each island's community identity and sense of place. Interestingly, the sites identified by MNFI as significant were almost identical to the sites most valued by each island community. This is not to imply that MNFI's data are unnecessary for identifying ecologically significant sites on an island. What it may demonstrate is that island residents have an appreciation for places that exhibit ecological integrity, intactness, and wildness. MNFI believes that these sites are important because of the global rarity and high quality of the plant communities found there, and the associated rare plants and animals that they harbor. MNFI's information provides added value because it supplies decision-makers with objective scientific knowledge that is meaningful to the local community.

Upon reviewing the previous two island workshops, several insights were drawn about the project. One of the more surprising insights was that up-to-date ecological surveys, which are the foundation of this project, appear to be a great tool for giving MNFI staff credibility in local communities that were otherwise unaware of MNFI. Ecological surveys also helped engage the imagination of community leaders, which seemed to lead to more local participation in the development of the workshops. Another important observation was that each island had at least one dedicated individual that was an integral part in the development of the workshops. Such individuals provided information about the best times, dates, and places for a workshop, contacted other community leaders, publicized the workshop, and basically served as the local liaison for MNFI. In addition, conservation

groups with an established local presence, such as The Little Traverse Conservancy and The Nature Conservancy's Northern Lake Huron Bioreserve, were critical for identifying and contacting these community leaders and enlisting their assistance in the development of the workshops.

In 2002, the five-year island project will conclude with a conservation outreach workshop on Bois Blanc Island. Bois Blanc Island is located in the Straits of Mackinac approximately 8 miles immediately north of Cheboygan. Similar to Drummond and Beaver Islands, visitors can visit the island by either boat or plane, and a ferry service runs out of Cheboygan. Approximately 45 people live on the island year round, and a significant percentage of Bois Blanc is state land. Unlike Drummond and Beaver islands, Bois Blanc Island is not considered a major tourist destination in Michigan, although tourism is a major part of the local economy. Another difference is that Bois Blanc contains a large population of the federal and state threatened dwarf lake iris (*Iris lacustris*), and is considered one of the epicenters of this Great Lakes endemic plant. In addition, Bois Blanc harbors the northernmost population of eastern massasauga rattlesnake (*Sistrurus catenatus catenatus*) in Michigan. Despite the relative global rarity of these species, both are considered problematic or controversial by many of the year-round residents of Bois Blanc Island. Dwarf lake iris is very abundant in many locations near the shoreline, thriving in many places now heavily platted for residential development. In addition, dwarf lake iris can respond positively to soil disturbances such as road grading or forest clearing. To the casual observer, dwarf lake iris appears to be more of a weedy plant than one requiring state and federal protection. Similar to other areas in Michigan, the eastern massasauga rattlesnake, state listed as special concern and a federal candidate species, is perceived as a public threat and was historically persecuted by residents living on the island. Both species pose a significant challenge to the conservation community, and will be a focal point for the upcoming conservation outreach activities in 2002. To address these challenges, the workshop will incorporate a field trip to provide participants more of a hands-on experience to learn about natural features and promote additional discussion between participants.

Identification of Significant Biodiversity Areas

The following consists of a brief overview of significant areas identified during 2001 surveys on Drummond Island. As noted in previous progress reports (Penskar et al. 2000), a cumulative summary of these areas will be provided in a final project report. In addition to this overview, Appendix I provides a cumulative list of all natural features (natural community types, rare plant species, and rare animal species) compiled through four years of island inventories.

The extensive alvar communities of Maxton Plains, which comprise much of the northern portion of Drummond Island, have long been identified with regard to their state and global significance. These alvars are also important because of they support several rare plant and animal species, as detailed in the limestone pavement lakeshore (alvar) abstract in Appendix VI. A portion of the Maxton Plains is owned and managed as a high quality preserve by the Michigan Field Office of The Nature Conservancy (MIFO-TNC), and an adjacent area of land within Lake Superior State Forest has been nominated as a state natural area. Smaller but important alvar habitats occur along or near the southern shore of the island, especially the Huron Bay area, Big Shoal Cove, and also Seaman's Point, the latter site identified during a previous CZM inventory (Albert et al. 1994).

The Marblehead Peninsula is a unique site on Drummond Island, with a complex series of successive limestone cliffs. This remote area, which is very

difficult to access, has only been partially surveyed, thus further exploration and characterization is warranted. Classified as an MNFI dry non-acid cliff community, Marblehead cliffs comprise the only extant location in Michigan for the state endangered *Asplenium ruta-muraria* (wall-rue), a rare fern species ranging mainly along the Appalachian mountain chain in eastern North America. Although MNFI botanists and community ecologists have completed surveys on portions of the cliffs, no zoologists have yet assessed Marblehead. Owing to a large number of rare and endemic snails known from alvars and related habitats, a targeted survey of the cliffs for this group has strong merit.

As a result of bird surveys from 2000-2001, several significant sites for both migratory and breeding species were recognized, as indicated in Figure 2. Six important bird breeding sites and five important bird migration sites were identified, indicating key forest blocks, wetland complexes, and significant grasslands (including old fields and pastures) throughout the island. Because bird surveys were conducted with respect to accessibility and dependence on sampling protocols, these sites cannot be considered to represent a comprehensive list. Additional important bird areas are to be expected elsewhere on the island, such as in more remote forest, wetland complexes, lakes, streams, and other open grassland areas.

Projected Work for 2002

Natural community surveys. Community surveys will be conducted on both Bois Blanc Island and selected islands within the Les Cheneaux chain. Bois Blanc Island will be photo-interpreted by the project ecologist to assist in planning and presenting a conservation outreach workshop. Previously delineated old-growth forest areas (mesic northern forests), and other sites, such as potential wooded dune and swale complexes, northern fens, and shorelines will be examined more comprehensively to enhance the database for this large and ecologically important island. Inventories in the Les Cheneaux Islands will focus on biologically significant portions of Marquette Island and accessible areas of islands that were not surveyed in 1999 (Penskar et al. 2000), including Little LaSalle Island and Government Island.

Botanical surveys. Rare plant fieldwork will be conducted in conjunction with all natural community surveys, including participation in photo interpretation and mapping of Bois Blanc Island and Les Cheneaux Islands as necessary. Botanical inventories will also

focus on selected known rare plant sites to obtain better population status information, particularly for occurrences with a last observed date of 20 years and older, with the exception of certain early or late-blooming species not identifiable during the targeted mid-summer survey. In addition to rare plant surveys, the project leader will assist in efforts related to conservation outreach activities, including participation in the presentation of a conservation outreach workshop for Bois Blanc Island. The Bois Blanc Island workshop will include a botanical presentation and a subsequent field trip.

Animal surveys. Animal surveys will consist of two separate efforts, a snake survey and a Hine's emerald dragonfly inventory. Bois Blanc Island, which supports the northernmost eastern massasauga population in Michigan, will be targeted for a comprehensive massasauga inventory. Emphasis for this federal candidate snake species will be placed on assessing historical and current records, as well as surveys to identify new sites.

These surveys will provide current information useful in assessing conservation needs for the island's snake population as a whole. In addition, a staff zoologist will assist in the late summer conservation outreach workshop. Zoology activities with regard to the workshop will include a presentation of the rare fauna of Bois Blanc Island, assistance with a separate massasauga workshop to be presented by a snake specialist, and participation in the workshop field trip. Surveys for the federal and state endangered Hine's emerald dragonfly will take place on Bois Blanc Island and in selected areas in the Les Cheneauxs, principally on Marquette Island in habitat of high potential.

Conservation outreach. Following conservation outreach workshops designed and conducted in 1999 for Beaver Island and then in 2001 for Drummond

Island, a similar one will be held for Bois Blanc Island during late summer of 2002. As in the previous workshops, MNFI's conservation planning specialist will engage a variety of island stakeholders (resident and seasonal landowners, local government agencies, the Chamber of Commerce, conservation groups, the local historical society, real estate companies, and others) to help develop an outreach presentation. The workshop will rely heavily upon the lessons learned in the previous outreach efforts. The format of the workshop will vary somewhat, in that it is anticipated that staff biologists will assist in preparing and giving the presentations, in addition to leading a brief field trip to selected sites. An analysis and overview of the Bois Blanc workshop will be provided in the 2002 island report.

Acknowledgements

Funding for this multi-year island project has been provided primarily through generous CZM grants provided by the Michigan Coastal Management Program, Land and Water Management Division, MDEQ. We would like to acknowledge in particular the Coastal Program Director, Ms. Cathie Cunningham, for her unflagging support, encouragement, and indispensable guidance. Christy Fox served as Project Officer for 2001. Very special thanks are extended to Randy Sheets and Fred Salas of the MSU Contracts and Grants Administration Office, and also to MNFI's Judy Soule (Director) and Lyn Scrimger (Budget Specialist), for their persistence in working with MDEQ staff to resolve a difficult administrative snafu and put a contract into place.

Bird surveys would not have been possible without the local knowledge, local friendliness and enthusiasm provided by Drummond Island volunteers Bruce Doerr, Linda Hebert, Nancy Kleiner and Greg Bodker. This was the second year we had local volunteers and it really was a great experience for all! A thank you also goes out to Drummond Island Yacht Haven for providing a boat, recommendations of shoals to visit, and an experienced driver to charter an afternoon of common tern nesting surveys.

The Department of Natural Resources provided housing at the DNR cabin in June during one of the busiest weeks of the summer on Drummond – in the midst of the Jeep Jamboree! Alvira Vetchell, at Vechell's Resort on Drummond Island, provided the bird, ecology, and botany staff with wonderful cabins

on the shore of Lake Huron. A gracious thank you is in store for her services, contacts, and stories! We are indebted to Marija Andrijones for assisting in Drummond Island plant and natural community surveys, including augmenting our work with some discoveries of her own. Nancy Kleiner provided lodging at her beautiful house along the lakeshore for staff who conducted the interactive workshop in September. We would like to give very special thanks to Jesse Hadley, who helped initiate interest on Drummond Island during our interactive community workshop. Jesse, who started out the project as Director of the Northern Lake Huron Bioreserve, leaned on her strong contacts made over the years while working and living along the northern Lake Huron shoreline in Cedarville. To Jesse's credit, she continued to play a critical role as community liaison despite her departure from TNC during the last month of this project. Last but not least, Cathi Shaul, lifetime resident of Drummond Island and current owner of the White Pines Bed and Breakfast, contributed a tremendous amount of her own time to the project. Cathi's B & B provided a great central meeting place to plan for the workshop, and she put in countless hours drumming up support for the workshop. During the workshop, Cathi made sure everyone had their refreshments of choice, and she even helped clean up in the kitchen. Cathi and her husband Bill also provided a wonderful bonfire after the workshop for anyone that wanted to warm their spirits and share great stories about the island.

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Appendices

Appendix I

Cumulative List of Natural Features Identified during 1998-2001 Island Inventories¹

Element	Common Name	Global/State Rank	Federal/State Listing Status
Natural Communities			
Alvar	-	G2/S1	-
Bog	-	G4/S4	-
Boreal forest	-	GU/S3	-
Dry-mesic northern forest	-	G4?/S3	-
Dry non-acid cliff	-	G4/S3	-
Great Lakes marsh	-	G3/S3	-
Hardwood-conifer swamp	-	G4/S3	-
Limestone pavement lakeshore	-	G3G4/S2	-
Mesic northern forest	-	G4/S4	-
Northern fen	-	G3/S3	-
Northern wet meadow	-	G4/S4	-
Open dune	-	G3/S3	-
Wooded dune and swale complex	-	G3/S3	-
Rare Plant Species			
<i>Adlumia fungosa</i>	climbing fumitory	G4/S3	SC
<i>Asplenium ruta-muraria</i>	wall rue	G5/S1	E
<i>Bromus pumpellianus</i>	Pumpelly's brome grass	G4G5T4/S2	T
<i>Carex concinna</i>	beauty sedge	G4G5/S3	SC
<i>Carex richardsonii</i>	Richardson's sedge	G4/S3S4	SC
<i>Carex scirpoidea</i>	bulrush sedge	G5/S2	T
<i>Cirsium hillii</i>	Hill's thistle	G3/S3	SC
<i>Cirsium pitcheri</i>	Pitcher's thistle	G3/S3	LT, T
<i>Cypripedium arietinum</i>	ram's head orchid	G3/S3	SC
<i>Drosera anglica</i>	English sundew	G5/S3	SC
<i>Eleocharis compressa</i>	flattened spike-rush	G4/S2	T
<i>Iris lacustris</i>	dwarf lake iris	G3/S3	LT, T
<i>Littorella uniflora</i>	American shore-grass	G5/S2S3	SC
<i>Mimulus glabratus</i> var. <i>michiganensis</i>	Michigan monkey-flower	G5T1/S1	LE, E
<i>Pellaea atropurpurea</i>	purple cliff-brake	G5/S2	T
<i>Pinguicula vulgaris</i>	butterwort	G5/S2S3	SC
<i>Piperia unalascensis</i>	Alaskan orchid	G5/S2S3	SC
<i>Pterospora andromedea</i>	pinetrops	G5/S2	T
<i>Sarracenia purpurea</i> f. <i>heterophylla</i>	yellow pitcher-plant	G5T1T2Q/S1	T
<i>Solidago houghtonii</i>	Houghton's goldenrod	G3/S3	LT, T
<i>Sporobolus heterolepis</i>	prairie dropseed	G5/S3	SC
<i>Tanacetum huronense</i>	Lake Huron tansy	G4Q/S3	T

¹ G = Global Rank (U = Undetermined, T = Subspecies, Q = Taxonomy in question)
 S = State Rank, LE = Federal Endangered, LT = Federal Threatened, C = Federal Candidate,
 E = State endangered, T = state threatened, SC = State special concern

Appendix I (continued)

Rare Animal Species			
<i>Botaurus lentiginosus</i>	American bittern	G4/S3S4	SC
<i>Buteo lineatus</i>	red-shouldered hawk	G5/S3S4	T
<i>Chlidonias niger</i>	black tern	G4/S3	SC
<i>Cistothorus palustris</i>	marsh wren	G5/S3S4	SC
<i>Falco peregrinus</i>	merlin	G5/S1S2	T
<i>Gallinula chloropus</i>	common moorhen	G5/S3	SC
<i>Gavia immer</i>	common loon	G5/S3S4	T
<i>Haliaeetus leucocephalus</i>	bald eagle	G4/S4	LT, T
<i>Pandion haliaetus</i>	osprey	G5/S4	T
<i>Sistrurus catenatus catenatus</i>	Eastern massasauga	G3G4T3T4/S3S4	C, SC
<i>Somatochlora hineana</i>	Hine's emerald dragonfly	G2G3/S1	LE, T
<i>Sterna hirundo</i>	common tern	G5/S2	T
<i>Trimerotropis huroniana</i>	Lake Huron locust	G2G3/S2S3	T

Appendix II.

Agenda for Natural Features Workshop Drummond Island

9/29/01

6:30pm Introductions (5 min)

6:35 Go around room - list one thing you like about Drummond Is. (10 min)
Crayon your Island Exercise - break out groups (15 min.)
List values/assets - break out groups (15 min.)
Share information with larger group - (30 min.)

7:45 Break (10 min.)

7:55 MNFI presentation on natural features (40 min)
MNFI presentation on threats (20 min)

8:55 10 min. wrap up - discussion of next steps

9:10 Adjourn!!!

Appendix III.

Example of Power Point Presentation given for Conservation Outreach Workshop on Drummond Island.

Agenda

- Who is the Michigan Natural Features Inventory?
- Significance of Great Lakes shoreline and Islands
- Results of biological surveys for Drummond Island



The Natural Heritage Network

- A network of agencies whose charge is to collect sound scientific information
- 85 primary data centers:
 - all states
 - 6 Canadian provinces
 - 13 Latin American and Caribbean countries




Who do we work for?

- Program of Michigan State University Extension operated cooperatively with the MI Department of Natural Resources.
- Funded by grants obtained from state agencies, federal agencies, and local governments, with core funding from the MDNR.

Information Flow


- Gather
- Track
- Analyze
- Disseminate

.....information on endangered, threatened and special concern species, rare or exemplary natural communities, and other unique natural features.



Tracking Data

- Over 600 species of plants, animals, and invertebrates
- Over 60 natural communities
- Over 12,000 element occurrences



Significance of Great Lakes Shorelines



Appendix IV.

Results of Interactive Exercise
09/21/2001

Drummond Island Community Workshop

Things participants loved about Drummond Island (round robin everyone contributed)

Natural	Cultural	Recreational	Other
Birds (2)	Ferry	Year round fishing	Peacefulness
Wildness and rocks	Original stewardship of early settlers	Snowmobiling opportunities	Winter
Fossils		Diverse recreational opportunities	Always something new
Lots of water		Picking wild mushrooms	No neighbors
Wolves			Friendly people
Waterfowl			Lots of public land
Prairie smoke ruggedness Seasonal transitions			

Drummond Island Workshop

Elements mapped during the crayon your community exercise

Commercial

1. Ferry operation
2. Quarry
3. Airport

Historic Features

1. Ft. Drummond
2. Old ship building site on Harbor Island
3. Johnswood docks
4. Wayfarers mart
5. Old settlement area

Cultural Features

1. Ferry
2. Museum
3. Hunting
4. Fishing

Natural Features

Renewable resource	Place	Element
Wild raspberries	Big Shoal Bay beach (3)	Prairie smoke
Mushrooms at the knobs	Whitney Bay (3 rd bay)	Wolves
	Harbor Island	Moose
	Old growth cedar forest (south shore)	Unique Rock formations
	Helen's Lake	
	Warner's cove	
	Unique rock formations	
	Wolves	
	Moose	
	Cloudman cliffs	
	McCormick marsh	
	Bald knobs (2)	
	Potagannissing River	
	Ledges at the old quarry	
	Lake Huron Shoreline	
	Ledges on the north shore (3)	
	Maxton Plains (5)	
	Bruce Point	
	Islands in Potagannissing Bay (2)	
	Chippewa Point	
	Grand Marais Lake	
	Fossil beach and ledges (2)	
	Marblehead (5)	
	Whole south shore (3)	
	Glen cove (2)	
	Potannissing Flooding (4)	
	Canoe Bay	
	Sheep Ranch Rd.	

Appendix V.

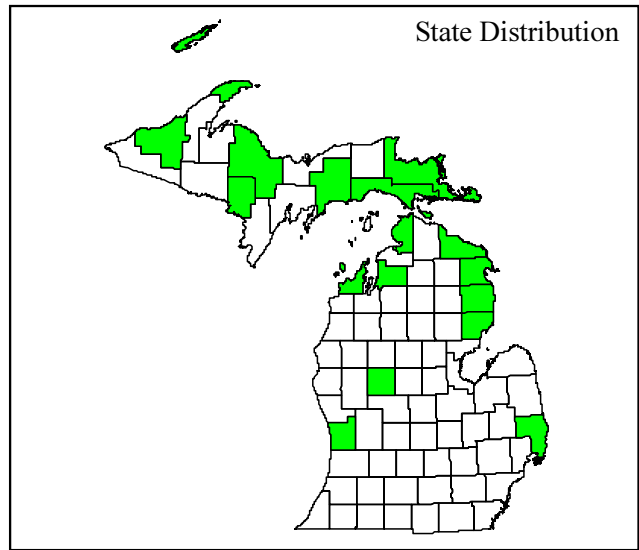
Species Abstracts

Plants

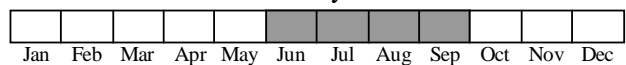
Pterospora andromedea (pine-drops)
Cirsium hillii (Hill's thistle)
Geum triflorum (prairie smoke)
Sporobolus heterolepis (prairie dropseed)

Communities

Limestone pavement lakeshore



Best Survey Period



Status: State threatened

Global and state rank: G5/S2

Family: Monotropaceae (Indian-pipe)

Other common names: giant birds nest, Albany beech-drops

Synonyms: *Monotropa procera* Torr.

Taxonomy: *Pterospora andromeda* is the only species in its genus (monotypic). Sometimes included in the Pyrolaceae or Ericaceae under subfamily Pyrolaceae, *Pterospora* and other species of the Monotropaceae differ in their saprophytic (absorb nutrients from dead or decaying matter) habit (Voss 1996).

Total range: A species primarily of Western North America, pine drops is disjunct in the Great Lakes region from the Black Hills and mountains of the west, and is known in scattered, rare, and localized populations further east to Quebec and New England (Voss 1996).

State distribution: Forty three occurrences of this species have been reported from Michigan, 22 of which are post-1978 records. The majority of these are associated with forested dune communities ranging from Ottawa to Keeweenaw County, with concentrations in Keeweenaw, Emmet, and Leelanau counties. Additional occurrences are widely scattered from Ottawa and St. Clair counties in southern Lower Michigan and from Drummond Island to Ontonagon County in the western Upper Peninsula. All occurrences were reported in low numbers ranging from a single individual to 11 stems, or in many cases simply

indicated as ‘rare.’ Seventeen occurrences occur on public lands or designated preserves. None of these occurrences, however, are under specific active protection.

Recognition: Pine-drop lacks chlorophyll and has one to several simple, erect stems, from 3-10 dm tall, bearing numerous scale-like leaves and a terminal raceme of numerous nodding flowers. The approx. 6-7 mm long, bell-shaped corolla is white while the sepals and vegetative parts of the plant are reddish to maroon. The stem and sepals are glandular-hairy giving the plant a clammy-sticky feel. The similar, but more widespread and common species *Monotropa uniflora* (Indian pipe) and *M. hypopithys* (pinesap), also lack chlorophyll, but are typically one half the size of *Pterospora* or smaller. In addition, the flowers of both Indian pipe and pinesap become erect in fruit, unlike the strongly nodding fruits of *Pterospora*. Indian pipe also differs in bearing only a single large flower on each stem.

Best survey time/phenology: Due to its distinctive habit and lack of chlorophyll, pine-drops should be recognizable during most of its aboveground life from June through early September, as long as the recognition characters are assessed carefully. The optimal time period, however, is when flowers and fruits are in their prime, typically from July through mid- to late August. It should be noted that pine drops is variable in its occurrence and may not appear aboveground each year.

Habitat: In Michigan, pine-drops is known from dry woods containing conifers such as pines, hemlock, spruce, balsam fir, or white cedar, and frequently including aspen or birch. Many occurrences are associated with dry to dry-



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mesic forests of sand dunes along the Great Lakes shorelines, while two occurrences have been reported from maple forests. This species typically occurs in forested habitats with a well-developed needle duff. Associated herbaceous species that have been noted include large leaved aster (*Aster macrophyllus*), Hepatica (*Hepatica* spp.), spotted coralroot (*Corallorhiza maculata*), winter-green (*Gaultheria procumbens*), and various ferns.

Biology: Lacking chlorophyll, *Pterospora* is thought to be dependent upon a fungus that forms a mycorrhizal relationship (a mutually beneficial association of a fungus and plant root) with a forest tree (likely a conifer) and *Pterospora*, to obtain nutrients. The fungal mycelia (the thread-like stands that collectively form the underground body of a fungus individual) form a sheath around the roots, isolating the roots from direct contact with the soil. Because there is no evidence that it is directly parasitic on a forest tree, it is considered a saprophyte by some, or alternatively, a parasite on the fungus (Bakshi 1959, Voss 1996). Further study is necessary to resolve these alternative viewpoints. The stems arise from a tight ball of mycorrhizal roots, producing flowers at about 4 weeks, the first typically opening in June. New shoots and inflorescences, however, can be produced throughout the growing season. Fruiting usually occurs in late July and August. Depending upon the size of the plant, from 20-128 fruiting capsules are produced, each bearing up to 4800 short-lived (3-9 weeks), wind-dispersed seeds. Germination in the greenhouse or lab has been unsuccessful, as has transplantation, thus suggesting that pine drops is sensitive to disturbance. Apparently, it isn't easy to replicate the specific biological and ecological conditions required for germination and establishment. Michigan populations have all been reported to be small (the largest comprised of 11 stems), as was the case for populations studied by Bakshi (1959). However, some populations in the Great Lakes region have been reported "in great quantities" (Voss 1996). Populations have also been noted as sporadic, not appearing every year, although Garlitz observed one population consistently over a 16-year period (MNFI element occurrence record #038).

Conservation/management: Little is known regarding specific management strategies for this species with the exception of the need to maintain its mycorrhizal association. Any strategy that lacks an understanding of this relationship is doomed to failure. Until additional knowledge regarding the biology and ecology of this species is available, management strategies should focus on preservation of ecosystem function, with particular attention paid to the maintenance of soil microbe and mycorrhizal diversity.

Research needs: Further investigation of the mycorrhizal system of *Pterospora* is of critical importance for the protection of this species. Systematic surveys to provide a thorough assessment of its status in Michigan is also a high priority, since this will also help to define its habitat

requirements.

Comments: Pine-drops derives its genus name *Pterospora* from the numerous winged (Ptero) seeds (spora) it produces (Bakshi 1959). Its species name comes from the flask-shaped flowers that resemble that of the Greek goddess Andromeda (Voss 1996).

Related abstracts: dry-mesic forest, dry northern forest

Selected references

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Abstract citation

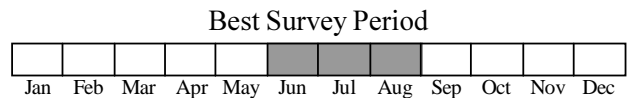
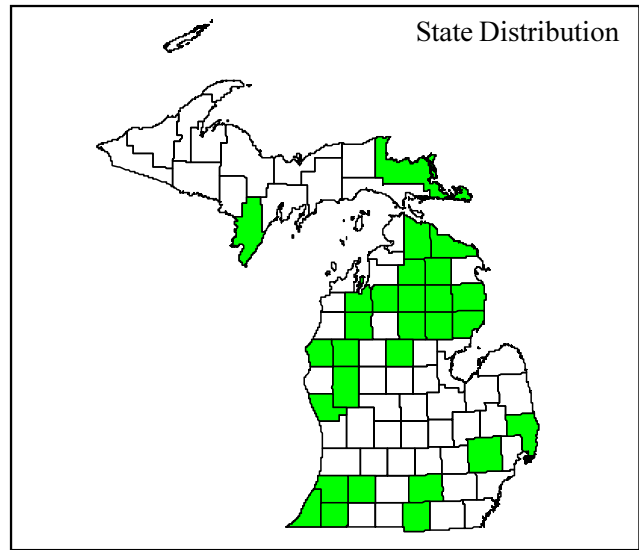
- Higman, P.J. and M.R. Penskar. 1999. Special plant abstract for *Pterospora andromeda* (pine-drops). Michigan Natural Features Inventory, Lansing, MI. 2 pp.

Funding for abstract provided by Michigan Department of Environmental Quality - Land and Water Management Division, Coastal Zone Management Program and Michigan Department of Natural Resources - Forest Management Division.

2-00/pjh



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Status: State special concern

Global and state rank: G3/S3

Other common names: hollow-rooted thistle

Family: Asteraceae (aster family)

Synonyms: *Cirsium pumilum* (Nutt.) Sprengel

Total range: Hill's thistle is centered in the Great Lakes region, ranging from South Dakota and Minnesota to southern Ontario and Pennsylvania.

State distribution: Hill's thistle is concentrated in three areas the state; the Shakey Lakes oak savanna region of Menominee County in the Upper Peninsula, the jack pine barrens of northern Lower Michigan, and in alvar habitat on Drummond Island. Its stronghold is in the jack pine barrens of the northern Lower Peninsula in Crawford County. It has been documented in other widely scattered locations throughout the Lower Peninsula, particularly in former oak savanna habitat in the southern tiers of counties. Due to the highly disturbed nature of the majority of former oak savanna communities, the status of Hill's thistle in these locations is likely very poor if it is extant at all. It is also known from Beaver Island and other scattered locations.

Recognition: Hill's thistle is a generally short (25-60 cm tall), perennial thistle with a **deep, hollowed, and thickened taproot**. The **leafy stems** are soft, ridged and **sparsely pubescent or tomentose** (with woolly hairs), with 1-2 short branches near the top terminating with a **single, large, pink flower head 4-7 cm high**. The outer

bracts at the base of the flower head are tipped by slender, short, and appressed spines. The elliptic-oblong leaves form a **basal rosette** with only a few progressively smaller leaves on the stem. The **leaf margins are typically undulating to very shallowly lobed** and sometimes slightly tomentose below, but often smooth on both surfaces.

Best survey time/phenology: Surveys are best conducted during the flowering period from June through August, however with experience this species can be recognized throughout the season both by the distinctive basal rosettes and fruiting heads.

Habitat: Throughout its range Hill's thistle is known from dry, sandy, gravelly soils in prairies, jack pine barrens, oak savanna, and open woods. In Michigan and Wisconsin, it is also known from limestone pavement communities known as "alvar". Species associates include typical prairie/savanna grasses such as big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium* [*Andropogon*] *scoparius*), Indian grass (*Sorghastrum nutans*), poverty grass (*Danthonia spicata*), hair grass (*Deschampsia flexuosa*), June grass (*Koeleria macrantha*), and a variety of goldenrods, asters, and other prairie forbs.

In the pine barrens communities of Michigan jack pine (*Pinus banksiana*) and Pennsylvania sedge (*Carex pennsylvanica*), in addition to the state threatened rough fescue (*Festuca scabrella*), state special concern Cooper's milk-vetch (*Astragalus neglectus*), and state threatened pale agoseris (*Agoseris glauca*) are also frequent associates.



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Biology: This perennial species blooms from June through August and persists from about two to five years. Flowering occurs one or two seasons after the establishment of the rosette, most typically in three-year-old plants. Seed production generally is abundant; however, both flowers and seeds are vulnerable to insects and fungi. Seed are dispersed by wind, with often the entire fruiting head often being broken off and blown away. *Cirsium hillii* also reproduces vegetatively by adventitious buds that form along the lateral roots. The primary taproots die with the remainder of the plant after flowering. Several lateral shoots may be produced by a single plant. Suppression of the natural fire regime in historical *Cirsium* habitat has resulted in increased litter accumulation which is thought to be responsible for poor seedling establishment. This is likely one of the primary causes for the rarity of this species.

Conservation/management: Conservation and management of this species should be directed along two major approaches. One is to make a concerted effort to locate extant populations and prevent further direct destruction of their habitat which, in addition to disruption of the natural fire regime, is a major cause of the species decline. The second approach is to address the problem of poor seedling establishment due to increased accumulation of litter. This concern is primarily an issue within the dry jack pine, savanna, and prairie habitats where lack of fire has allowed considerable encroachment of successional plants. Management in these areas with the use of prescribed fire is recommended. The accumulating duff layer is effectively removed by fire, opening up germination sites in the ground layer. Fire management may not be necessary in alvar communities where the harsh conditions appear to act as a natural check to woody species encroachment and resultant litter accumulation. In addition, in more mesic prairie/savanna communities, fire may actually have a negative effect. In these communities where lush prairie growth results from fire management, the thistle may actually be shaded out or out-competed by other species.

Research needs: The primary research needs for this species include more intensive inventory work to more adequately assess its status in Michigan, and further research on its basic life history, particularly the requirements for seed germination, seedling establishment, and vegetative reproduction, as well as the specific role of fire.

Related abstracts: alvar, pine barrens, dry sand prairie, oak savanna, Alleghany plum, pale agoseris, rough fescue, secretive locust

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Abstract citation

Higman, P.J. and M.R. Penskar. Special plant abstract for *Cirsium hillii* (Hill's thistle). Michigan Natural Features Inventory, Lansing, MI. 2 pp.

Funding for abstract provided by Michigan Department of Natural Resources - Forest Management Division and Wildlife Division, Non-Game Program.

7-99/pjh



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Geum triflorum Pursh

prairie-smoke

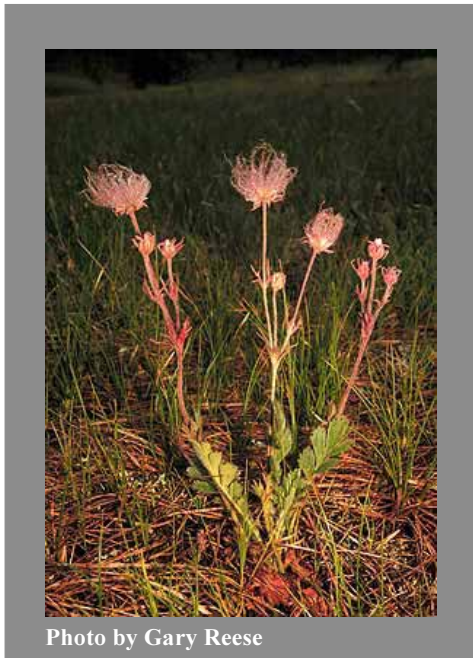
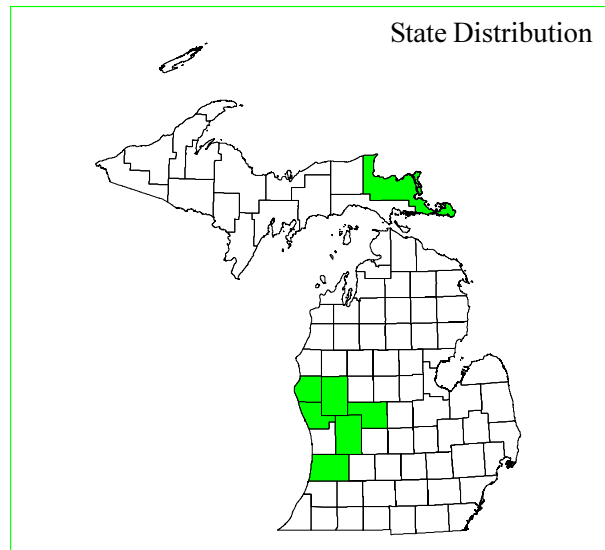


Photo by Gary Reese



Best Survey Period



Status: State threatened

Global and state rank: G4G5/S2S3

Family: Rosaceae (Rose family)

Other common names: prairie avens, purple avens

Total range: *Geum triflorum* ranges from western New York north to Ontario, through the Great Lake states, occurring west through the Great Plains, the Rockies, and to British Columbia and California. It is considered rare in New York and Michigan.

State distribution: *Geum triflorum* occurs primarily in the Lower Peninsula, where it is restricted to dry prairies, barrens, and oak-pine savannas of Montcalm, Oceana, Muskegon, and Newaygo counties. There are a few historical collections from Kent and Allegan counties where it has not been observed in several years. In the eastern Upper Peninsula, a well-known disjunct population occurs in the alvar grasslands on Drummond Island in Chippewa County.

Recognition: The **hairy basal leaves** of *Geum triflorum* are **pinnately-compound** (leaf divided into leaflets that are positioned in two rows along a central axis) with the lateral leaflets increasing in size toward the leaf tip. The short (8-12mm) floral shoots bear a few reduced leaves and **terminate in a loose cluster of several flowers on arching or drooping stalks**. **Dark purple, triangular sepals** obscure the short (8-12mm),

maroon petals that open only slightly. When in fruit, the **silky styles** elongate to produce a cluster of pale, **rosy plumes** that give this species its "prairie-smoke" appearance when viewed from a distance.

Prairie smoke is somewhat similar to other species of *Geum*, such as *G. rivale* (water avens), but is unlikely to be confused when in flower or fruit owing to its long, plumose styles. Prairie-smoke is also somewhat superficially similar to the common *Potentilla anserina* (silverweed), however the latter can be distinguished by leaves that are glabrous (not hairy) above and yellow flowers.

Best survey time/phenology: Surveys are best conducted during the flowering and fruiting periods from mid-May to mid-June.

Habitat: Throughout its range, *Geum triflorum* is usually found in prairies and dry, open woodlands. Most of the populations found in Michigan occur in dry sand prairie and other types of prairie remnants, frequently occurring in Sparta loamy sand. It is often concentrated on lower slopes, probably favoring areas of increased moisture. *Geum triflorum* is typically found growing with such dominants as *Carex pennsylvanica* (Pennsylvania sedge) and *Danthonia spicata* (poverty grass). Other associates include *Rubus allegheniensis* (blackberry), *Artemisia caudata* (wormwood), *Blephilia ciliata* (horsemint), *Coreopsis lanceolata* (lance-leaved coreopsis), *Heuchera richardsonii* (prairie alum-root), *Opuntia compressa*



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(prickly pear), *Phlox pilosa* (downy phlox), and *Penstemon hirsuta* (hairy beard-tongue). On Drummond Island, *Geum triflorum* grows on seasonally wet organic soils that overlie limestone pavement, occurring in a natural grassland community known as alvar. It is commonly associated with such typical species as *Arenaria stricta* (stiff sandwort), *Antennaria plantaginifolia* (pussy toes), *Castilleja coccinea* (Indian paintbrush), *Eleocharis compressa* (flat stemmed spikerush), *Carex scirpoidea* (bulrush sedge), *Juniperus communis* (ground juniper), *Saxifraga virginensis* (Virginia saxifrage), and *Senecio pauperculus* (ragwort).

Biology: *Geum triflorum* is a rhizomatous (possessing an elongate, underground stem) perennial. It flowers in mid-May and bears fruit from late-May to mid-June. Plants may flower as early as their second year of growth, but young plants are often vulnerable to desiccation. Bumblebees effect pollination by forcing their way through the nearly closed petals in search of nectar. The amplified, plumose styles aid the dispersal of fruits by wind and/or animals. Seeds are ready to germinate immediately upon maturation and can be stored for up to two years with high germination rates. In the fall, the leaves turn burgundy red.

Conservation/management: This species is threatened by severe or persistent disturbances, especially ORVs that destroy turf and destabilize the easily erodible sandy soils found in dry sand prairies. In addition, *Geum triflorum* is threatened by competition in disturbed areas from aggressive weeds such as *Centaurea maculosa* (spotted knapweed) and *Hypericum perforatum* (St. John's-wort). The best strategy for conservation of *Geum triflorum* is habitat preservation and the minimization of severe unnatural disturbances such as that caused by ORVs. Where invasive species are significant, appropriate application of prescribed fire may favor *Geum triflorum*'s establishment and proliferation by reducing competition. Since succession is extremely slow in dry sand prairies, prescribed burning should be infrequent, and spring fires should be avoided (Rock 1981). In the alvar communities of Drummond Island, conservation of prairie smoke will be favored by minimizing mechanical and hydrological disturbances.

Geum triflorum is known from at least three protected land sites, a Nature Conservancy preserve, a Michigan Nature Association Sanctuary, and a National Forest Ecological Study Area. Several other colonies are on state or federal lands, some of which are proposed for Natural Area designation.

Research needs: Detailed research to determine optimal fire management regimes is of high priority for this species, as well as monitoring of populations in restoration areas.

Related abstracts: Oak-pine savanna, Hill's thistle, red-legged spittlebug

Selected references:

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Abstract citation:

- Choberka, E.G., P.J. Higman, and M.R. Penskar. 2000. Special plant abstract for *Geum triflorum* (prairie smoke). Michigan Natural Features Inventory, Lansing, MI. 2 pp.

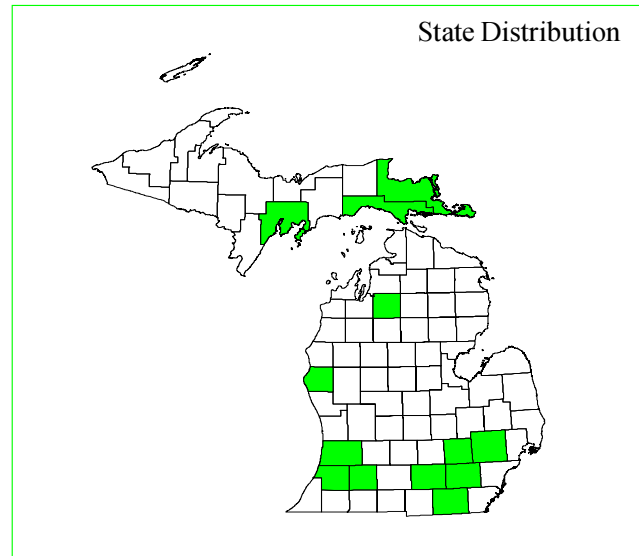
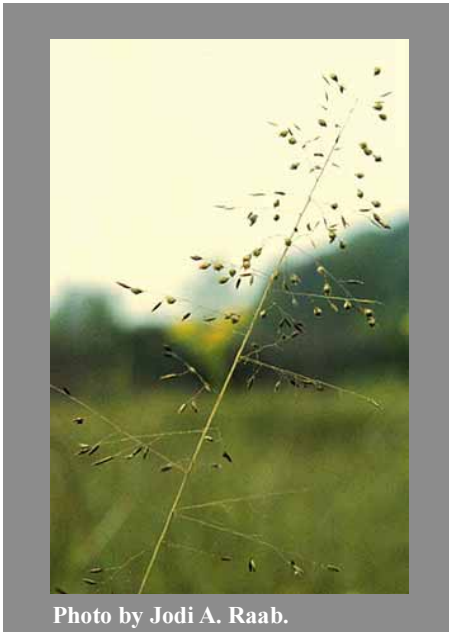
Funding for abstract provided by Michigan Department of Natural Resources-Forest Management Division and Wildlife Division.



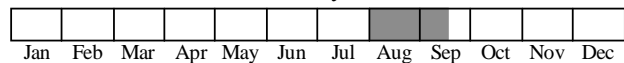
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Sporobolus heterolepis (Gray) Gray

prairie dropseed



Best Survey Period



Status: State special concern

Global and state rank: G5/S3

Other common names: Northern dropseed

Family: Poaceae (also known as Graminae; grass family)

Total range: A prairie species at the heart of its range in central United States, prairie dropseed ranges north into Saskatchewan and Manitoba, south to Texas and Arkansas, and west to Colorado and Wyoming. Widely scattered, localized populations occur eastward from Ontario, Quebec, and New York to Michigan, Ohio, Kentucky, North Carolina, and Louisiana.

State distribution: Prior to 1994 in the Lower Peninsula, this grass was known only from a dozen or so sites in the southern three tiers of counties where it is frequent to locally common. In 1994, a large population was discovered in Crawford County, in northern Lower Michigan, during an intensive floristic inventory of Camp Grayling Military Reservation (Higman et al. 1994). Upper Peninsula occurrences of prairie dropseed are restricted to highly localized areas where it is a dominant component of the bedrock grassland (alvar) communities along the Escanaba River and on the expansive exposed bedrock on Drummond Island.

Recognition: *Sporobolus heterolepis* grows in dense, roundish clumps or tufts, forming a turf when abundant. The tall, waist-high stems, reaching 4-10 dm in height, bear elongate, usually narrow and somewhat inrolled leaves, the basal ones up to one-half as long as the stems. The

ligule (at the inner juncture of leaf sheath and blade) consists of a fringe of short hairs. Fertile stems are terminated by an open to ovoid inflorescence with spreading to ascending branches. Each one-flowered spikelet is about 3.5-6.5 mm in length, and the glumes (tiny, leaf-like scales at the base of the spikelet) are distinctly unequal, the first about one-half as long as the second. The lemma and palea (tiny bracts at the base of an individual floret) are glabrous and lack lateral nerves. Perhaps most distinctive of this species is the characteristic fruit, a somewhat shiny, yellowish, spherical grain (2 mm in diameter) that when mature splits the palea and spreads open the parts of the spikelet. *Panicum virgatum* (switchgrass) superficially resembles prairie dropseed in general aspect, but the glumes are conspicuously nerved and it lacks spherical fruits.

Best survey time/phenology: The characteristic spherical fruits are unmistakable in this species, thus the optimal survey time is when the species is fruiting, typically during August and into early September. With experience, one can learn to distinguish the dense basal tufts of narrow, inrolled leaves characterized by a short fringe of hair at the ligule. For the very experienced, the rather delicate inflorescence, prior to fruiting, can also be keyed in on, noting characteristics of the glumes, lemma, and palea, within the context of appropriate habitat.

Habitat: In the Upper Peninsula, prairie dropseed is characteristic of alvar, becoming a dominant, turf-forming plant of that thin-soil, limestone and dolomite bedrock community. On Drummond Island, prairie dropseed was found to be the most abundant species of the Maxton Plains



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alvar, dominating in pavement and other grassland sites (Stephenson and Herendeen, 1986). Its common associates include *Carex scirpoidea* (bulrush sedge), *Eleocharis compressa* (flattened spike-rush), *Senecio pauperculus* (ragwort), and *Andropogon scoparius* (little bluestem). The northern Lower Michigan population consists of hundreds of plants that occur in pockets along a linear, mesic sand prairie-like wetland. It appears to follow a pro-glacial lakeplain resulting from the receding Wisconsin glaciation. This rather unique site includes other rarities such as *Solidago houghtonii* (Houghton's goldenrod), *Scirpus clintonii* (Clinton's bulrush), and *Juncus vaseyi* (Vasey's rush), New England violet (*Viola novae-angliae*) as well as additional species characteristic of the Great Lakes shore such as *Deschampsia cespitosa* (hair grass) and *Castilleja coccinea* (Indian paintbrush). In southern Michigan, *S. heterolepis* occurs primarily in calcareous wetlands (prairie fens), where it may be a frequent to dominant plant with *Andropogon gerardii* (big bluestem), *Andropogon scoparius*, *Sorghastrum nutans* (Indian grass), *Muhlenbergia richardsonis* (mat muhly), *Carex stricta*, and a number of other prairie fen associates. Within the main body of its range, prairie dropseed occurs in upland and lowland mesic prairies, dry open ground, and in open woods.

Biology: Prairie dropseed is a perennial, fruiting primarily during August, though fruiting specimens have been collected from early July through September. As with many other prairie plants, fire is an important component of this species' biology and ecology. Research conducted on burned and unburned prairies sites, where *S. heterolepis* was a dominant component, has demonstrated that fire greatly enhances productivity, both in biomass and flowering (Ehrenreich and Aikman, 1957; Dix and Butler, 1954). The beneficial effects of fire largely result from the removal of deep litter layers, improving nutrient cycling, raising soil temperatures (which stimulates nitrifying bacteria), and eliminating competing vegetation (Wright, 1980). In the alvar communities of Upper Michigan, however, fire may not be a critical environmental factor. Stephenson (1983) suggests that drought rather than fire has prevented the succession of invading vegetation, particularly competing woody plant species. Stephenson and Herendeen (1986) found drought to have profound effects on the alvar species of the Maxton Plains, where following a significant decrease in rainfall, prairie dropseed failed to grow and successfully flower over large portions of the communities it dominated.

Conservation/management: Much of the Maxton Plains alvar is under protection of The Nature Conservancy and the DNR with a portion of the state land proposed for Natural Area dedication. One southern Michigan population also lies within a Nature Conservancy preserve (Ives Road Fen), and at least portions of two other localities are in Michigan Nature Association sanctuaries (Harvey's Rocks and Little Goose Lake Fen). A fifth locality is within a Washtenaw County park. Hydrologic

alterations can degrade or destroy prairie dropseed's habitat, as can woody encroachment due to fire suppression in southern Michigan fens.

Research needs: Attempts to locate additional inland locations in northern Lower Michigan, similar to the Camp Grayling site, may provide insight into the ecological requirements of this species and could possibly lead to the discovery of additional rarities.

Related abstracts: Alvar, prairie fen, English sundew, mat muhly, prairie Indian plantain, small white lady's-slipper, Eastern massasauga, Mitchell's satyr.

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Abstract citation:

- Higman, P.J. and M.R. Penskar. 1999. Special plant abstract for *Sporobolus heterolepis* (prairie dropseed). Michigan Natural Features Inventory, Lansing, MI. 2 pp.

Updated September 2000.

Funding for abstract provided by Michigan Department of Natural Resources-Forest Management Division and Wildlife Division.

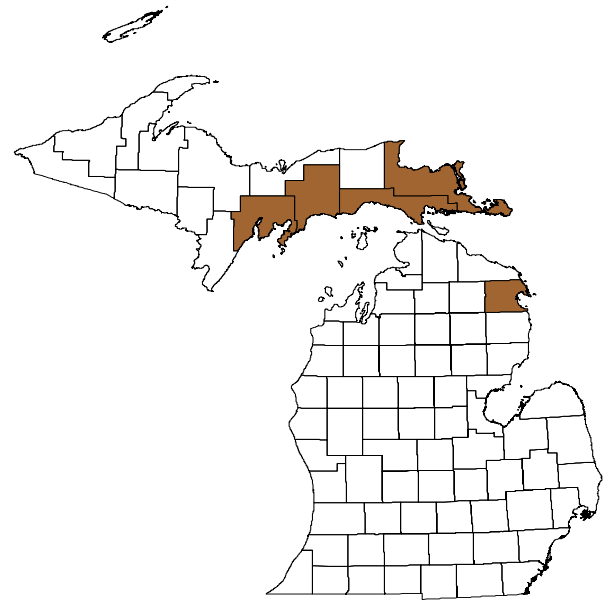


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Photo by Patrick J. Comer

State Distribution



Global and state rank: G3G4/S2

Rank justification: This community has a restricted distribution but the status and ranking of sparsely and unvegetated communities has not been entirely resolved.

Range: Limestone/dolostone pavement lakeshores are found along the Great Lakes shorelines of Wisconsin, Michigan, Ontario, and New York. Fourteen occurrences are known from Michigan along the northern Lake Michigan and Lake Huron shorelines. Similar communities are found along Lake Champlain and on lakeshores throughout the Adirondack region.

Landscape context: In Michigan, these plant communities are commonly found along northern Great Lakes shores where flat bedrock pavement associated with the Niagaran Escarpment is exposed. The bedrock of the Niagaran Series is Silurian-age limestone and dolostone formed from marine reefs that were common in shallow portions of the Michigan Basin (Ehlers 1973). Ordovician-age limestone and dolostone also support these plant communities on northern Drummond Island. Being formed from marine organisms, these rocks are rich in calcium carbonates. Resistance to erosion is variable; limestone and dolostone are readily dissolved by rain water, producing solution cracks that often connect to the underlying groundwater system. In contrast, limestone rich in sand, silt, or clay sized particles originating from terrestrial sources (argillaceous limestone) is much more resistant to solution and typically contains few broad cracks. These lakeshores are located within sub-subsections

VII.6.3, VIII.1.1, and VIII.1.3 of the Regional Landscape Ecosystems as delineated by Albert (1995). The proximity of the Great Lakes results in moderated climate and high precipitation in these sub-subsections, relative to adjacent portions of the upper Great Lakes region. The pavement of this community forms a gentle slope (averaging 1%) dipping into the lake. Immediately inland of the exposed pavement is often a ridge of limestone or dolostone cobble (typically 1-2 m high) deposited from ice scours and major storm events in years when lake levels were higher. From this point inland, more continuous soil development is common. Typically, beginning with the cobble ridge, there are dense forests of northern-white cedar (*Thuja occidentalis*), white spruce (*Picea glauca*), balsam fir (*Abies balsamea*), and paper birch (*Betula papyrifera*). Given their location along Great Lakes shorelines, these forests tend to experience frequent windthrow, but typically have 80% forest canopy. Occasionally, the exposed pavement is bordered along the inland edge by open northern-white cedar glades, dense herbaceous and shrub vegetation.

Natural processes: Composition and diversity of plant species is largely determined by distance from the waters edge and the width of bedrock cracks. Soil accumulation begins in the cracks forming the first sites for vegetative colonization. A distinctive vegetative zonation results from the ice scrape and wave wash dynamics of the lakeshore. The lower zone of this community, averaging 10 m wide, is continually washed by waves and is very sparsely vegetated. Ice buildup and wave wash from severe storm events may also scour the pavement surface, depositing cobbles in a



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narrow ridge. This zonation varies with fluctuations in Great Lakes water levels. Pools of water typically occupy about 10% of the surface of this zone. Above the wave wash/scrape zone, a more densely vegetated zone extends to the inland forest edge. The width of this zone in Michigan varies from 5-70 m wide, averaging 23 m. Pools of water typically occupy about 1% of the surface of this zone. The soils and substrate are neutral to slightly alkaline (pH 6.7-8.0). All communities along these shorelines experience frequent high winds and storm events.

Vegetation description: Limestone pavement lakeshores are sparsely vegetated communities. The wave-washed and ice-scoured zone immediately adjacent to the lake on average contains 2% vegetative cover, with *Juncus balticus* (rush), *Potentilla anserina* (silverweed), and *Populus balsamifera* (Balm-of-Gilead) being most frequent. Mosses typically occupy 1% of the surface of this zone. The more densely vegetated zone, with patches of herbs, and occasional shrubs, typically has about 20% vegetative cover. Characteristic plant species include *Calamintha arkansana* (Arkansas mint), *Potentilla fruticosa* (shrubby cinquefoil), *P. anserina*, *Panicum lindheimeri* (panic grass), *Thuja occidentalis* (Northern white cedar), and *Deschampsia cespitosa* (hair grass). Mosses in this zone comprise 5% areal coverage. Occasionally, a glade zone occurs in the upper portion of the shoreline, dominated by stunted conifers, low evergreen shrubs, and dense herbaceous plants and mosses. These areas have, on average, 23% coverage of shrubs, 78% coverage of herbaceous plants, and 10% coverage of mosses. Characteristic plant species include: *Thuja occidentalis*, *Potentilla fruticosa*, *Arctostaphylos uva-ursi* (bearberry), *Deschampsia cespitosa*, *Senecio pauperculus* (ragwort), *Juniperus communis* (common juniper), and *Picea glauca* (white spruce).

Other plant species commonly associated with limestone pavement lakeshores in Michigan include: *Deschampsia flexuosa* (hair grass), *Hypericum kalmianum* (Kalm's St. John's-wort), *Aster laevis* (smooth aster), *Solidago ohioense* (Ohio goldenrod), *Campamula rotundifolia* (harebell), *Lycopus americanus* (water horehound), *Viola nephrophylla* (bog violet), *Euthamea graminifolia* (grass-leaved goldenrod), *Eleocharis elliptica* (spikerush), *Primula mistassinica* (bird's eye primrose), *Carex viridula* (sedge), *C. eburnea* (ebony sedge), and *Zigadenus glaucus* (white camass). Rare plants may include such species as *Carex richardsonii* (Richardson's sedge), *C. concinna* (beauty sedge), and *C. scirpoidea* (bulrush sedge). A total of 147 vascular plant species have been recorded along limestone pavement lakeshores in Michigan. On any given stretch of pavement lakeshore one would, on average, encounter 24 vascular plant species.

Strata	Most abundant
Tree canopy	<i>Thuja occidentalis</i>
Short shrub	<i>Potentilla fruticosa</i> , <i>Populus balsamifera</i> , <i>Thuja occidentalis</i>
Herbaceous	<i>Calamintha arkansana</i> , <i>Potentilla anserina</i> , <i>Juncus balticus</i> , <i>Deschampsia cespitosa</i> , <i>Panicum lindheimeri</i>



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Michigan indicator species: *Primula mistassinica*, *Carex richardsonii*.

Other noteworthy species: *Solidago houghtonii*, *Carex scirpoidea*, *C. richardsonii*, *C. concinna*, *Iris lacustris*, *Cirsium hillii*.

Special animals: Special animal species that associate with the limestone pavement lakeshores in Michigan include several land snails and one uncommon butterfly. *Vertigo hubrichti* is a periglacial relict snail known from less than 30 sites worldwide and from two sites in Michigan. One of these is from a shaded, damp to dry low ledge in the shrub zone of limestone pavement shoreline.

A number of butterflies have been recorded from the limestone lakeshores including the tawny crescent spot (*Phyciodes batesii*). In addition to lakeshore pavements, this species can be found in alvar glades and wet meadows of northern Michigan where its larvae feed on a variety of aster species.

The shorelines also provide stopover and feeding corridors important to neotropical migratory birds including many warbler species.

Conservation/management: Principle threats to these areas are related to trampling of vegetation and the introduction of invasive, non-native plant species. Residential subdivision of adjacent uplands frequently causes degradation to this community through trampling, off-road vehicle use, water pollution, and non-native plant introduction. Protection of adjacent vegetation and limited shoreline access are needed surrounding each lakeshore occurrence.

Research needs: Range-wide perspective of the relative rarity and biological variation of these systems is needed to further clarify conservation priorities. Additional characterization of non-vascular plants and insects in Michigan shorelines is needed as well as research into the effects of residential development on the function of these communities.

Similar communities: alvar pavement, alvar grassland, limestone/dolostone glade, spruce-fir forest.

Other classifications:

Michigan Natural Features Inventory (MNFI)
Presettlement Vegetation (MNFI): 74, exposed bedrock.

Michigan Department of Natural Resources (MDNR):
K, rock

Michigan Resource Information Systems (MIRIS):
74, exposed rock.

National Wetland Inventory (NWI): none.

The Nature Conservancy National Vegetation Classification:

ALLIANCE: Sparsely vegetated pavement.
ASSOCIATION: Great Lakes alkaline rock shore.

Related abstracts: Dwarf lake iris, Houghton's goldenrod, Hill's thistle, prairie smoke.

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Comer, P.J., D.L. Cuthrell, D.A. Albert, and M.R. Penskar. 1997. Natural community abstract for limestone/dolostone pavement lakeshore. Michigan Natural Features Inventory, Lansing, MI. 3 pp.

Updated September 2000.

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