A Life Science Inventory and Evaluation of Rondeau Provincial Park

Ministry of Natural Resources and Forestry

Ontario Parks

2012

Webpage title: Life Science Inventory and Evaluation of Rondeau Provincial Park

Webpage description: This document contains a detailed life science inventory evaluation of Rondeau Provincial Park's flora and fauna.

Ontario

Table of Contents

Introduction 7
Purpose of Report 7
Report Organization 8
Acknowledgements 9
Chapter 1: Regional and Physical Background 10
1.1 Location 10
1.1.1 Mapping 11
1.2 Regional Context 12
1.2.1 Ecozone, Ecoregion and Ecodistrict 12
1.2.2 Forest Region 13
1.2.3 Adjacent Land Use and Summary of Regional Natural History Features 17
1.3 Geology, Physiography and Soils 20
1.3.1 Bedrock 20
1.3.2 Surficial Geology and Physiography 21
1.3.3 The Formation of Pointe aux Pins 22
1.3.4 Erosion of Rondeau's South Beach 30
1.3.5 Overlying Soils 32
1.4 Hydrology 34
1.5 Climate 35
Chapter 2: Site Establishment and Management 38
2.1 Site Context 38
2.1.1 Regulated Park Area 38
2.1.2 Classification 39
2.1.3 Size 40
2.2 Historical and Current Management 42

2.2.1 Establishment History 42
2.2.2 Management Policy Framework 44
2.2.3 Park Zoning 45
2.2.4 Park Use 48
Chapter 3: Current and Historical Vegetation Considerations 49
3.1 Excessive Numbers of White-tailed Deer 49
3.1.1 The Rondeau Deer Population 49
3.1.2 The Effects of a High Deer Population 51
3.1.3 Other Management Options Considered 55
3.1.4 Current Deer Management Policy in Rondeau Provincial Park 57
3.2 Fire and Fire Suppression 60
3.2.1 Determining the Location of Oak Savannah and Woodland Communities in Rondeau 61
3.2.2 Determination of Areas Appropriate for Prescribed Burning 65
3.3 Other Influences on Vegetation Communities 67
3.3.1 Logging and Clearing 67
3.3.2 Grazing 69
3.3.3 Dutch Elm Disease 69
3.3.4 Planting of Trees, Shrubs and Garden Plants 69
3.3.5 Windthrow 71
3.3.6 Other Influences 72
3.4 Previous Vegetation Surveys 72
3.4.1 Ralph Carman 1928 72
3.4.2 Charles Bartlett 1958 76
3.4.3 Gary Bradfield 1972 79
3.4.4 Matsy Kenney 1974 81
3.4.5 T.S. Dai, D.G. Stevens and D.W. Smith 1975 84

3.4.6 Paul Pratt 1975 90
3.4.7 Edward Haggith 1982 95
Chapter 4: Methods 96
4.1 Current Field Investigations 97
4.1.1 Ecological Land Classification and Botanical Surveys 97
4.1.2 Small Mammal Trapping Survey 98
4.1.3 Breeding Bird Surveys 99
4.1.4 Salamander Coverboard Survey 104
4.2 Other Monitoring or Inventory Projects 105
4.2.1 Turtle Studies 105
4.2.2 Fowler's Toad 106
4.2.3 Butterfly Count 106
4.2.4 Opportunistic or Incidental Data 106
4.3 Other Ecological Inventory or Research Projects 106
4.3.1 Breeding Bird Atlas 106
4.3.2 Marsh Bird Monitoring Program 107
4.3.3 External Research 108
Chapter 5: Life Science Features – Vegetation Communities 108
5.1 Community Descriptions - Terrestrial Systems (Natural and Naturalized) 129
5.1.1 Shoreline Class (SH) 130
5.1.2 Sand Barren and Dune Class (SB) 131
5.1.3 Meadow Class (ME) 134
5.1.4 Thicket Class (TH) 136
5.1.5 Savannah Class (SV) 139
5.1.6 Woodland Class (WO) 142
5.1.7 Forest Class (FO) 146
5.2 Community Descriptions - Terrestrial Systems (Cultural) 151

5.2.1 Constructed Class (CV) 152
5.3 Community Descriptions - Wetland Systems 153
5.3.1 Swamp Class (SW) 153
5.3.2 Marsh Class (MA) 159
5.4 Community Descriptions - Aquatic Systems 171
5.4.1 Open Aquatic Class (OA) 172
5.4.2 Shallow Water Class (SA) 173
Chapter 6: Life Science Features - Flora 174
6.1 Plant Species at Risk 175
6.2 Other Significant Plant Species 180
6.3 Alien and Invasive Plant Species 182
Chapter 7: Life Science Features - Fauna 184
7.1 Mammals 184
7.1.1 Recent Mammal Research and Inventories 184
7.1.2 Uncommon Mammals of Rondeau 185
7.1.3 Historical, Incidental and Introduced Mammals of Rondeau 186
7.1.4 Mammals Not Found in Rondeau 187
7.1.5 Mammal Species at Risk 188
7.2 Birds 189
7.2.1 Bird Monitoring Results – Forest Bird Monitoring Program 190
7.2.2 Bird Monitoring Results – Marsh Bird Monitoring Program 193
7.2.3 Bird Monitoring Results – Ontario Breeding Bird Atlas 194
7.2.4 Prothonotary Warbler Recovery Efforts 195
7.2.5 Bird Species at Risk 197
7.3 Herpetofauna 202
7.3.1 Herpetofauna Species at Risk 202
7.3.2 Salamander Coverboard Monitoring 206

7.3.3 Ambystoma Complex Assessment 209
7.3.4 Results of Amphibian Monitoring by the Marsh Monitoring Program 209
7.4 Fishes 210
7.4.1 Fish Species at Risk 211
7.5 Insects 212
7.5.1 Lepidoptera 212
7.5.2 Odonata 213
7.5.3 Other Insect Lists for Rondeau 214
7.6 Freshwater Mussels 215
Chapter 8: Site Evaluation and Summary of Significance 217
8.1 Representation 217
8.1.1 GapTool Summary 217
8.1.2 ELC Summary 218
8.2 Condition 219
8.2.1 Direct Anthropogenic Disturbances 219
8.2.2 Indirect Anthropogenic Aspects Impacting Condition 220
8.2.3 Condition Ranking 221
8.3 Diversity 221
8.3.1 Landscape Diversity 221
8.3.2 Species Diversity 221
8.4 Ecological Functions 222
8.5 Special Features 224
8.5.1 Rare Vegetation Communities 224
8.5.2 Rare Species 226
8.5.3 Specialized Habitats and Recognized Areas 227
8.6 Provincial, Regional or Local Significance 227
Literature Cited 228

Appendix 1. Explanation of Codes Used in Appendices 250
Appendix 2. Checklist of the Vascular Plants of Rondeau Provincial Park 252
Appendix 4. Checklist of the Birds of Rondeau Provincial Park 296
Appendix 5. Checklist of the Amphibians and Reptiles of Rondeau Provincial Park 304
Appendix 6. Checklist of the Fishes of Rondeau Provincial Park 306
Appendix 7. Checklist of the Odonata and Lepidoptera of Rondeau Provincial Park 311
Appendix 8. Checklist of the Freshwater Mussels of Rondeau Provincial Park 331

Introduction

Established in 1894, Rondeau is Ontario's second oldest provincial park. The tall pines, safe harbour and other natural resources have, however, been a point of interest for centuries. Prior to European settlement the Neutrals used the peninsula as a seasonal camp to hunt deer and fish in the shallow waters of the bay. The arrival of the Europeans began with Etienne Brule's exploration of the lower great lakes in the early 1600's and soon after untold numbers of French explorers and traders paddled by the peninsula and gazed on its massive Eastern White Pine, camped on its shores or hunted for food to restock their supplies. By 1656 Pointe aux Pins as it had been dubbed, was a prominent feature on early charts and by 1670 the importance of the bay and peninsula as a strategic landmark was well known.

Use of the bay and peninsula increased substantially over the course of the next century, but in 1790 the strategic value of the bay as a naval harbour and the value of the significant stands of pine timber were brought to the attention of Lieutenant Governor John Graves Simcoe. To protect these valuable resources, Simcoe declared a portion of Pointe aux Pins as a landguard - ordnance lands under crown control for use at the Governor's discretion. This effectively protected a portion of the peninsula from settlement and unauthorized exploitation more than a century before its designation as a provincial park.

Rondeau's early years as a provincial park focussed on recreational use with picnicking, camping, cottaging and water sports predominating. It was not until the late 20th century that the significance of the park, with respect to the unique Carolinian habitats and species at risk, was fully realized. Rondeau is now known as one of the most species rich locations in Ontario, and is likely home to more Species at Risk than any other protected area in the province.

Purpose of Report

Since its establishment as a provincial park over 100 years ago, hundreds of documents, reports, studies and papers have been written about various aspects of Rondeau's flora and fauna, and research and inventory work is ongoing. This report is intended to summarize the bulk of this information, provide up-to-date information on

the status of the park's flora and fauna and provide an overall evaluation on the status of the park's life science features.

In support of this effort and in anticipation of the report, a number of studies and monitoring projects have recently been conducted including a small mammal trapping study, a salamander cover board monitoring program, forest bird monitoring, a complete ecological land classification and various species at risk projects. These studies, combined with general observations, element occurrence data from the Natural Heritage Information Centre and park records and checklists, have all been compiled in this report to provide an up-to-date picture of the park's life science values.

Report Organization

Chapter 1 of the report provides a regional and physical background for the park including geographical location; provincial scale ecological conditions including Ecoregion, Ecodistrict and forest zone summary; adjacent land use; geology, physiography and soils; a discussion on the formation of the Rondeau peninsula; hydrology and climate.

Chapter 2 outlines the long history of, and interest in the protection of Ronde eau and Pointe aux Pins, including its status of land guard under John Graves Simcoe and establishment of the provincial park in 1894. The chapter also outlines the past and current park boundaries, classification and zoning as well as the current management framework and a summary of current park use.

Chapter 3 is a summary of historical vegetation considerations including natural (deer, windthrow, fire) and anthropogenic (clearing, logging) disturbances to the Rondeau forests. It also summarizes a number of significant historical vegetation surveys conducted in the park as far back as 1928. These historic reports provide an essential snap shot in time with which we can make comparisons to current conditions.

Chapter 4 summarizes methods used for investigations undertaken as part of the current life science inventory including community assessment using the Ecological Land Classification for southern Ontario, botanical inventories, a small mammal inventory and breeding bird surveys. It also quickly summarizes some of the more significant projects undertaken by other MNR staff and external researchers.

Chapters 5-7 provide an up-to-date assessment of Rondeau's flora and fauna including a detailed description of vegetation communities within the park characterized in the Ecological Land Classification (Chapter 5), botanical inventory (Chapter 6) and faunal resources (Chapter 7).

Chapters 8 summarizes the findings of current field work and existing information, and provides an assessment of the parks biological features according to the five standard selection criteria (Representation, Condition, Diversity, Ecological Functions and Special Features) used by Ontario Parks to assess natural heritage sites as outlined in Patterson *et al*. (2003).

Appendix 1 provides an explanation of provincial S-ranks as described by Ontario's Natural Heritage Information Centre, and status designations used on the Species at Risk in Ontario (SARO) list. Appendices 2-8 are checklists for the various taxon.

Acknowledgements

This project benefited from a large number of people, all of whom cannot be mentioned here. However, the following people played a key role:

Harold Lee, Dave Bradley and Greg Escott played a key role in field work for the Ecological Land Classification portion of the report, and Harold and Dave provided invaluable advice in the classification of the parks communities.

Bird Studies Canada kindly provided data gathered during the Marsh Monitoring Program within the park, and the Canadian Wildlife Service provided data gathered through the Forest Bird Monitoring Program.

Mapping and GIS analysis has been conducted by a number of people including Noel Grasso, Tim Marchand, Jocelyn Moffett and Brandan Woodworth.

Mike Oldham and Bill Crins provided extensive review of species lists.

This report has benefited significantly from the review of the various drafts by a number of reviewers including: Dawn Bazely, Laura Bjorgan, Bill Crins, Phil Kor, Mike Oldham and Emily Slavik.

Chapter 1: Regional and Physical Background

1.1 Location

Rondeau Provincial Park is situated in southwestern Ontario on the north shore of Lake Erie, in Harwich Township, Kent County, in the amalgamated municipality of Chatham-Kent. The Park is located approximately 40 km SE of the city of Chatham, 12 km southeast of Blenheim and 13 km south of Ridgetown. The location of the Park with respect to southern Ontario is illustrated in Figure 1, and with respect to local context in Figure 2.

The park is centred at 42° 17’ N latitude and 81° 52’ W longitude (UTM 428500E 4682000N NAD 83), at an approximate elevation of 176m above sea level.

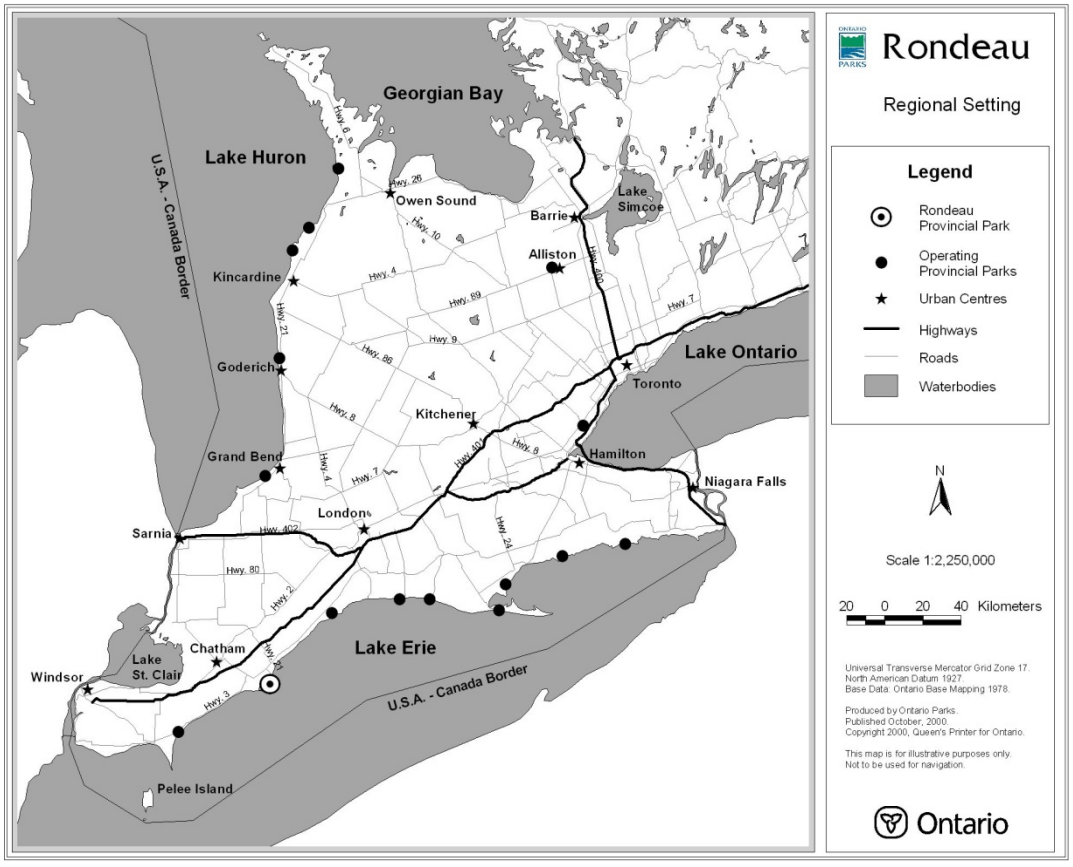

Figure 1. Regional Setting

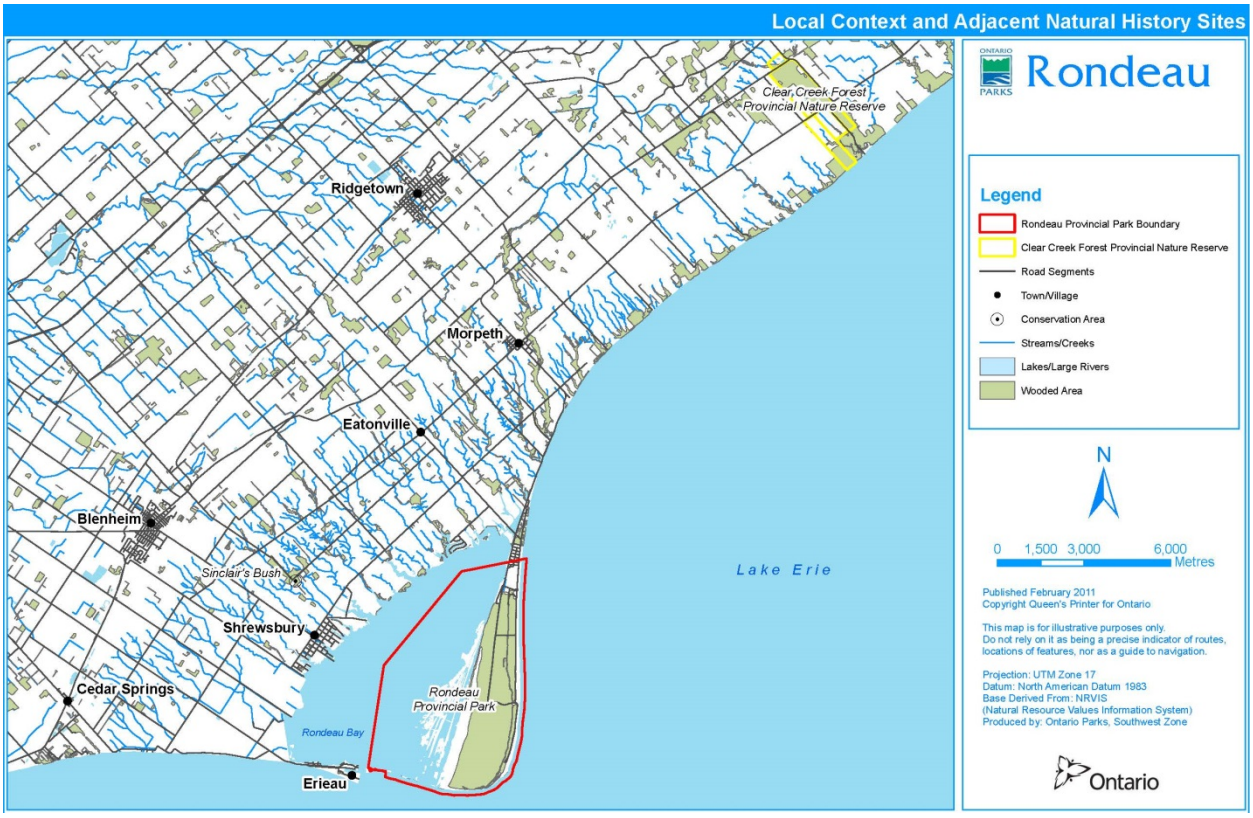

Figure 2. Rondeau Provincial Park local context and adjacent natural history sites

1.1.1 Mapping

Rondeau Provincial Park is illustrated on topographic map sheet 40-I/5 (1994, Department of Energy, Mines and Resources). Mapping is also provided on the Ontario Base Map (OBM) series, and on colour infrared (CIR) aerial photographs. OBM sheets and air photo pages for Rondeau include the following:

OBM Sheets

10 17 4300 46800

10 17 4250 46800

10 17 4250 46750

10 17 4300 46850

10 17 4300 46750

Year	Flight Line	Numbers
1995	0013	3613-3619, 3775
1994	0005	9674-9679
1995	0012	3397-3402
1994	0005	9680-9684

Digital ortho photography (2006 and 2010) is available through Land Information Ontario.

1.2 Regional Context

1.2.1 Ecozone, Ecoregion and Ecodistrict

In 1959, Angus Hills published a report entitled “A Ready Reference to the Description of the Land of Ontario and its Productivity”, which provided an ecological approach to land classification within the province. The basis of Hills’ classification was the observation that the flora and fauna of a site are dependent upon the combined effects of geology, physiography, soils (depth and type), drainage, climate, land use (disturbance) and other factors. Thus, he classified Ontario into a series of 12 Site Regions, which he defined as “areas of land within which the response of vegetation to the features of landform follows a consistent pattern”. He further indicated that “if the interrelationships between vegetation and physiographic site classes are uniform throughout the landform division, this landform unit becomes a single Site District within a site region”. Hills mapped 65 site districts, which have subsequently been revised to better fit the physiographic features, climate and vegetation patterns that he originally

intended (Hills 1961, Burger 1993, Jalava *et al*. 1997, Crins and Uhlig 2000, Crins *et al*. 2009).

The Ontario Ministry of Natural Resources has adopted Hills' classification system (with modifications), and now uses it as the basis for ecological land classification (ELC) in Ontario. To become more consistent with ELC classification used throughout the rest of Canada, we have revised our nomenclature to more closely match that used within the federal system (Crins 2002, Crins *et al*. 2009). Thus site regions are now referred to as Ecoregions and site districts as Ecodistricts. The terms do, however, remain synonymous.

Rondeau Provincial Park falls within the Mixedwood Plains Ecozone, Ecoregion 7E and the Chatham Ecodistrict 7E-1 (Figure 3). The Mixedwood Plains Ecozone occupies those areas of Ontario south of the Precambrian Shield situated on limestone and dolostone formations. Hill's (1959) described the Ecoregion as having a forest climate type of "dry-humid Great Lakes hardwoods", on a regional landform of "undulating bevelled till plains with lacustrine deposits between the ridges". He further described the Ecodistrict as "a smooth plain of moderate lime clay broken by ridges of sand and gravel". The Ecoregion has one of the mildest climates in Canada and has been classified in the Humid High Moderate Temperate Ecoclimatic Region, characterized by cool winters and long, hot, humid summers (Ecoregions Working Group 1989).

Since ecologists have long accepted Hills' premise that the physical and climatic features of a site are the dominant factors controlling the flora and fauna found there, then it becomes apparent that an understanding of these features will form the basis of a complete Life Science Inventory. Thus, sections 1.3-1.5 of this report are dedicated to providing a summary of the physical and climatic features of Rondeau Provincial Park and surrounding area.

1.2.2 Forest Region

While defining what an Ecoregion was, Hills (1959, 1961) indicated that an Ecoregion (site region) was essentially the same as a forest type region. Hills defined Ecoregions as "areas of land within which the response of vegetation to the features of landform follows a consistent pattern". In his book entitled Forest Regions of Canada, Rowe (1972) defined a forest region as "a major geographic belt or zone, characterized vegetationally by a broad uniformity both in physiognomy and in the composition of the

dominant tree species". Both authors point to a consistent or uniform vegetation pattern in their definition of a region. It is not surprising, then, that a comparison between Rowe's forest regions of Canada and Hills site regions reveals many similarities in regional boundaries. In particular, Hills Ecoregion 7E (in which Rondeau is found) is an almost perfect match for Rowe's Deciduous Forest Region.

Rowe further subdivided his Forest Regions into a series of Forest Sections on the basis of distinctive patterns of vegetation and physiography. His Deciduous Forest Region, however, is represented entirely by only one Forest Section; the Niagara Section. Consequently, the Deciduous Forest Region in Canada is essentially synonymous with the Niagara Section.

Rowe describes the Deciduous Forest Region as a small portion of the Eastern Deciduous Forest, which is widespread in the eastern United States, and extends only slightly into Canada in southwestern Ontario between lakes Huron, Erie and Ontario (Figure 4). The region is characterized by broadleaved trees typical of the Great Lakes-St. Lawrence Forest Region, mixed with a number of other broadleaved species that are more commonly found to the south in the eastern United States. These southern species have the northern limits of their range in this part of Ontario. In explaining the presence of these southern species, Rowe points to the favourable climatic conditions created by the moderating effects of the Great Lakes, and the rich soil conditions found in this part of the province.

The southern flavour of southwestern Ontario has led many authors to refer to the Deciduous Forest Region as the Carolinian Zone, based on the presence of trees similar to those found much further south in the eastern United States (i.e., North and South Carolina) (Fox and Soper 1952, 1953, 1954, Allen *et al*. 1990, Theberge 1989). Waldron (2003) outlined the use of the term "Carolinian", and indicates that it has been in use for over 100 years, but has been more widely used since Fox and Soper wrote a series of papers on the distribution of trees and shrubs in the Carolinian zone of Southern Ontario (Fox and Soper 1952, 1953 and 1954) and is now a widely used term for the region. It is within the Carolinian Zone that the highest frequencies of rare and endangered flora and fauna are found in Canada.

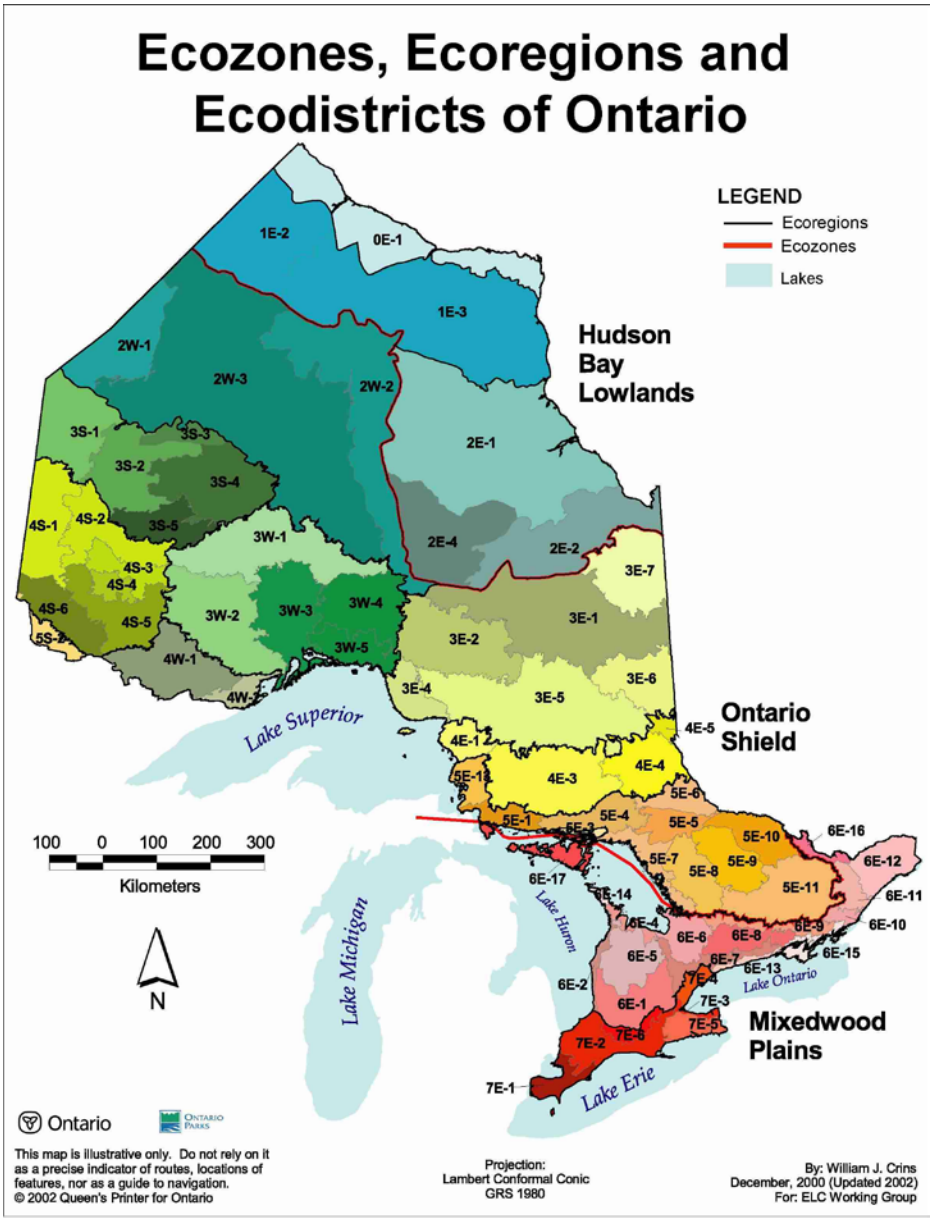

Figure 3. Ecozones, Ecoregions and Ecodistricts of Ontario. (From Crins 2002)

Trees commonly found within this region include those typical of the Great-Lakes-St. Lawrence Forest Region such as American Beech (*Fagus grandifolia*), Sugar Maple (*Acer saccharum*), Red Maple (*Acer rubrum*), Basswood (*Tilia americana*), White Ash (*Fraxinus americana*), Red Ash (*Fraxinus pennsylvanica* var. *pennyslvanica*), Red Oak (*Quercus rubra*) and White Oak (*Quercus alba*), along with a number of southern

specialists such as Sassafras (*Sassafras albidum*), Tuliptree (*Liriodendron tulipifera*), Sycamore (*Platanus occidentalis*), Black Oak (*Quercus velutina*), Red Mulberry (*Morus ruba*), Black Walnut (*Juglans nigra*) and various hickories (*Carya* sp.). Conifers in this region are less common and tend to be restricted to small stands of Eastern White Pine (*Pinus strobus*) and scattered Eastern Red Cedar (*Juniperus virginiana*) (Rowe 1972).

The similarity of this zone to more southern areas does not end with the trees. A number of typically southern fauna are found in this region including the Virginia Opossum (*Didelphis virginiana*), Gray Fox (*Urocyon cinereoargenteus*), Carolina Wren (*Thryothorus ludovicianus*), Tufted Titmouse (*Baeolophus bicolour*), Acadian Flycatcher (*Empidonax virescens*), Prothontary Warbler (*Protontaria citrea*) and others (Cadman *et al*. 1987, Dobbyn 1994).

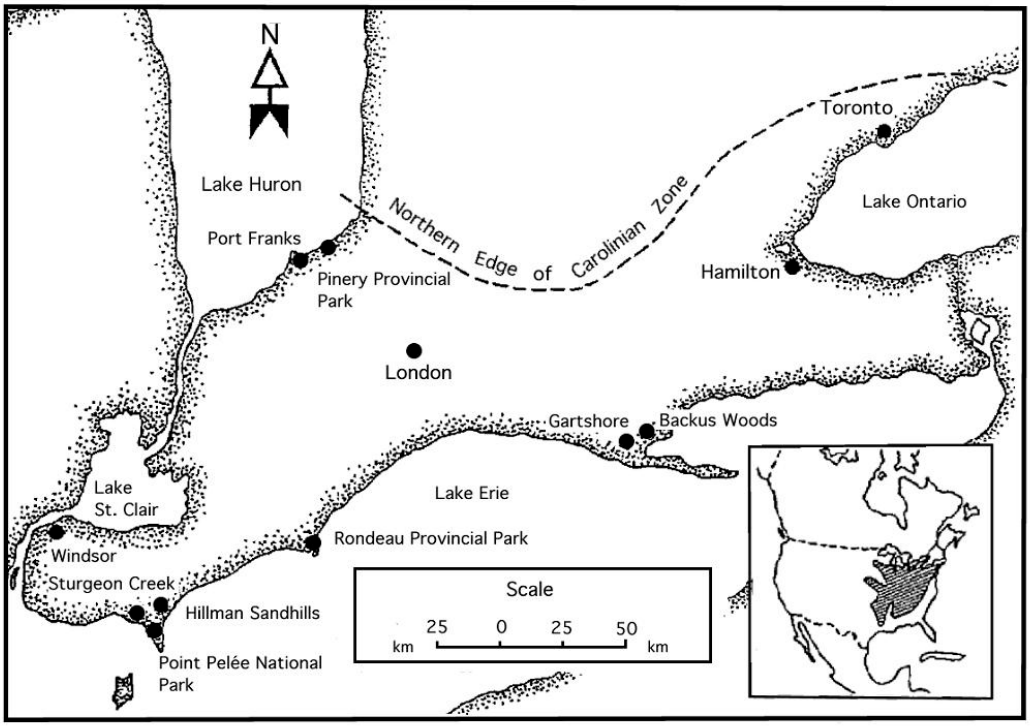

Figure 4. The Deciduous Forest Region or Carolinian Zone in Ontario.

1.2.3 Adjacent Land Use and Summary of Regional Natural History Features

The lands of southwestern Ontario, including those surrounding Rondeau, have some of the richest soils in the province. That, combined with the warm climate and long growing season, has resulted in this area being one of the most intensively agricultural parts of the province. As much as 90% of the watershed around Rondeau Bay is used for agriculture and related industries. Some of the lands to the west of Rondeau Bay have even been re-claimed from the bay itself, and a series of dykes and pumps are required to keep the land from being re-flooded (J.E. Hannah and Associates 1984).

Other land uses in the surrounding area include a marina and fishing port at Erieau, and residential and seasonal homes and cottages along parts of the Rondeau Bay and Lake Erie shorelines.

The intense agricultural resource base of Chatham-Kent has resulted in intensive clearing of forests and conversion of land to agriculture. The amount of forest cover in the municipality is one of the lowest in the province, and has been estimated at less than 4% (Rondeau Watershed Coalition 2004, Stewardship Kent 2004). Although most of the local area has been cleared for agriculture, a few small wooded areas remain. Two of these, Clear Creek Forest and Sinclair's Bush, are significant parcels due to their size and the biological diversity that remains within them.

Clear Creek Forest is a 403 ha property located at the far eastern end of the municipality of Chatham-Kent, approximately 20 km northeast of Rondeau. The property was purchased by the Nature Conservancy of Canada and leased to Ontario Parks to be managed as a Provincial Nature Reserve. Clear Creek is significant as a regional natural history feature as it is one of the largest remaining tracts of mature forest in the municipality (after Rondeau itself), and is the largest woodland in the provincially significant Kent-Elgin Shoreline Life Science Area of Natural and Scientific Interest (ANSI). The location of Clear Creek Forest is illustrated in Figure 2 (OMNR 2002).

Sinclair's Bush is a small, 50 ha site, located approximately 8 km northwest of Rondeau Provincial Park. The site is predominantly comprised of an upland woods on a clay plain, and supports several community types including upland woods, lowland woods, marshy ponds and a creek community. A total of 244 vascular plants have been found on the site including a number of typically Carolinian species (Allen 1988, NHIC 2004).

The significance of the site led to its designation as a Life Sciences ANSI in 1984. Most of Sinclair's Bush is held in private ownership; however, the Lower Thames Conservation Authority acquired a 1.6 ha parcel of the forest in 1987 (LTVCA 2004). The location of Sinclair's Bush is illustrated in Figure 2.

Rondeau Provincial Park, Rondeau Bay and the surrounding agricultural areas are known world-wide as a significant stop-over site for migrating birds and as a significant breeding area for a number of threatened and endangered bird species (see section 5.2). In recognition of this, BirdLife International designated the Greater Rondeau Important Bird Area (IBA) as a globally significant IBA. The IBA Program is an international initiative coordinated by BirdLife International, a partnership of member-based organizations in over 100 countries seeking to identify and conserve sites important to bird species world-wide. In Canada, Bird Studies Canada and the Canadian Nature Federation are the BirdLife partners, and the IBA program is coordinated by Ontario Nature (formerly known as the Federation of Ontario Naturalists) (Cheskey and Wilson 2001).

The Greater Rondeau Important Bird Area was established for its overall significance as a site for migrating and breeding birds; however, the following species were of particular significance:

Congregatory Species: (significant numbers during migration)	**Resident Breeding Species**: (breed in the park)
Tundra Swan (*Cygnus columbianus*)	Prothonotary Warbler (*Protonotaria citrea*)
Greater Scaup (*Aythya marila*)	Acadian Flycatcher (*Empidonax virescens*)
Black-bellied Plover (*Pluvialis squatarola*)	Red-headed Woodpecker (*Melanerpes erthrocephalus*)
American Golden-Plover (*Pluvialis dominica*)	Cerulean Warbler (*Setophaga cerulea*)
Whimbrel (*Numenius phaeopus*)	King Rail (*Rallus elegans*)
	Least Bittern (*Ixobrychus exilis*)
	Forster's Tern (*Sterna forsteri*)

The IBA encompasses an area of just over 14000 ha, of which Rondeau Provincial Park comprises about 23%. The boundary extends from Erie Beach, along Bisnett Line to Fargo Road, extending the length of New Scotland Line to where it intersects with Rose Beach Line southeast of Morpeth. On the lake the boundary extends 2 km offshore from the mainland and Rondeau Peninsula. Figure 5 illustrates the boundary of the Greater Rondeau IBA.

A conservation plan for the IBA has been written that provides a series of goals, objectives and strategies to protect and enhance the IBA for bird conservation. The plan was written to support the vision statement that was created by the IBA working group, that vision being: ”The Greater Rondeau Important Bird Area will promote conservation and stewardship to protect its global and national significance for breeding, wintering, and migratory birds, as a place where birds can be monitored, studied and enjoyed for the ecological, educational, economic and recreational benefits of the people of Ontario and beyond.” (Cheskey and Wilson 2001).

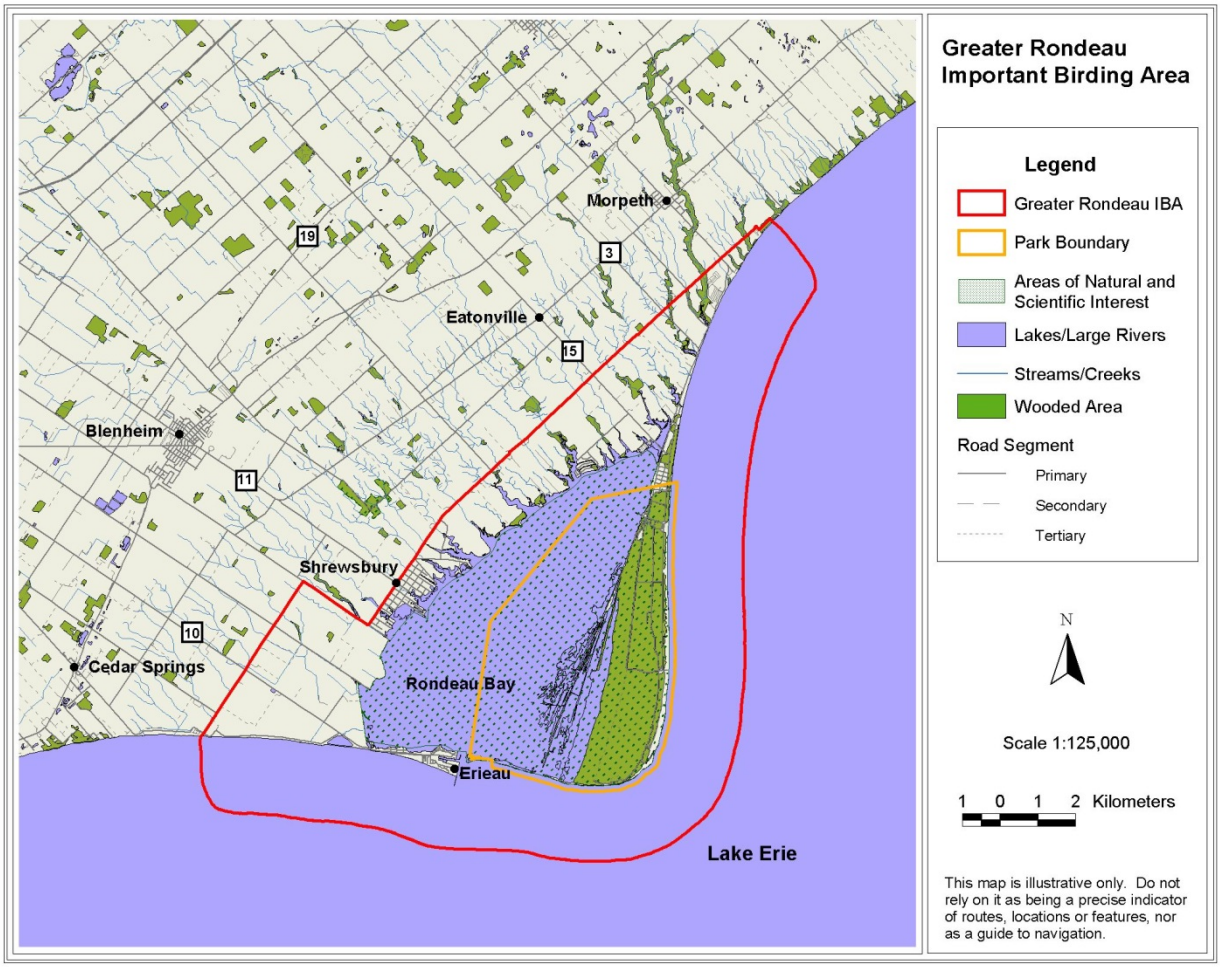

Figure 5. The Greater Rondeau Important Bird Area

1.3 Geology, Physiography and Soils

1.3.1 Bedrock

In southwestern Ontario the ancient Precambrian bedrock is overlain by deep layers of softer, sedimentary limestones, shales, and sandstones. These sedimentary rocks originated as marine sediments of marl, clay and sand that accumulated to great depths, indicating a long period of inundation. Over time and under the intense weight of overlying material, these sediments became cemented to form solid rock (Chapman and Putnam 1984). The sedimentary rocks in this part of southwestern Ontario were formed during the Upper Devonian period of the Paleozoic era, and became part of the Kettle

Point Formation, which extends from Lake Erie to Lake St. Clair and Lake Huron (Warren 1974, Chapman and Putnam 1984). The sedimentary rocks in the Kettle Point Formation are described as a dark brown to black bituminous shale with occasional interbeds of green shale (Warren 1974). The bedrock is not exposed at Rondeau, being buried under deep layers of surficial deposits.

1.3.2 Surficial Geology and Physiography

Southern Ontario experienced many periods of glaciation during the last two million years. The most recent of these is known as the Wisconsinan, which was responsible for depositing the surficial materials and shaping the landforms that exist today (Warren 1974, Chapman and Putnam 1984).

During the last retreat of the Wisconsinan glaciers, ice from two main lobes advanced and retreated several times over the local area. One of these, the Ontario-Erie lobe, advanced southwest through the Ontario and Erie basins. The second lobe, the Huron Lobe, advanced from the north from the Lake Huron basin. The two lobes met along a line joining London, Blenheim, Leamington and Detroit. The final retreat of these two lobes resulted in a small interlobate moraine, known as the Blenheim Moraine. This moraine is approximately 10 km wide at its widest point, and extends from Blenheim to Muirkirk in the east. To the west of Blenheim, the moraine is less pronounced and is seen as a broad gravel bar which extends south through Cedar Springs to Lake Erie. During the final retreat of these lobes, much of southern Ontario was inundated by a series of extensive glacial lakes, including Lakes Maumee, Whittlesey and Warren.

The majority of the surficial deposits that exist in the area immediately north of the park today were laid down by these glacial lobes and during the flooding that occurred as they retreated. The Ontario-Erie lobe deposited a layer of heterogeneous till that the ice dug out of the Lake Erie basin. The thick layer of clay that overlays the till originated as glaciolacustrine deposits from the glacial lakes, particularly Lakes Whittlesey and Warren, and from the erosion and deposition of material from the Blenheim Moraine. The result was the large clay plain that we see to the north of the park today.

During the years of Lakes Whittlesey and Warren, water did not drain out of the St. Lawrence as it does today because ice continued to dam that route. Instead, water drained south through the Mississippi Valley. Approximately 12 000 years before present the ice in the eastern end of Lake Erie retreated, and a new outlet was opened

near present day Buffalo. This caused rapid draining of the Lake Erie basin, and water levels fell to 20-30 m below current levels. Over time, however, the land around Buffalo rose as a result of isostatic rebound, and the lake levels rose with it. Between 9000 and 10 000 years ago Lake Erie reached its current level (Warren 1974, Chapman and Putnam 1984). At that time, a visitor to southwestern Ontario would not have recognized the Rondeau peninsula because the shoreline of Lake Erie looked nothing like it does today.

1.3.3 The Formation of Pointe aux Pins

The Rondeau Peninsula or “Pointe aux Pins”, is one of four large sandspits on the shore of Lake Erie, along with Point Pelee and Long Point on the north shore and Presque Isle on the southern shore at Erie, Pennsylvania (Coakley 1989, McKeating 1989). Pointe aux Pins is an asymmetrical, triangular-shaped cuspate foreland or sandspit, composed of two sandbars that converge to create the “cusp” which points away from the Lake Erie shoreline. The main part of the foreland is formed by a series of north-south sandbars that extend approximately 10 km out into Lake Erie, and varies from 0.4 km wide in the north to 4 km wide at the southern end. The second sandbar complex extends in an east-west direction, approximately 5 km from the mainland to intersect the main part of the peninsula. The town of Erieau occupies the first 3-4 km of this bar, followed by a cut which provides access to Rondeau Bay from Lake Erie (see figures 4 and 5) (Wood 1951, Warren 1974, Haggith 1982, Coakley 1989, McKeating 1989).

The Erie sandspits are all situated at the intersection of cross-lake glacial moraines. The three moraines trend roughly north-south and divide Lake Erie into four basins (Figure 6). They were formed as recessional moraines during the retreat of the Ontario-Erie ice lobe, when the ice front had paused for a period of time. The moraine situated adjacent to Rondeau is known as the Erieau Moraine and was important in the formation of the present day peninsula. Coakley (1989) also suggests that during the time that the moraine was being formed, streams draining the glacier and the areas to the north would have flowed along the ice margin and deposited large quantities of sand as deltas at the northern end of the moraine. This material would eventually contribute to the formation of the peninsula.

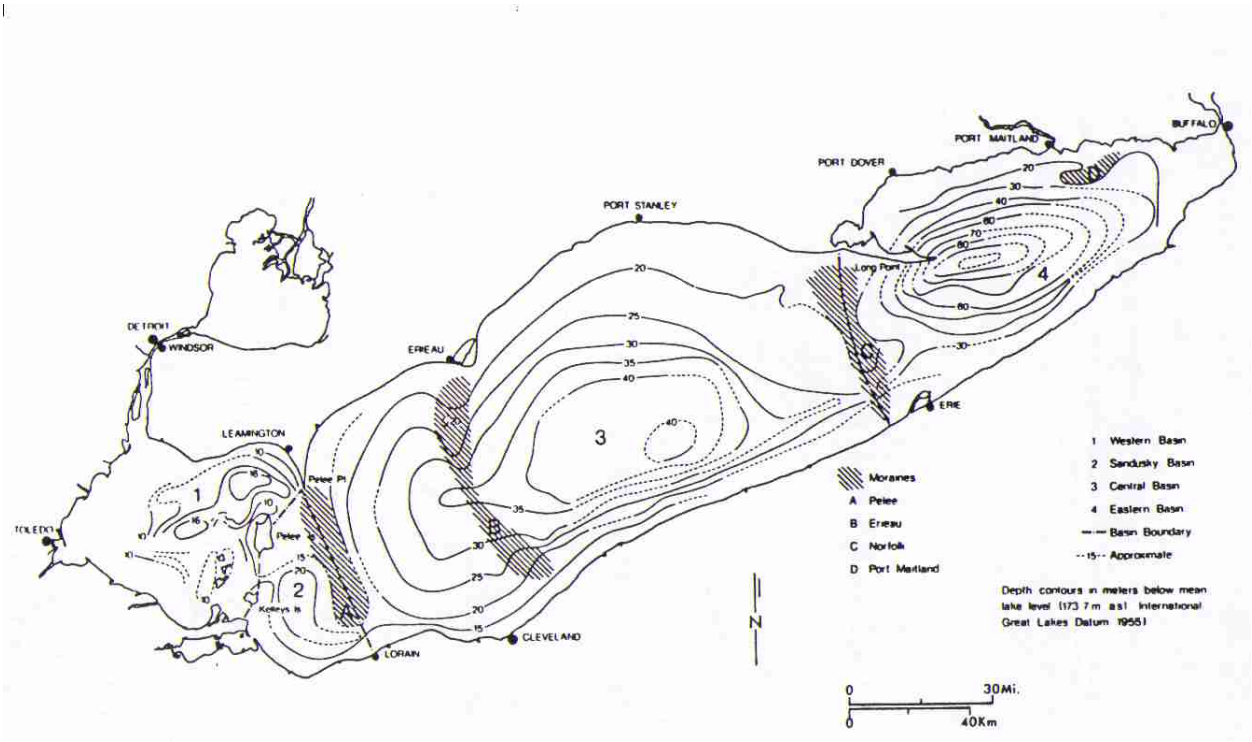

Figure 6. The cross-lake moraines of Lake Erie. From Sly, P.G. 1976. © Canadian Science Publishing or its licensors.

There are two predominant theories that describe the formation of the Rondeau Peninsula. In both theories the Erieau Moraine played a key role, along with the erosion, transportation and deposition of sand and fine gravel by currents, waves and wind. The theories differ in that one assumes that there was a pre-existing ancestral peninsula (Coakley 1989), while the other assumes that the current-day peninsula was built from scratch (Wood 1951, Warren 1974).

Wood (1951) and later Warren (1974) both explained the formation of the peninsula as a product of convergent lake currents and wave action. Currents and wave action from the east eroded the bluffs that are found to the east of the park, and carried sand and fine gravel westward along the shore. The material was moved along the shore until the force of the waves and currents decreased to the point where deposition occurred. This would happen where there was a change in the structure of the bottom of the lake or where the shoreline would divert and slow the currents. Wood (1951) theorized that this occurred due to the presence of a large rounded bay in this part of Lake Erie. Waves

and currents coming from the east would be deflected by the western portion of the bay, resulting in deposition and the formation of a north-south sandbar.

Warren (1974) pointed to the Erieau Moraine as an explanation as to why the peninsula was formed where it was. He theorized that the moraine would have deflected and slowed longshore currents and wave action from the east. This would have resulted in the deposition of long sand bars perpendicular to the dominant wave action from the east. Figure 7 illustrates how convergent lake currents could have constructed the Rondeau peninsula.

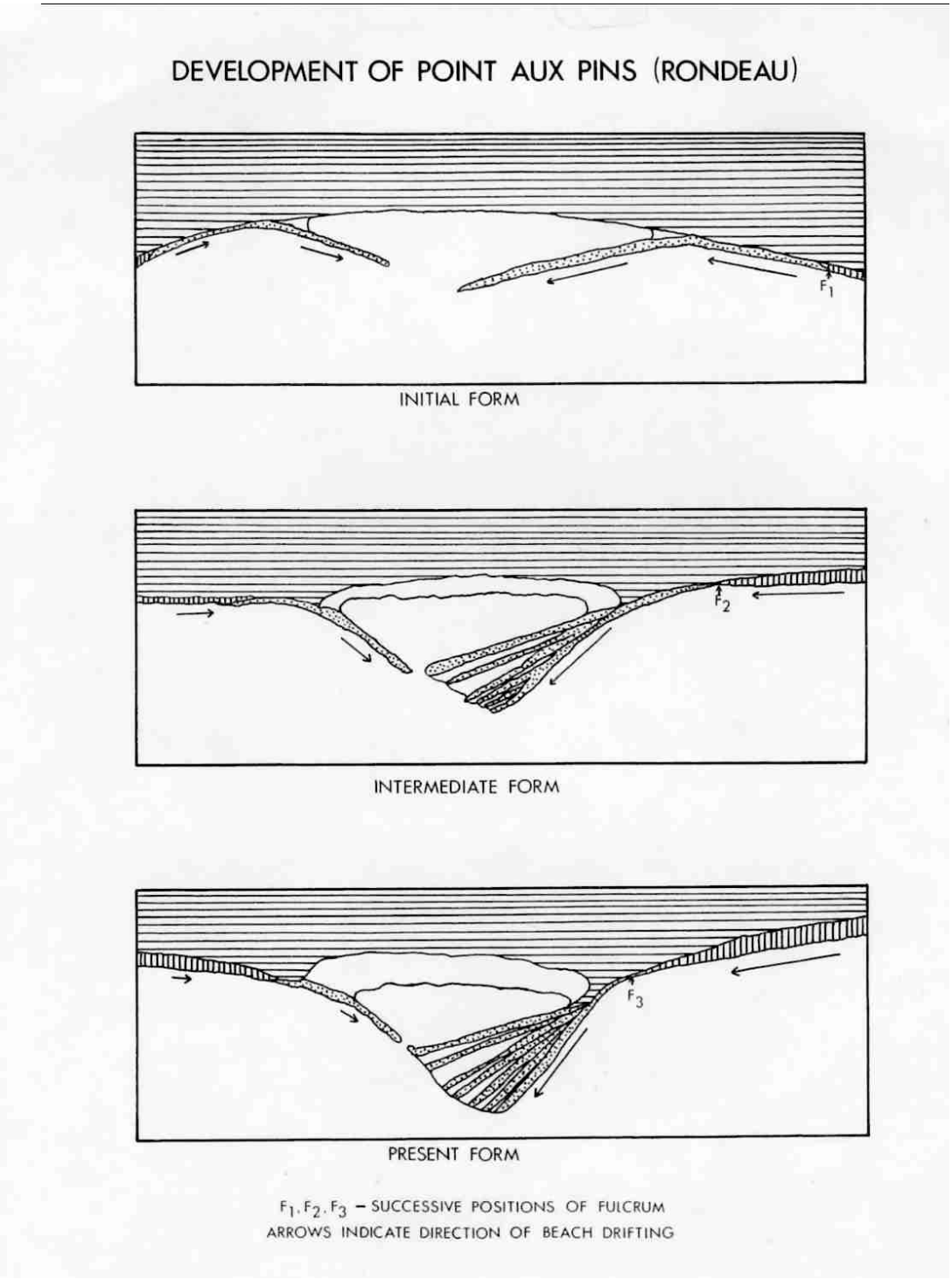

Figure 7. Development of the Rondeau Peninsula by convergent lake currents (From Wood 1951)

No matter which force initiated the process, the formation of the first sand bars marked the beginning of the peninsula. Sand and gravel continued to be deposited in a series of long submerged bars. During storm events from the east, large waves would drive the sand shoreward, piling it up until the sand bars broke the surface and formed new shoreline.

After the storm, as the sand dried out, some of it was blown landward forming a long, low shore dune. New submarine bars were created off of the new shoreline and the process continued, adding shoreline to the east in a series of dune ridges and troughs. Average lake levels continued to rise slowly over the years, resulting in lower ridges in the west and higher ridges in the east. Some of the first ridges in the west are now submerged under Rondeau Bay (McKeating 1989).

At the same time that the north-south bars were being created, currents and the predominating wind from the southwest eroded the bluffs to the west of Rondeau and transported sand easterly. These materials were deposited in a sand bar extending eastward from the shoreline that eventually met the main peninsula and enclosed the current day Rondeau Bay. The reason for the much smaller amount of deposition from the Erieau side is the result of a lower amount of source material coming from the west. Warren (1974) indicated that eight times as much material is supplied from the east of the park as is contributed from the west. Mann (1978) also theorized that more material would be available from the east, where extensive sand plains are found up to the shore of Lake Erie (such as the Norfolk Sand Plain), than from the west where surficial deposits are primarily clay (see Chapman and Putnam 1984). As well, the predominant wave direction at Rondeau is from the east, which is the direction of maximum fetch. Historical notes indicate that prior to the construction of the Erieau piers, the south beach bar was a low, narrow bar, with one or more openings that shifted continuously (Mann 1978).

The other major theory explaining the formation of the Rondeau Peninsula came from Coakley (1989). He utilized stratigraphic information taken from boreholes, the distribution of near shore sediments, surface geomorphology, radio-carbon dating and previously published interpretations of Lake Erie water levels to develop his model of how the Rondeau Peninsula was formed. His theory suggests that the Rondeau Peninsula formed from a pre-existing promontory which existed as an artefact of the intersection of the Erieau Moraine and the original lake shoreline. He suggests that after

Lake Erie began to drain to the east through Buffalo, and lake levels dropped to 20-30 m below current levels, that the Erieau Moraine formed a promontory where the foreland extended out into the lake some 20 km further than it does now. At that time the shoreline of Lake Erie would have been much further south.

As water levels increased as a result of isostatic rebound, currents and waves eroded this foreland. As water levels began to stabilize, these materials were laid down along the sides of the remaining foreland, leading to the formation of beach ridges and dune fields (in the same manner as the Wood/Warren theory). The result would have been an asymmetrical cuspate foreland shaped more like a boomerang than the current triangular shape. The peninsula was also still much larger than present day size. Approximately 4000 years ago, however, lake levels rose to about 5 m above current levels, drowning out most of the peninsula. At this time, much of the sand that formed the peninsula would have dispersed into the adjacent lake, forming an extensive sand-covered shelf. By 3500 years before present, lake levels returned to present day levels and the deposition of sand bars and dunes began once again. Dominant wave action from the east continued to build successive ridges to the east. Since insufficient sediments come from the west, however, the southern shore of the point continued to recede to the north. Eventually the shape of the Rondeau peninsula resulted. Figure 8 illustrates Coakley's theory of how the Rondeau peninsula could have formed.

Although these theories differ in the original shape of the Lake Erie shoreline, both point to sand deposition as one of the primary forces that determined the final shape of the peninsula and resulted in the ridge and slough (trough) topography (Figure 9). No matter which theory is correct, the Rondeau peninsula is a fascinating and unique land formation which led Warren (1974) to conclude that the Rondeau peninsula is "one of the largest and best quality examples of a shoreline depositional feature on the Great Lakes and probably one of the best freshwater cuspate forelands in the World".

The age of the Rondeau peninsula has been under considerable debate for many years. More recently, however, radiocarbon dating of peat deposits found under the north end of the peninsula, and better information on the history of water levels in Lake Erie, indicate that the modern peninsula is approximately 3500 years old (Coakley 1989).

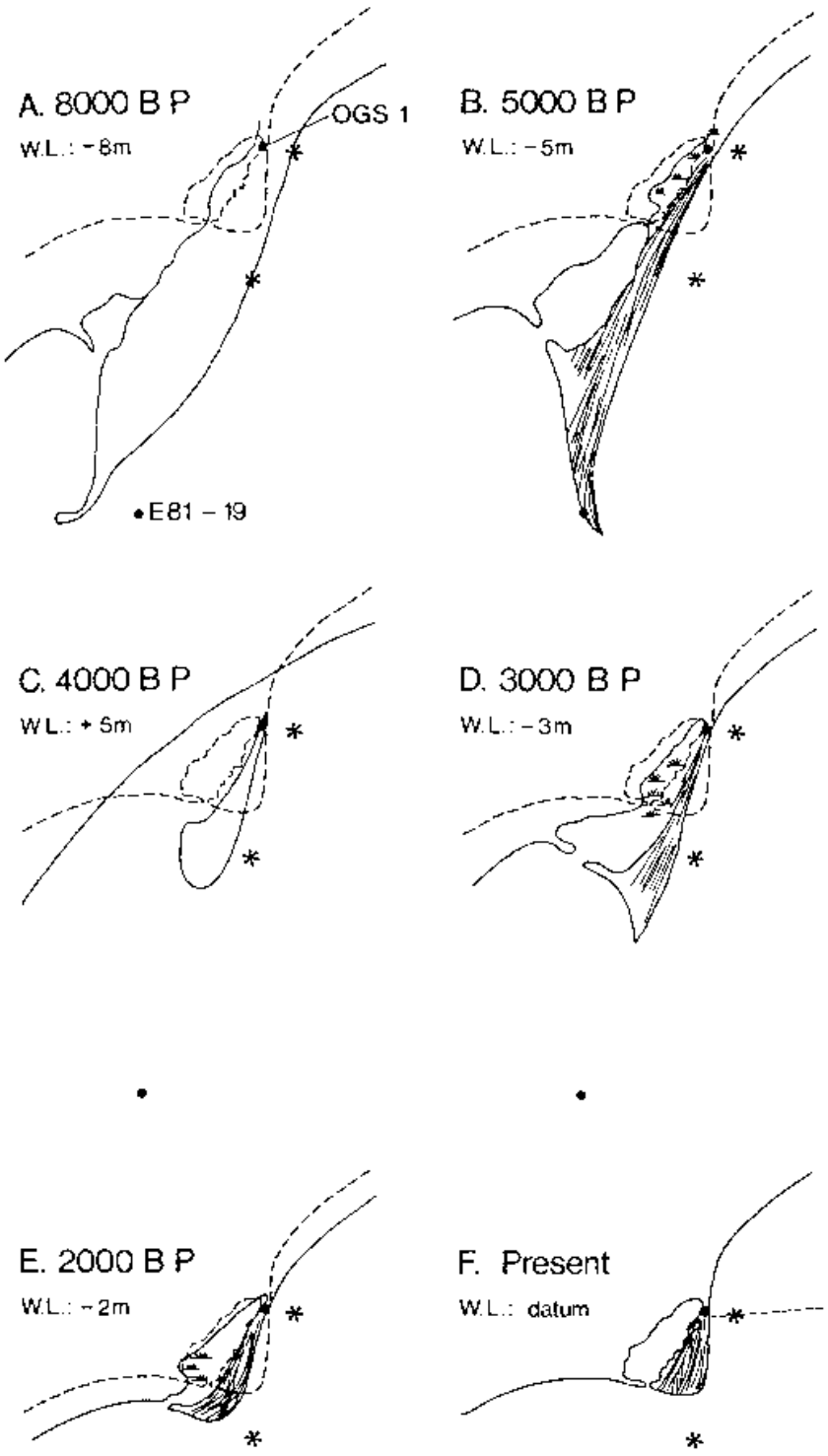

Figure 8. The formation of the Rondeau peninsula according to Coakley

Figure 9. The ridge and slough formation of the Rondeau peninsula

1.3.4 Erosion of Rondeau's South Beach

The dynamic nature of the Rondeau peninsula means that the processes of erosion and deposition that created it will continue on in perpetuity, continuously re-shaping the peninsula (Crysler and Lathem 1975). This is quite evident and can be observed along the peninsula's east beach which is constantly changing shape and gradually growing further out into Lake Erie. Historical notes indicate that south beach, in particular, was continuously shifting, with inlets to the bay opening and closing at various locations along the sand bar. Between 1844 and 1848, however, the original Erieau piers were built and other openings to the bay closed (Mann 1978).

Since that time, erosion of south beach has tended to exceed deposition, and the beach has receded to the north. In his 1928 report on the forest of Rondeau, Ralph Carmen noted that "wave action appears to be wearing away a portion of the sand and gravel at the south end of the park. There are quite a number of trees down, and although the trunks have been removed, the roots and stumps are evidence of the wave action on the trees". Carmen suggested that erosion be monitored on south beach. Since that time, several authors have pointed to the problem of erosion on south beach, but it was not until the 1970's that a comprehensive erosion study was completed by Crysler and Lathem (Wood 1951, Voute 1967, Crysler and Lathem 1973, 1974, 1975).

Prior to the Crysler and Lathem study, at least two authors tried to estimate the rate of erosion on south beach. Wood (1951) estimated that "within the past 96 years the shore has retreated 700 feet, an average annual recession of over 7 feet" (2.1m). Davidson (referenced in W.E. Coates and Associates Ltd. 1977) estimated that south beach had receded 394 m during the first 122 years since establishment of the Erieau piers, an average of 3.2 m per year.

In 1975, Crysler and Lathem utilized aerial photographs to more accurately measure the rate of erosion, and the results were quite disturbing. They found that south beach had retreated approximately 660 feet (200 m) between 1942 and 1972, or an average of almost 7 m per year. They noted, however, that erosion was not constant, and that storm events from the west, southwest or south tended to result in significant levels of erosion in single events. For example, in 1972, they documented the erosion of 30 m of shoreline during a single storm event. Lake levels also play a role, with a higher rate of erosion during years of high water levels. Crysler and Lathem also pointed to the presence of large trees and woody vegetation on the sand bar as an indication that the

beach used to be much wider. Typically, trees and woody vegetation in a dune community establish themselves on a secondary dune which is protected from natural forces by a primary or frontal dune.

Although the entire south shoreline is retreating to the north, the effect seems to be most significant at the west end of the beach, immediately east of the Erieau piers. This has resulted in a hooked pattern to south beach, with the east end of the peninsula remaining slightly further to the south while the west end of the beach is progressing north at a faster rate.

The consensus of most authors is that the Erieau piers are the primary cause of the erosion of south beach (Wood 1951, Voute 1967, Crysler and Lathem 1975, Mann 1978). Historically, an equilibrium existed between the normal deposition forces of waves and currents from the west, and erosion during storm events from the west or south. Erosion tended to occur during the fall and spring with deposition occurring during the summer. This equilibrium no longer exists (Mann 1978). Human activities such as cottaging, farming and, most significantly, the development of the Erieau piers on the shoreline west of Rondeau have impeded or reduced sediment movement from the west, meaning that insufficient quantities of sand and gravel are being transported to south beach to replace the sand that is being eroded and washed away (Crysler and Lathem 1975, Mann 1978). The halting of littoral drift can be seen in the large quantities of sand that have been deposited on the west side of the Erieau piers, and the gradually increasing size of the Erieau beach (Wood 1951).

The results of erosion on the Rondeau Peninsula are evident. Large trees are being washed into the lake, South Point Trail has been washed out several times requiring relocation further inland and buildings have been lost from the point. There has been a gradual northward migration of the south boundary of the peninsula, cutting off the ends of the ridges and opening the sloughs to the lake during high winds. During years of high water levels fish have been observed in the sloughs, often throughout much of the park.

Although a number of reports recommended constructive measures to reduce the rate of erosion, the only efforts that were ever instigated were in 1934 when concrete crosses were placed in a breakwater pattern along several thousand feet of shoreline. These proved ineffective in reducing erosion and retreat of the shoreline continued

(Mann 1978). The extensive report by Crysler and Lathem (1975) provided numerous structural and mechanical methods to stabilize the Rondeau shoreline, but none of these were ever implemented. In fact, the Rondeau Provincial Park Advisory Committee, that was established to provide recommendations during the Master Planning process in the 1970's, stated that although they were aware that the erosion problem existed, they recommended that the natural processes of erosion and deposition should be allowed to continue and that any attempts to control erosion should only be considered after biological and environmental impacts have been thoroughly investigated (Rondeau Provincial Park Advisory Committee 1975).

Crysler and Lathem (1975) concluded that unless something was done to mitigate the rate of erosion, south beach would eventually disappear altogether, opening the bay and extensive wetland to the full force of lake Erie and causing significant change to the Park. Thus far, this has not occurred, although south beach has continued to retreat northward and significant portions of South Point have been lost.

Most studies have focused on erosion at the south end of the park, however, Wood (1951) noted that erosion was also occurring at the north end of the park. He theorized that unless corrective action was taken, the lake would eventually wear its way through and Rondeau would become an island. This also has not materialized and despite the erosive activity in the south and north, the eastern part of the point has been growing at an increasing rate of speed.

1.3.5 Overlying Soils

According to the soil maps for Kent County (Wilson *et al*. 1996), the soils of Rondeau all fall into one of three types. The extensive wetland complex on the west side of the Rondeau peninsula is composed of Marshland Type soils which are characterized by very poor natural drainage and a variable surface texture with a mostly level surface topography. The remainder of the park is composed of predominantly Fox Type soils with a significant component of Granby soils.

The Fox soils are composed of deep, coarse-textured lacustrine material of predominantly medium sand. Surface material is frequently modified by wind. Natural drainage is fast and the main surface texture is sandy loam, loamy sand and sand. Fox soils are present throughout the park on the ridges where the surface is nearly level, with a gently undulating topography of mainly short, irregular slopes that range between

1 and 5%. These soils are weakly to moderately calcareous, which indicates the presence of carbonates in the surface layer. The Granby soils are also composed of deep, coarse-textured lacustrine material of predominantly medium sand in which the surface layer is slightly calcareous. Unlike the Fox soils, however, Granby soils have poor drainage and are usually associated with the nearly level topography of low lying areas (sloughs) where the slopes are less than 2%. The main surface texture of this soil type is sandy loam and loamy sand. A series of boreholes drilled in 1974 indicates that the depth of these soils is extensive, exceeding 30 m in depth throughout the majority of the park. The only exception was found in a borehole drilled at the far north end of the park where a layer of peat was found at approximately 9 m, followed by a layer of clay at 10 or 11 m below ground level (William Trow Associates Ltd. 1974).

In general, the pH of the soil changes as you move from east to west, from alkaline in the beach-dune areas, to slightly acidic under the pine-oak forest, highly alkaline (pH=8.5) in the hardwood forest and moderately alkaline in the marsh. The organic richness of the soils also increases from east to west (Mann 1978). Although the accumulation of organic materials in the wet depressions of the park is continuing, the relatively recent origin of the park formation (3500 years) is the major factor in a notable absence of organic soils. The lack of significant soil profile development on the drier sand ridges is also a result of the relatively young age of the peninsula. The sandy soils beneath the leaf litter have very weak horizon development in the wooded areas and there is minimal textural and colour variation in the subsurface soil layer of these areas (Ecological Services for Planning 1975).

The lands to the north of the Park and adjacent to Rondeau Bay are significantly different from the soils in the park. These are composed largely of Beverly Type soils, which are deep, fine to very fine textured lacustrine material containing less than 60% clay, occasionally with layers of medium textured material. Drainage in these areas is imperfect and the soil texture is a silty clay loam. In some instances, these soils are capped with 15-40 cm of medium textured material or even 40-100 cm of medium textured material (Tavistock Type). A portion of the agricultural land on the south-west side of Rondeau Bay is composed of Organic Type soils, which were originally wetland areas with 40 cm or more of organic material that were drained for agriculture purposes (Wilson *et al*. 1996).

1.4 Hydrology

Due to the lack of topographical relief within the Park, the rapid drainage of the soils and the low height of land above the lake, hydrological features within the park are almost non-existent. Runoff of precipitation is primarily by percolation directly through the sandy soils and there are no natural flowing streams within the park. During heavy rainstorms water will run off the sides of the ridges into the adjoining sloughs, although the length of runoff in these instances would not generally exceed 10 m. The low elevation of the land mass prevents drainage to the lake and has resulted in a high water table which consequently restricts the rooting depth of vegetation and limits the anchoring ability of larger trees (W.E. Coates and Associates Ltd. 1977).

Some of the larger sloughs remain inundated with water year-round, while others tend to dry up by mid-summer. Generally the sloughs to the west are deeper and remain inundated longer into the season or even year-round; however, there are a few larger sloughs on the south-east side that also remain flooded year-round (W.E. Coates and Associates Ltd. 1977, Dobbyn Pers. Obs.). Water levels in a few of the interior sloughs can be up to a foot higher than lake level, which may be attributed to sealing of the bottom of the slough by organic litter accumulation and shading of the water surface by the adjacent forest (W.E. Coates and Associates Ltd. 1977).

Water depths in the sloughs are likely controlled by a number of factors including current lake level, the amount of snow during the previous winter, recent precipitation and season. Generally, the sloughs become recharged during the winter, increase in depth during the spring rains, and then drop in level during the summer, but levels do fluctuate significantly throughout the year (S. Dobbyn, pers. obs.). Spring water levels in the sloughs can range from a few cm (or even just saturated ground) to between 15-45 cm in the eastern sloughs, to 1 m or more in depth in some of the deeper sloughs on the west side of the park. The deeper sloughs are generally found on the west side of the Park and correspond to the lower ridges that were formed when lake levels were lower (McKeating 1989).

1.5 Climate

Rondeau Provincial Park is found in the extreme southwestern part of the province on the shore of Lake Erie, in what many consider to be Ontario's "banana belt". This label seems appropriate when you consider that Kent and Essex counties have the warmest temperatures and longest growing seasons in the province. The growing season extends from early April until mid-November, with a mean annual length of 217 to 243 days. The mean annual frost-free period is 165 days (Brown *et al*. 1968).

The warm temperatures and long growing season that are typical of southwestern Ontario are a result of the southern locality and the moderating effects of the Great Lakes. The lake moderates the climate by increasing cloud cover and precipitation, and moderating the temperature. During the summer, Lake Erie acts as a heat source at night, keeping temperatures over adjacent inland areas warmer, while providing a cooling effect during the day. During the winter, the water in Lake Erie is warmer than the adjacent land, increasing air temperatures. The closer that a location is to the shoreline, the more pronounced the effect, particularly for a peninsula like Rondeau that is surrounded by water (Brown *et al*. 1968, Mann 1978, Haggith 1982).

Daily weather data have not been recorded at the park consistently over the years, and thus, we have to rely on data from other near-by stations. Although there is a weather station at Erieau, it does not provide data for all weather variables. The Ridgetown weather station (13 km to the north) has been running for over thirty years, and Environment Canada has compiled Climate Normals or averages for that station (Environment Canada 2004).

Data from the Ridgetown station indicate that the daily annual mean temperature at Ridgetown is 8.5° C, with an annual mean daily maximum of 12.8° and an annual mean daily minimum of 4.1°. The July daily mean is 21.5° and the January daily mean is -6.0°. Annual precipitation averages 969 mm with 117 mm of snow. Tables 1 and 2 provide a summary of the average monthly temperature and precipitation data for Ridgetown from 1971 to 2000 (Environment Canada 2004).

A comparison of temperature data between the Ridgetown and Erieau stations was done to determine how significant the moderating effect of Lake Erie is on the park's climate. Erieau is located immediately to the west of Rondeau on a narrow spit of land between Lake Erie and Rondeau Bay and is more representative of the conditions at

Rondeau. The analysis revealed that the lake does have a significant moderating effect on the temperature at Rondeau (Table 3). It indicates that the daily mean temperature at Rondeau is 0.6° C cooler in the summer and 0.8° warmer in the winter than Ridgetown. The effect was more pronounced during the summer with the summer daily maximum being 3.7° cooler at Rondeau, and the daily minimum (generally night time temperature) being 2.6° warmer.

Precipitation is distributed evenly throughout the year with no pronounced wet or dry season. Most of the summer rainfall results from showers and short thunderstorms (Haggith 1982). Rain occurs in significant quantities in all months of the year and snow cover tends not to be constant during the winter months (Environment Canada 2004).

The prevailing winds in southern Ontario are westerly, blowing from the west, northwest or southwest directions over 50% of the time. In the Rondeau area, the southwest winds predominate year-round and are generally light in the summer and strongest during the spring and winter months (Brown *et al*. 1968).

Rondeau is susceptible to severe storms because of its exposed location in Lake Erie and because of its flat terrain. Large storm events with high winds and rain have caused significant damage to the forest and extensive windthrow of trees (see 3.3.6) (W.E. Coates and Associates Ltd. 1977, Larson and Waldron 2000).

Hills (1959) notes that “Southern Ontario is an area of variable weather lying in the path of at least three main storm tracks. The weather of much of Southern Ontario is influenced by both the continental-tropical and continental-polar air masses. The continental-polar mass is dominant everywhere in Ontario, except in the extreme south.”

Table 1. Monthly temperature values for Ridgetown (in degrees Celsius). (From Environment Canada 2004. Canadian Climate Normals 1971-2000 for Ridgetown Ontario)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Mean	-6.0	-4.6	0.7	7.1	13.6	18.8	21.5	20.6	16.8	10.6	4.5	-1.9	8.5
Daily Maximum	-2.5	-1.0	4.5	11.9	18.9	23.9	26.8	25.5	21.6	14.8	8.0	1.4	12.8
Daily Minimum	-9.5	-8.2	-3.1	2.2	8.3	13.5	16.2	15.6	12.0	6.3	1.0	-5.2	4.1
Extreme Minimum	17.2	16.7	25.6	31.1	33.9	37.2	40.6	36.7	37.2	30.0	23.9	18.5	
Date (yyyy/dd)	1950/25	1930/25+	1946/29	1925/23	1962/18	1933/20+	1936/10	1948/27+	1953/02	1897/15+	1950/01	1982/03	
Extreme Minimum	-29.4	-29.4	-23.9	-12.2	-6.7	-2.2	2.8	0.6	-4.4	-10.0	-20.0	-22.8	
Date (yyyy/dd)	1887/07	1934/09	1900/12	1954/03	1891/17	1888/03+	1890/10+	1890/24	1893/26+	1887/26	1891/30	1886/16+	

Table 2. Monthly precipitation values for Ridgetown (in millimetres). (From Environment Canada 2004. Canadian Climate Normals 1971-2000 for Ridgetown Ontario)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rainfall	25.6	36.1	66.6	73.0	76.8	82.1	92.8	104.9	92.9	55.4	84.2	61.1	851.4
Snowfall	28.6	25.4	15.2	4.5	0.0	0.0	0.0	0.0	0.0	0.1	9.0	34.5	117.3
Precipitation	54.2	61.4	81.9	77.5	76.9	82.1	92.8	104.9	92.9	55.4	93.3	95.6	968.8

Table 3. A comparison of seasonal daily maximum, minimum and mean temperatures between Erieau and Ridgetown. (compiled from Environment Canada 2004)

Measurement	Season	Erieau	Ridgetown	Difference (+/-)	Rondeau is: (as compared to Ridgetown)
Daily Max	Winter	4.98	5.47	-0.5	Cooler
Daily Max	Summer	19.31	23.05	-3.7	Cooler
Daily Min	Winter	0.08	-1.93	2.0	Warmer
Daily Min	Summer	13.98	11.42	2.6	Warmer
Daily Mean	Winter	2.54	1.77	0.8	Warmer
Daily Mean	Summer	16.67	17.25	-0.6	Cooler

Chapter 2: Site Establishment and Management

2.1 Site Context

2.1.1 Regulated Park Area

The regulated area of Rondeau Provincial Park totals 3254 ha and includes the vast majority of the Rondeau peninsula, a significant portion of Rondeau Bay and a portion of Lake Erie from the shoreline to a point approximately 300 m out into the lake (Figure 10).

Prior to 1984 all of Rondeau Bay was included within the park boundary. The western portion of Rondeau Bay is now administered by the Ministry of Natural Resources under the Ontario Public Lands Act (OMNR 1991).

A small area (8.4 ha) of the barrier beach adjacent to Erieau is owned by Transport Canada as a lighthouse reserve, and has never been part of the regulated park boundary.

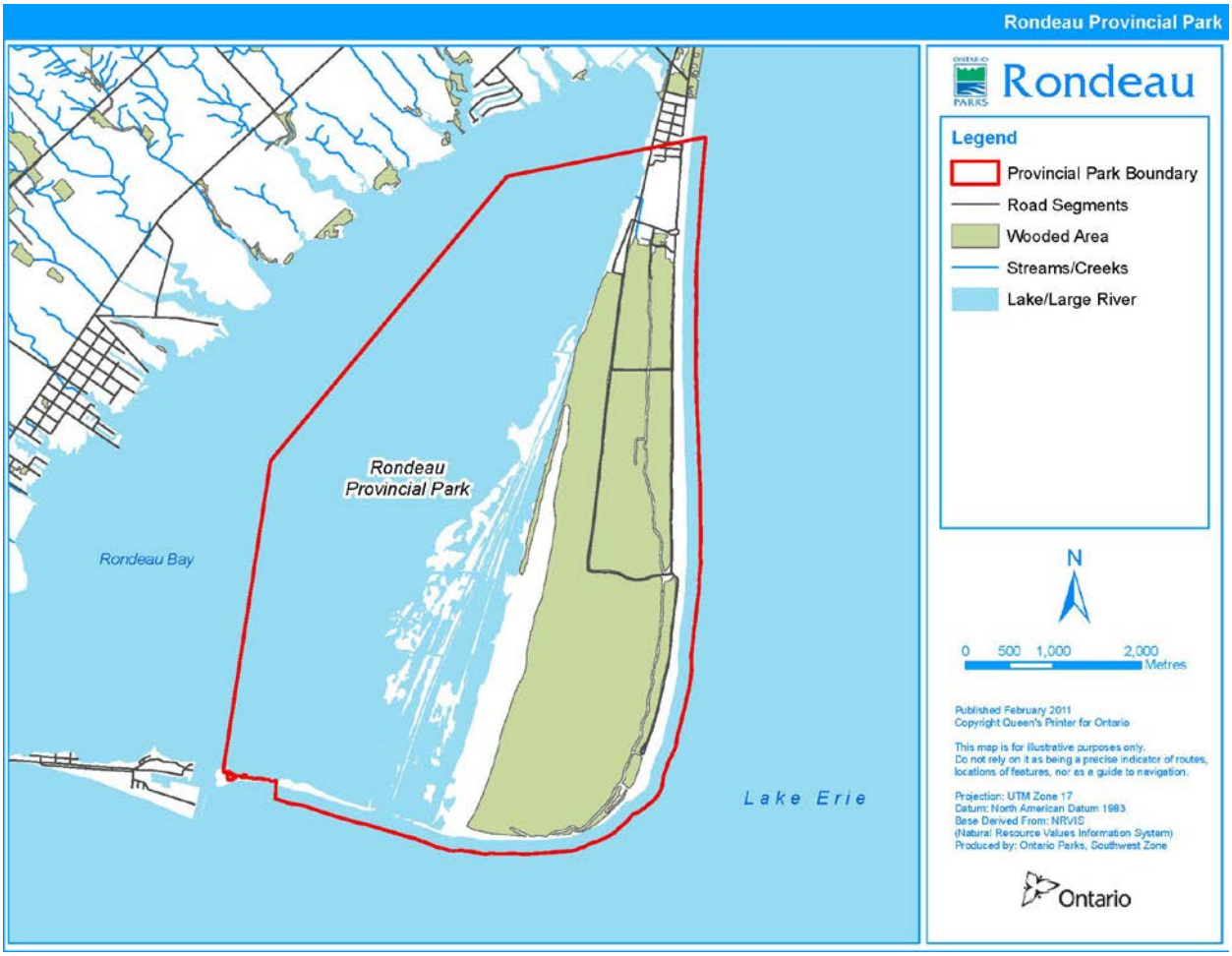

Figure 10. Rondeau Provincial Park boundary

2.1.2 Classification

Within Ontario's provincial park system, Rondeau is classified as a Natural Environment park. This designation was made in recognition of the provincially significant landforms and associated flora and fauna that the park protects, as well as its capability to provide a diversity of outdoor recreational activities in an attractive natural setting. Natural Environment Parks protect outstanding recreational landscapes, representative ecosystems and provincially significant elements of Ontario's natural and cultural heritage and provide high quality recreational and educational experiences (OMNR 1978, 1991, 2006a).

Both Rondeau Bay and the Rondeau peninsula are also recognised as provincially significant areas (Klinkenberg 1985, Riley *et al*. 1997, Environment Canada and Ministry of Natural Resources 2003).

2.1.3 Size

Although the regulated park area is 3254 ha, the GIS layer for the park provided by NRVIS (Natural Resource Values Information System) is 3293.8 ha. This discrepancy is likely due to shoreline changes between the time of the original survey and digitizing of the aerial photography.

Lands within the federal lighthouse reserve (8.4 ha) have been included in the life science study because they are contiguous with the parks south beach (and otherwise isolated from the mainland) and important for the protection of a number of species at risk, in particular turtles. This brings the total study area as calculated by GIS to 3302.2 ha.

Of the 3302 ha, 1669 ha are open water (Rondeau Bay and a small portion of Lake Erie), 774 ha are wetland (marsh and swamp) and the remaining 858 ha constitutes the terrestrial land base. Figure 11 illustrates the major aquatic and terrestrial divisions within Rondeau Provincial Park. The total area for each of these components is as follows:

Open Water (1669.3 ha)	Rondeau Bay	1498.5 ha	
Open Water (1669.3 ha)	Lake Erie	170.8 ha	
Wetland (774.4 ha)	Marsh	522.7 ha	
Wetland (774.4 ha)	Swamp	251.7 ha	
Terrestrial (858.5 ha)	Forested	633.7 ha	(forest, savannah, woodland)
Terrestrial (858.5 ha)	Open terrestrial	127.2 ha	(beach, dune, meadow and thicket)
Terrestrial (858.5 ha)	Constructed	97.6 ha	(roads, buildings and development)

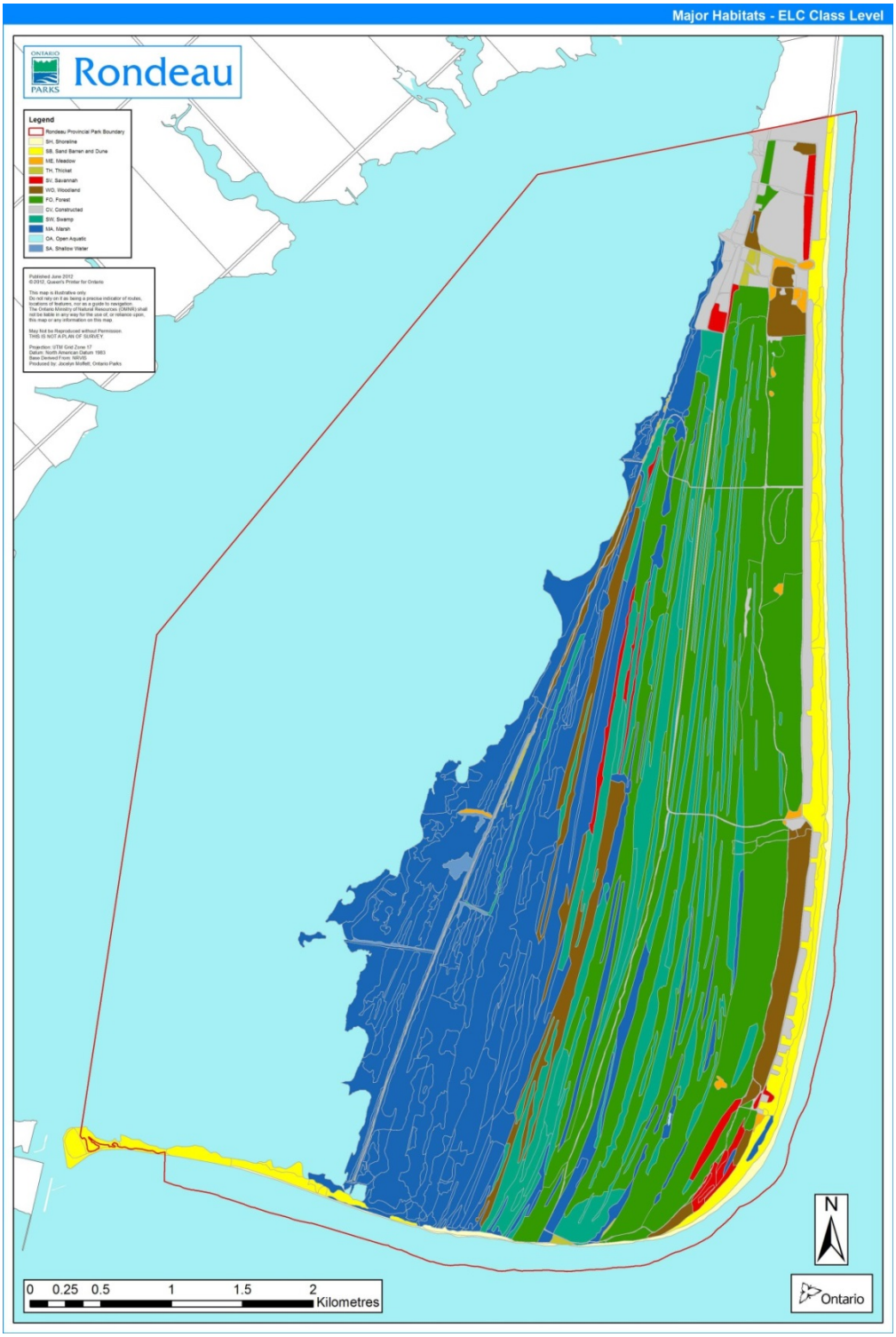

Figure 11. Major habitat divisions within Rondeau Provincial Park

2.2 Historical and Current Management

2.2.1 Establishment History

Rondeau Bay and the Rondeau Peninsula have long been recognised as unique and valuable geographic features. As early as the mid-1600's, French explorers wrote about the expansive spit of land with its towering stands of Eastern White Pine, and the sheltered lake that lay behind. The tall pines that lined the point's eastern shore led these early explorers to dub the peninsula Pointe aux Pins, and the protected waters of the bay became known as Ronde Eau or round water. Pointe aux Pins became a standard stop-over location for travellers along Lake Erie's north shore due to the peninsula's contrast to the steep bluffs and narrow beaches that were characteristic of the shoreline for many miles in both directions. Pointe aux Pins and Ronde Eau became a strategic landmark with which "everybody contemplating Lake Erie travel should be acquainted" (OMNR 1973, Price 1994).

On May 19, 1790, Alexander McKee, Deputy Agent of the British Indian Department, negotiated a treaty with the principal chiefs of the Ottawa, Potawatami, Chippewa, Huron and Wyandotte Indians whereby most of the lands within the current day counties of Essex, Kent, Elgin and Middlesex became the property of Britain. The treaty became known as the McKee Purchase and opened up most of southwestern Ontario for British and Loyalist Settlement (Price 1994).

Shortly after the McKee Purchase, His Majesty's Land Surveyor, Patrick McNiffe, conducted his initial surveys of the area around Pointe aux Pins. He reported to Lieutenant Governor John Graves Simcoe that Ronde Eau had the greatest harbour potential of any British possession on the Lake. Simcoe quickly realized the potential of Rondeau Bay as a strategic naval port and began plans for the town of Shrewsbury on the western side of the bay. Simcoe also knew that Pointe aux Pins held the only substantial stands of Eastern White Pine on the north shore of Lake Erie. Pine from the point had been used regularly in the construction and repair of the King's vessels, and Simcoe wanted to protect this valuable resource for the exclusive use of the crown. He declared a portion of Pointe aux Pins as a naval ordnance or land guard under crown control for use at the Governor's discretion. This designation served to protect that portion of Pointe aux Pins from development and settlement for almost 100 years (OMNR 1973, Price 1994).

In 1864, Henry Lawe surveyed the Rondeau peninsula into 17 odd-shaped lots for use as farms. Only two of these were suitable for cultivation, however, and none were ever sold for this purpose (Figure 12). The shallow, sandy soils were too infertile in comparison to those in the surrounding area (Killan 1993).

In the mid to late 1800's, the public began to become aware that the province's natural resources were not limitless. The resulting conservation movement began to gain strength, pressuring the government to protect the fish and game of Ontario. In response, the Mowat government appointed the Royal Commission on Game and Fish in 1890 to investigate the problem and provide recommendations to the government. One such recommendation was that the government should form a Provincial Game Park to serve as a wildlife sanctuary. This game park would be used to re-build Ontario's depleted stocks of game and fur-bearing animals. This recommendation was well received within the government and almost immediately, the Royal Commission on Forest Reservation and National Park was established and tasked with making preparations for Algonquin Park. It took three years but in May 1893, Algonquin National Park was established as Ontario's first provincial park (the term "National Park" was meant to infer the park's importance rather than the jurisdiction that was responsible for it) (Killan 1993).

In the months following the formation of Algonquin, the government came under pressure from the residents of southwestern Ontario for a second provincial park. The residents of Chatham and Kent County had been petitioning the government for many years to establish a public and national park on Pointe aux Pins but, with the formation of Algonquin, pressure on the government quickly increased. The government responded favourably and passed the Rondeau Provincial Park bill, setting aside Point aux Pins as "a public park, reservation and health resort" on May 5, 1894 (OMNR 1991, Killan 1993). Rondeau Provincial Park is now administered by the Ontario Ministry of Natural Resources under the Provincial Parks and Conservation Reserves Act, 2006 (S.O. 2006, c. 12).

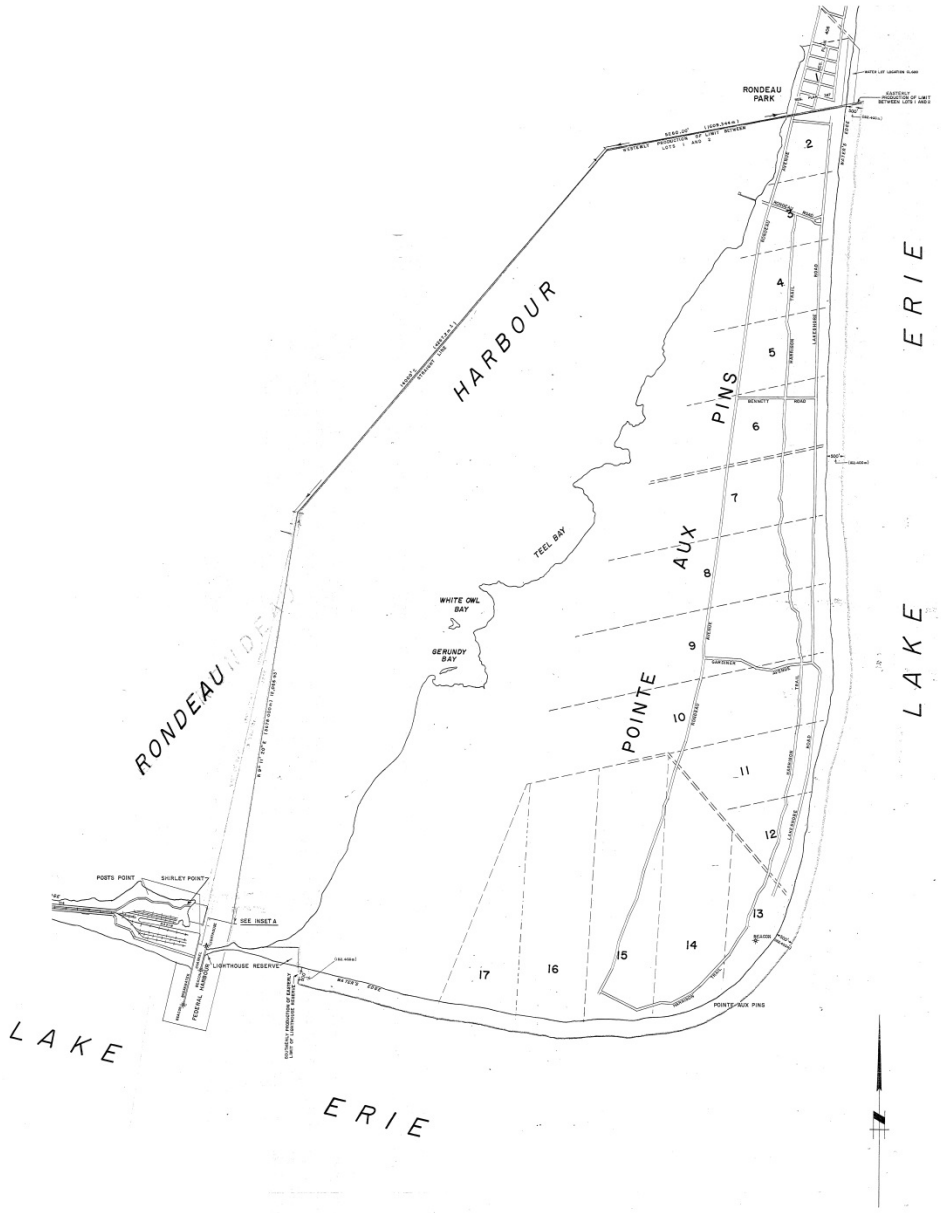

Figure 12. The survey of Rondeau Provincial Park done in 1864 by Henry Lawe

2.2.2 Management Policy Framework

Management of Rondeau Provincial Park is guided by the Provincial Parks and Conservation Reserves Act, 2006 (OMNR 2006a); Ontario Provincial Parks Planning

and Management Policies (OMNR 1978 and its revision in 1992) and the Rondeau Provincial Park Management Plan (OMNR 1991). The goal of Rondeau Provincial Park, as stated in the management plan, is to protect and enhance the quality of the park environment, especially its unique Carolinian features, and to provide compatible recreational, educational and conservation activities. The management plan provides direction for all management activities initiated within the park and sets the context for routine park operations.

In 2001, the Rondeau Vegetation Management Plan was prepared to meet the commitment of the management plan to prepare a vegetation management strategy for the park. The strategy was to recommend specific management techniques for fulfilling the principles of vegetation management that were identified in the management plan, which are:

- To perpetuate the natural succession of plant communities native to the park and representative of its geographical location and
- To protect rare, threatened and endangered species and those naturally occurring species that are representative of this southern area of Ontario.

The vegetation management plan was also meant to provide direction on all vegetation management issues facing park managers including (but not limited to) removal of exotic and invasive species, hazardous trees, planting, cottage lot naturalization, prescribed burning and others.

2.2.3 Park Zoning

Rondeau has been divided into four different zones as outlined in the Rondeau Provincial Park Management Plan (OMNR 1991) (Figure 13). These zones were chosen to ensure that the most significant natural areas of the park are protected, while infrastructure and access roads are restricted to as small a portion of the park as possible. The zones within Rondeau are as follows (from OMNR 1991):

Development Zone (398 ha). Development Zones are those areas of the park where infrastructure and intensive recreational facilities are permitted. Within such zones, all maintenance and development activities are carried out with special care for the environment. The campground, cottages and all park infrastructure are located in this zone.

Access Zone (308 ha). Access zones serve as public or service vehicle travel routes, and provide visitor access to the significant natural environment areas of the park. These zones include the roads and a 30-metre strip on both sides, although the strips alongside the roads are managed in a manner compatible with the adjacent zone.

Natural Environment Zone (1432 ha). The Natural Environment Zone is an extensive area that includes most of the marsh and bay that is within the park boundary, and is designated to provide long-term stewardship of the marsh. This zone allows for compatible day-use activities including fishing, canoeing, waterfowl hunting and hiking.

Nature Reserve Zone (1116 ha) – The Nature Reserve Zone is designated to provide long-term stewardship and protection of the natural and least disturbed areas of Rondeau's Carolinian forest and wetland environments. Visitor use of this zone is restricted to interpretive and hiking trails.

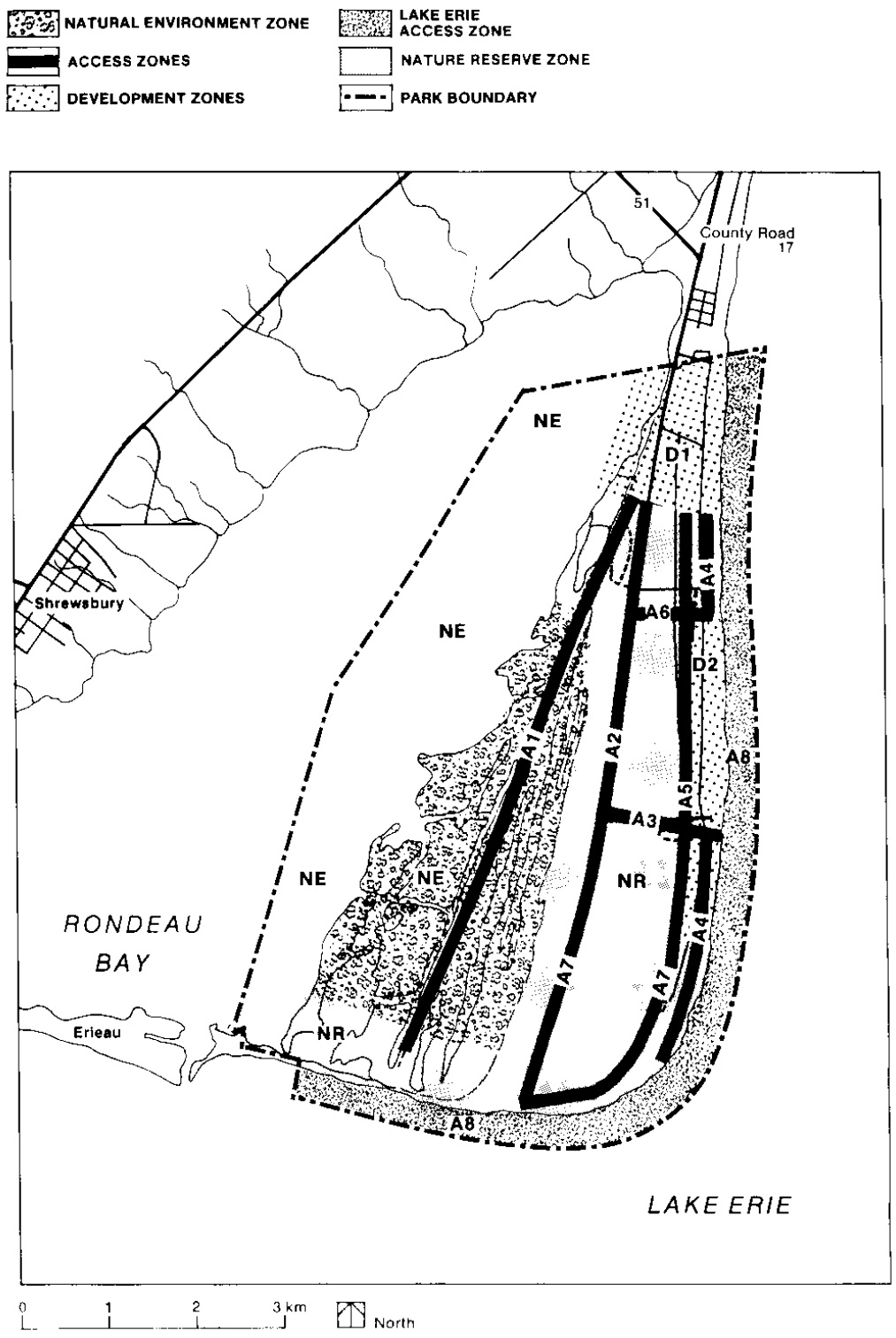

Figure 13. Park Zoning (from OMNR 1991)

2.2.4 Park Use

Rondeau Provincial Park is open year-round for day use activities and from the first weekend in April to the last weekend in October for camping. Rondeau's campground is located in the north end of the park and has 263 campsites, 153 of which have electrical hook-up. On average, Rondeau receives approximately 70 000 camper nights and 164 000 visitors per year based on the five year average from 2005-2009 (OMNR 2006b, 2007, 2008. 2009, 2010).

Day use activities include bird and butterfly watching, nature appreciation, canoeing, hiking, cycling, swimming and roller blading (among others). Interpretive programs are also offered year-round and focus on the unique physical and biological features that the park protects.

Rondeau also has 286 active cottage leaseholds in the park. Leases are currently set to expire on December 31, 2017. The majority of the cottages are located on the east side of the park along Lakeshore Road, and in the subdivision area at the north end of the park, with a smaller number being found on the west side of the park along Water Street and Rondeau Park Road.

The park has six interpretive and hiking trails totalling approximately 28 km. Trails range from shorter (1.4-2 km) walking trails to longer (7-8 km) trails that allow for hiking or cycling. There is also more than 12 km of beach within the park, 7 km of which have direct access for swimming and other beach activities.

Waterfowl hunting is permitted within the Natural Environment Zone areas of Rondeau's marsh. Waterfowl hunting is governed by regulation under the Fish and Wildlife Conservation Act and is managed according to the Rondeau Waterfowl Management Unit Operating Plan. Administration of the waterfowl unit is done through an agreement between the Rondeau Bay Waterfowlers Association, the Ontario Ministry of Natural Resources and the Ontario Federation of Anglers and Hunters. Hunting is permitted on Mondays, Wednesdays, Fridays and Saturdays during the regular open season for ducks from blind locations approved by the park.

Chapter 3: Current and Historical Vegetation Considerations

3.1 Excessive Numbers of White-tailed Deer

3.1.1 The Rondeau Deer Population

When Isaac Gardiner became the first Superintendent of Rondeau, he did not list White-tailed Deer (*Odocoileus virginianus*) as one of the animals found within the park, and it is assumed that deer were absent at the time of the park's establishment (Gardiner 1895, Bartlett 1958a, OMNR 1973, 1981). At the end of the 19th century, however, low deer densities were not unique to Rondeau. Historically (pre-European contact), deer populations in eastern North America were at moderate levels due to the extensive tracts of mature forest. As Europeans began arriving, deer numbers fell for a short period of time in response to increased harvest but then increased due to the increase in edge habitat that was being created by settlers clearing the land. Populations remained high until the mid 1800's when heavy exploitation once again resulted in a significant decline. This trend continued until over-hunting and habitat loss resulted in a massive population crash. By 1900, deer populations throughout eastern North America were at an all-time low (McCabe and McCabe 1984, Ellingwood and Caturano 1988).

At Rondeau, Colonel John Prince of Essex County leased the Rondeau Peninsula during the 1850's and used it as his own private hunting reserve. He and his friends seriously over-exploited the Rondeau deer herd, and were likely one of the most significant forces in eliminating deer from the peninsula (OMNR 1973, 1981).

Although not present in 1894, Gardiner noted that by 1900, there were at least six deer in a 14 acre enclosure that he built, and at least five deer running at large in the park. In 1901, he introduced a doe and fawn to Rondeau from Algonquin Provincial Park (Bartlett 1958a quoting Gardiner 1901). Deer numbers began to rise and by 1905, Gardiner estimated that there were at least 65 deer in the park (Gardiner 1906, referenced in Bartlett 1958a). By 1910, Gardiner estimated that there were at least 150 deer, and by 1911, he noted a reduction in Eastern White Pine and hardwood regeneration (Gardiner 1913).

In the fall of 1912, the population was estimated at 500 deer and the first cull (or deer herd reduction) was undertaken with 90 deer being shot. Subsequent reductions followed (Figure 14). Early deer herd reductions focused on bucks, however, and did little to slow the growth of the deer population. Despite removing 517 deer from the park between 1912 and 1918, Goldsworthy estimated that there were still 400 deer in the park in 1920 (Bartlett 1958a). In 1928, Ralph Carman conducted an extensive forest inventory of the park and concluded that deer were seriously reducing tree regeneration. He further concluded that the herd should be significantly reduced. Deer herd reductions became more frequent and between 1935 and 1947, almost 700 deer were removed from the park, reducing the population to less than 100 animals (Bartlett 1958a). After 1947, however, deer herd reductions became less regular and the population began to rebound until Charles Bartlett conducted his study of deer and forest relationships in Rondeau in the mid-1950's. Bartlett concluded that deer were still threatening the park's forest, and deer herd reductions once again became more frequent for a short time (Bartlett 1958a).

Deer herd reductions were conducted until 1973 and the population fluctuated significantly depending on the frequency of reductions and the number of deer taken (Figure 14). In 1974, public concern over the killing of deer in a provincial park prompted the government to suspend the program while other options could be considered. The issue of deer management was one of the primary factors contributing to the initiation of a master plan review for the park, which began in the early 1970's. As a result, no deer were removed from the park from 1974 to 1993 when deer herd reductions were reinstated (see section 3.1.4).

Such rapid population increases by White-tailed Deer have been documented in many other locations such as Long Point, Point Pelee, The Pinery Provincial Park, Navy Island and the George Reserve where natural predators have been removed and hunting is not generally allowed (O'Roke and Hamerstrom 1948, Bartlett 1955, McCullough 1984, Ashley 1990, The Landplan Collaborative Ltd. 1990, 1991). At the same time that the Rondeau herd was increasing, deer numbers throughout the rest of southern Ontario were also experiencing rapid growth (Bartlett 1958b). Deer populations are able to grow at a very rapid rate due to the high reproductive output that deer are capable of. Under normal conditions on good range, adult does generally have two fawns per year with yearlings having one, and triplets not being uncommon. This can result in a doubling of the population in one year (Ellingwood and Caturano 1988).

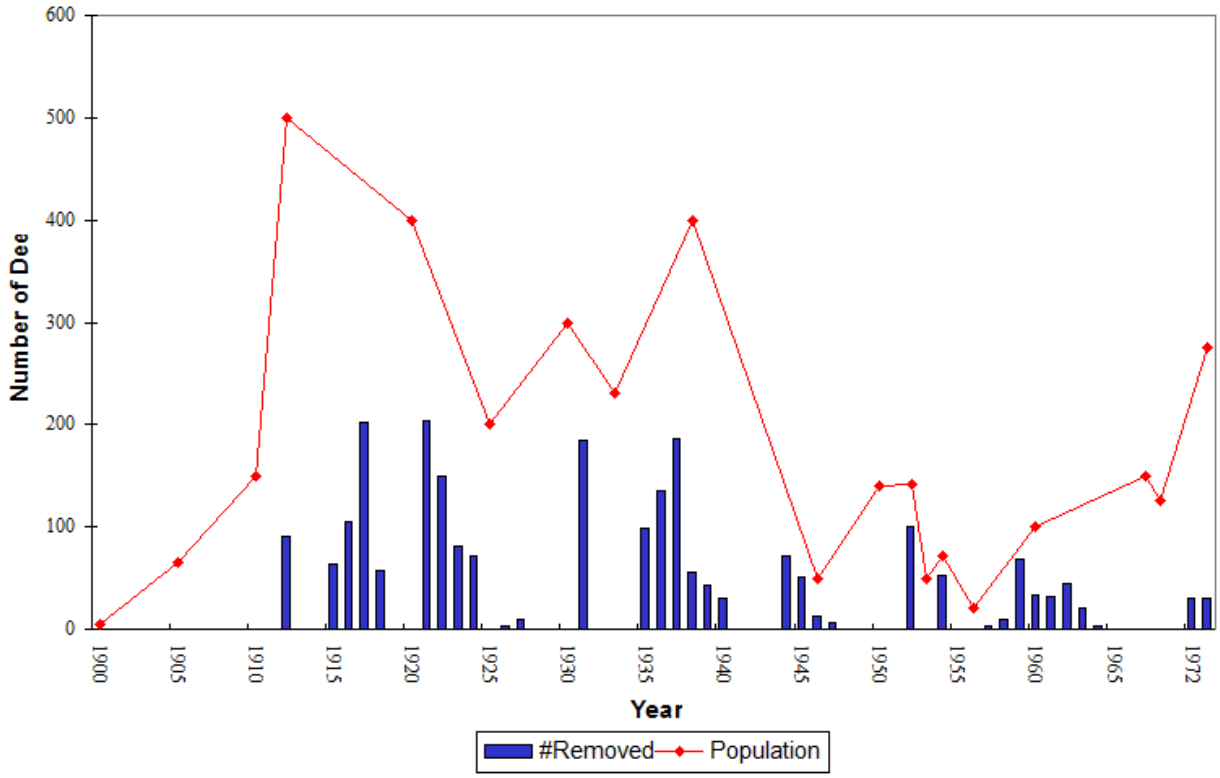

Figure 14. Deer population and number removed from 1900 to 1973.

3.1.2 The Effects of a High Deer Population

The Effects on Vegetation

In order to study the effects of over-grazing by White-tailed Deer in Rondeau, a number of deer exclosure studies have been conducted within the park (Bartlett 1958a, Stephenson 1959, OMNR 1977, Koh 1991a). The first of these was initiated by Charles Bartlett in 1953 with the establishment of a 0.03 ha deer exclosure in the south-eastern part of the park near Dillon Trail which was later re-sampled by Stephenson (Bartlett 1958a, Stephenson 1959). This study focused on woody species (trees and shrubs) and concluded that some species such as Basswood, Sugar Maple, American Beech, Sassafras and Virginia Creeper (*Parthenocissus quinquefolia*) increased in abundance as a result of protection, but that other species, including Red Maple, Wild Black Cherry (*Prunus serotina*), and White Elm (*Ulmus americana*) showed no change in abundance. They concluded that deer browsing was not the main factor influencing the regeneration of all species. The study also found that browse-tolerant species such as Hop

Hornbeam (*Ostrya virginiana*) and Blue Beech (*Carpinus caroliniana*), become more dominant outside of the exclosure.

The second deer exclosure study was initiated in 1978, shortly after deer herd reductions were suspended in the park. The study was to demonstrate and quantify the effects of deer on the regeneration of the Rondeau forest and the results (combined with deer counts and other deer monitoring data) were to be used to assist with the formulation of management options for the parks deer herd (OMNR 1977). Two 0.2 ha deer exclosures were constructed; one south of Bennett Ave. just east of Rondeau Road and the other south of Gardiner Ave., just east of South Point Trail. This study also focussed on woody species including trees, saplings and seedlings. Sampling of the exclosures and control plots (unfenced areas immediately adjacent to the exclosures) was conducted in 1978, 1980 and 1982 (Yaraskavitch 1981, 1983).

The results indicated that deer were having a profound effect on forest regeneration. Outside of the exclosures, seedlings were becoming established but were quickly grazed, with few growing into the sapling stage. Non-palatable shrub species such as Hop Hornbeam, Blue Beech and Spicebush (*Lindera benzoin*) were becoming more common in the lower shrub levels and tree species, especially intolerant Carolinian species, were declining. Inside the exclosures, regeneration was occurring normally. The reports concluded that species such as Tuliptree could disappear entirely if natural regeneration was not restored (Yaraskavitch 1981, 1983).

Beginning in the early 1990's, Dr. Dawn Bazely and a number of her graduate students from York University, began to conduct research on the effects of overgrazing in Rondeau and Pinery Provincial Parks and Point Pelee National Park. At Rondeau, they utilized the 1978 deer exclosures combined with 40 smaller (2X2 m) exclosures erected in various locations throughout the park in 1991 (Pearl *et al*. 1995). Although they also looked at tree and shrub regeneration, they expanded their research to include herbaceous plants.

The York studies found that the new (1991) exclosures did not see a significant change in herbaceous plant composition between 1992 and 1995 after one deer reduction, but that the 1978 exclosures, 1991 exclosures and grazed areas were all significantly different from one another. Plant species composition in the new exclosures had not changed significantly by 1995, but plant cover had dramatically increased. This

suggested that a new stable state had been initiated by grazing and that a longer period of recovery would be required before the vegetation would revert back to its original composition (Koh 1991a, Koh and Bazely 1994, Bazely *et al*. 1996, Engel 1996, Chopra 2002, Koh 2002). In some areas of the park the seed bank had become depleted, meaning that plants would have to recolonize from other areas where grazing pressure had been less intense and plants had survived (Koh 2002).This “alternative stable state” has been observed elsewhere (Putnam *et al*.1989, Stromayer and Warren 1997).

Comparisons with other forests in southwestern Ontario showed that only the 1978 exclosures were similar to sites that have never received high grazing pressure (Koh *et al*. 1999). As with Yaraskavitch (1981, 1983), the York studies found that there had been a shift in woody vegetation outside of the exclosures to unpalatable species such as Blue Beech and Hop Hornbeam (Koh 1991a, Koh and Bazely 1994, Bazely *et al*. 1996, Chopra 2002).

Further research suggested that light levels were at least partly responsible for the shift in plant composition. The lack of regeneration as a result of overgrazing by White-tailed Deer resulted in a more open forest with increased light levels reaching the ground. This changed the microclimate of the forest floor, shifting it to a sunnier and drier condition with less organic matter and reduced moisture retention capability. These conditions favoured the growth of non-native and weedy species which out-compete and reduce the number of ephemeral forest species (Koh and Bazely 1994, Bazely *et al*. 1996, Koh *et al*. 1999, Firanski 2003). As openings developed in the forest, there was an increased chance of windthrow, which in turn added more light, exascerbating the effect (Bazely *et al*. 1996, Hynes *et al*. 2000). Results of their studies were similar to those found throughout North America and other parts of the world (Putman *et al*. 1989, Ashley 1990, Bakowsky 1995, Stromayer and Warren 1997, Gill and Beardall 2001, Kirby 2001, Watkinson *et al*. 2001, Fuller and Gill 2001, Rooney 2001, etc.).

The York studies also showed that ongoing herbivory had a dramatic effect on plant size. They showed that individuals of a number of spring ephemerals were smaller outside of deer exclosures and experienced reduced flowering rates (Koh 1991b, Koh 1995, Bazely *et al*. 1996, Dennis 1996, Firanski 2003, Koh *et al*. 2010). Specific plants studied included White Trillium (*Trillium grandiflorum*), Jack-in-the-pulpit (*Arisaema triphyllum*), Downy Yellow Violet (*Viola pubescens*) and Common Blue Violet (*V.*

sororia). After a number of deer reductions, plant sizes began to increase and eventually became similar to areas with normal grazing (D. Bazely, unpublished data).

Effects on other taxa

The effects of high deer numbers are not restricted to vegetation. High deer densities have been shown to have an effect on a variety of taxa as a result of the loss of vegetation structure and habitat, including forest birds, small mammals and invertebrates (McShea and Rappole 2000, Flowerdew and Ellwood 2001, Fuller 2001, Perrins and Overall 2001, Stewart 2001). For example, several studies have shown that vegetation loss in the lower forest strata can result in a decline in ground and low nesting bird species (McShea and Rappole 2000, Fuller 2001, Perrins and Overall 2001). This was observed at Rondeau, and was demonstrated through forest bird monitoring studies done in 1991 and 1993 by Long Point Bird Observatory (Bowles and Gartshore 1992, Gartshore 1994). Those studies showed that there were low numbers of birds that use the shrub strata below 5 m for foraging and very few birds which nest on or near the ground due to a lack of vegetation in those strata. Ongoing forest bird monitoring since 1998 has shown that since deer herd reductions have been reinstated, the numbers of some low and ground-nesting species such as Wood Thrush (*Hylocichla mustelina*) have increased (S. Dobbyn, unpublished data).

Effects on deer size

When deer populations remain abnormally high for an extended period of time, and the amount of available browse has been significantly depleted, the deer themselves are also affected. Deer in overpopulated range tend to have smaller antlers, reduced body size and lower reproductive rates (Sauer 1984, Ashley 1990, Voigt and Smith 1994). In a study at Long Point, a peninsula on the north shore of Lake Erie where the population had been abnormally high for several decades, deer were found to have smaller body size, reduced antler development and lower reproductive rates than deer from the adjacent mainland where population levels were lower (Ashley 1990, Ashley *et al*. 1998). Five years later, after a series of public hunts that reduced the population by 85%, there was a significant increase in body and antler size, particularly in younger deer (Ashley *et al*. 1998).

In 1993, the first deer reduction at Rondeau in 20 years was conducted, with the removal of 322 deer. Both antler size and body weight were smaller than deer from all other areas of the province except those from the 1989 and 1990 Long Point culls.

Although not statistically significant, hind foot lengths from the Rondeau deer were actually smaller than those from Long Point, suggesting that although the Rondeau deer weighed more, they had proportionally smaller bodies than the Long Point deer (Voigt and Smith 1994). After the initial population reduction, body weight, hind foot length and reproductive rates all began to increase (Rondeau Provincial Park, unpublished data).

3.1.3 Other Management Options Considered

During the planning process for the new park management plan, twelve management options were developed and considered for the Rondeau Deer Herd (OMNR 1989). Each one of these options was given full consideration before a final decision was made. Many of the options were rejected because they were not feasible, would not result in a significant enough reduction of the population or simply failed to protect the park's natural values. The following is a summary of the options that were considered; for a complete discussion of each, see OMNR 1989.

Do nothing – let nature take its course. Some people felt that nature should be left to take its course, regardless of the outcome. This option was rejected because it failed to protect the Carolinian forest and associated flora and fauna including numerous Species at Risk.

Scientific collection of deer. This option would have seen deer removed from the park for scientific study. This option was not feasible because the number of deer that would be needed for such research would not be sufficient to reduce and maintain the Rondeau population at a sustainable level.

Introduction of natural predators. This option would have involved the introduction of natural predators into the park to control and possibly decrease deer populations. Predators could have included Coyotes (*Canis latrans*), Grey Wolves (*Canis lupus*) or Black Bears (*Ursus americanus*). This option was not practical because there would be no way to prevent the predators from leaving the park; most of these animals have natural home ranges that are much larger than the park itself. There would also be significant public opposition to the introduction of predators that could prey on livestock and threaten people and pets. As well, there was already a population of Coyotes in the park which was not having a significant effect on the deer population, meaning that there was no evidence that the introduction of Coyotes would significantly decrease the herd.

Sterilization and birth control measures. Contraception has been suggested as a method to control deer populations. Several studies have found that reproduction in White-tailed Deer can be controlled through the use of contraceptives however, all of these studies have indicated that it would not be practical in a wild, non-captive population and would also be prohibitively costly (Ellingwood and Caturano 1988, Seagle and Close 1996, Gionfriddo *et al*. 2008).

Increased hunting pressure outside the park. Radio-telemetry studies on Rondeau deer found that although some deer come and go from the park, many remain in the park year-round. This means that, although desirable, an increase in hunting pressure outside of the park would not significantly decrease the herd on its own.

Forest management options. This would have included such things as planting programs and the spraying of animal repellents on existing vegetation to discourage browsing by deer. It was determined that these options would not have been sufficient on their own to effect a significant decline in the deer herd, and would not be practical at the scale of the park. As well, the increased browse provided may actually promote an increase in the herd as a result of the increase in available food.

Deer feeding programs. This option would have involved the use of grains and other feed placed out for deer to take pressure off of natural browse. This option was not deemed practical because deer do not tend to be attracted to artificial feeds during the summer months when fresh growth is available. The cost of a year-round feeding program would also have been prohibitive. A feeding program may even have resulted in an increase in the number of deer, rather than helping control the population.

Capture and relocation. This option would have involved capturing deer alive by darting or box traps and relocating them to an area outside of the park. To explore the feasibility of this option, darting was attempted at Rondeau in 1973 and 1974 by the Ontario Humane Society and the University of Guelph. After more than 500 person hours, twenty deer had been darted, of which only ten were re-located and captured. Of these, seven were relocated and three died. The estimated cost per deer to continue with this method of control was over $500 (Lincoln 1974), and was therefore deemed impractical. Another consideration is that with deer numbers on the rise throughout the rest of Ontario, there are few locations where the deer could be released. There were also

concerns about relocating deer that may carry diseases, such as Lyme disease or Chronic Wasting Disease.

Fencing of the north park boundary. A deer-proof fence across the northern end of the park has been suggested as a method to keep deer out of Rondeau. This would involve a massive deer drive to push all of the deer north and out of the park, and a deer-proof gate at the main entrance. This option is not practical because deer could easily swim around the fence or walk around it on the ice. As well, it would be impossible to get all of the deer out of the park, and thus, regular deer drives would be required.

Controlled public hunt. Many people felt that the Rondeau deer population should be reduced through a public hunt. To allow for public hunts within the park, park zoning would have to be changed to conform to provincial park policy. This could reduce overall protection within the park. There would also have been considerable opposition from the public who do not want sport hunting in a provincial park. Concern was also raised that a public hunt would not be sufficient to reduce numbers to the level required.

Population reduction by OMNR staff. This option would have used OMNR staff to conduct the shooting with the meat going to food banks. Disposal of the meat using this method would have been difficult due to inspection and health regulations. This option was also not satisfactory to members of the public who felt that the deer should be removed through a public hunt.

OMNR cull involving public participation. This option was similar to the population reduction by OMNR staff, except that a few skilled and specially trained marksman would be selected from the public to participate. This method had similar problems to the OMNR reduction such as disposal of the meat and the fact that it would still be largely restricted to only a few selected members of the public.

3.1.4 Current Deer Management Policy in Rondeau Provincial Park

In 1991, after extensive public review and careful consideration of all of the options, the new Rondeau Provincial Park Management Plan was approved which provided direction for all aspects of park operations including deer management (OMNR 1991). The management plan (and its amendments) concluded that in the absence of any practical non-lethal alternative, culling would be reinstated to reduce the deer herd in order to preserve the park's significant Carolinian habitats. Based on comparisons with

other deer populations in the Great Lakes Region, biologists concluded that the park could sustain between 65 and 75 deer (Voigt and Smith 1994). Up until 2006, deer population estimates were determined through regular deer counts that were achieved by driving the entire Rondeau peninsula with a line of volunteers and counting deer as they cross a count line (Voigt and Smith 1994). Since that time, helicopter visual surveys and Forward Looking Infra-red surveys have been used (Dobbyn 2007, 2009, 2010; Bernatas 2007; Senese 2009; Cairns 2011).

Deer herd reductions were reinstated in 1993 with the removal of 311 deer. After 1993, deer herd reductions were suspended until 1998, but were then conducted annually until 2009. In 2010, a review of the deer herd reduction program under the Class Environmental Assessment for Provincial Parks and Conservation Reserves was initiated, as is required every ten years.

Successive reductions between 1998 and 2000 were successful at reducing the population to less than 100 deer. However, between 2001 and 2004, numbers increased to approximately 200 deer despite ongoing annual reductions (Table 4, Figure 15). This increase has been attributed to an increased reproductive rate, and the increased wariness in the deer. As the population decreased in the park, the vegetation began to recover and the amount of natural food that was available to deer increased. This in turn resulted in an increase in deer health and a subsequent increase in reproductive rate. The deer herd is now growing at a much higher rate than it was prior to 2000. At the same time, deer have become much more wary and more difficult to shoot. Many deer are now active only at night, and the ones that are active during the day are much more easily spooked. Increased efforts and changes in timing to December rather than November reductions reversed this trend and saw a reduction to population estimates at or just over the park carrying capacity by 2010. Experience with ongoing deer management has shown that deer will have to be removed from the park on an ongoing and regular basis (likely annually) in order to maintain the population at a level that is ecologically sustainable (Voigt and Broadfoot 1989).

Ongoing research by York University has shown that after more than a dozen years of deer management, recovery is beginning to occur within the park. Tree regeneration is beginning to occur and is evident in the smaller size classes, while a lag continues with an ongoing reduction in middle and larger size classes due to the lack of smaller trees that would have grown to fill these size categories. It is apparent that, although recovery

is occurring, it will take a long period of time to replace trees lost in the larger size categories due to the decades of over-browsing (Tanentzap *et al*. 2011).

Table 4. Estimated population and number of deer removed 1990 to 2010. *Deer count not conducted in 1993 - number estimated

Year	Estimated Population	# Removed
1990	575	0
1991	493	0
1992	478	0
1993	460*	322
1994	85	0
1995	150	0
1996	196	0
1997	250	0
1998	300	96
1999	207	57
2000	111	42
2001	87	32
2002	134	58
2003	159	75
2004	202	73
2005	134	55
2006	85	40
2007	35	25
2008	56	33
2009	70	40
2010	54	(no cull)

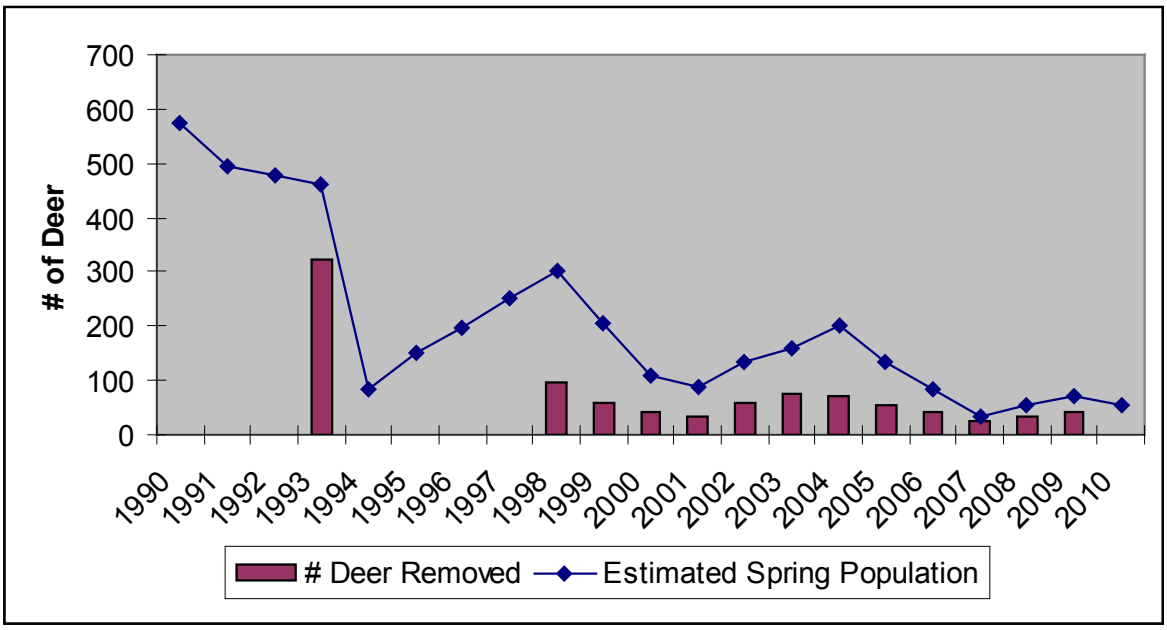

Figure 15. Estimated spring population and number of deer removed between 1990 and 2010.

3.2 Fire and Fire Suppression

Many authors make mention of wild fires on the Rondeau Peninsula (Bartlett 1958a, Mann 1978, OMNR 1981, Prevett 1983, etc.). In all cases, these fires were restricted to oak savannah/oak woodland habitats on the east side and south ends of the park, or the marsh (including the savannah ridges in the marsh). There are no records of fires within the deciduous forest west of Harrison Trail.

Mann (1978) theorized that fires could have had an influence on Rondeau's habitats as early as 1650 when First Nations occupied the area. First Nations likely used fire as a management tool within the marsh and possibly on the dry sandy ridges of the peninsula (Bartlett 1958a, Mann 1978).

Mann (1978) indicates that fire documentation began in 1891 when a large fire occurred on the lighthouse (ordnance) reserve at South Point. Mann documented fires (mostly in the marsh) in 1892, 1893, 1896, 1913, 1928, 1932, 1958 and 1963. OMNR (1981) noted fires on the east side in 1905 (no specific location given) and in 1928 near the

Coll fishery between Lakeshore Road and the beach. OMNR (1981) also noted a marsh fire during the winter of 1934 and in the spring of 1942.

Although a number of small fires have occurred over the century since the park was established (as noted by Mann and others above), complete fire suppression has been the general policy at Rondeau. The lack of fire has had a negative impact on the park's savannah and woodland habitats, stalling regeneration of savannah species and favouring the growth of non-savannah species and resulting in an increased rate of succession (Prevett 1983). Prescribed burning to restore the park's savannah and woodland habitats has been recommended for over twenty years, but was not initiated until 2001 after the completion of the park's vegetation management plan.

3.2.1 Determining the Location of Oak Savannah and Woodland Communities in Rondeau

In 2000, a decision was made to proceed with prescribed burning to restore oak savannah, oak woodland and tallgrass grassland habitats within the park. It was readily apparent where potential grassland habitats were found within the park due to the presence of abundant tallgrass grass species in these areas. However, it was felt that much of the eastern forested portion of the park (generally east of Harrison Trail) was actually degraded savannah and woodland that had been allowed to succeed at a more rapid rate than would have occurred naturally in the absence of fire suppression (see OMNR 2002 for further discussion). To support the belief that these areas were originally savannah or woodland, three types of investigations were initiated. The first was to investigate the composition and characteristics of the oak trees in these areas to determine if they had grown up in a forested situation or a more open community. The second was to examine older aerial photographs of the park to determine if the communities appeared to be more characteristic of savannah or woodland conditions (with respect to canopy closure). Finally, some of the earlier vegetation community inventories and mapping conducted in Rondeau were reviewed to determine where oak savannah had been mapped historically.

Open-grown Oak Study

This study was premised on the fact that oak trees (and other species) vary in their growth form depending on the density of trees around them. Trees that grow in forested situations tend to grow tall and narrow, putting the majority of their crown high on the stem with the major limbs reaching upwards. Trees that grow in open circumstances tend to have branches spread out from low on the stem to the top, and the limbs reach outward as well as up, resulting in an “open-grown” form (Leach and Givnish 1988, Franklin and Mercker 2009). Since oak savannah and woodland communities have low tree density (as represented by canopy closures ranging from 25-60%), then trees growing in these communities tend to be open-grown. The presence of older, open-grown oak trees in an otherwise young forest (such as the eastern portion of the park) has been used to identify degraded but potentially restorable savannah (Leach and Givnish 1988).

In 2002, a study was conducted to inventory the growth forms of oak trees along the eastern portion of the Rondeau peninsula (Dobbyn and Pasma 2002). Initial work was done to determine what characteristics could be used to classify oak trees into various scales of “open-growness” and to familiarize the field technician as to what characterizes an open-grown tree. Transects were then walked from the lakeshore, westward until the older mature forest was reached, and open-grown trees were no longer found (or the bay was reached in the northern transects). Open-grown oaks were categorized into one of three general categories: Partially open-grown, Mostly open-grown or Fully open-grown. Once complete, a map was produced that illustrated the location of only the Fully open-grown trees (Figure 16).

Figure 16. Location of open grown oak trees in Rondeau

Aerial Photograph Examination

Historical aerial photographs are available for Rondeau from the years 1954, 1972 and 1985, as well as ortho- photographs from 2002, 2006 and 2010. Older aerial

photographs were examined to determine overall tree cover within the park to test the belief that much of the east side of the park had been oak savannah or woodland. From the air photos, it is apparent that some areas of the park between Harrison Trail and Lakeshore Road were much more open historically than they are now. Some areas show very apparent openings between trees, consistent with savannah and woodland community types. Figure 17 illustrates two examples of the 1954 aerial photographs. The first is a close-up of the area from Rondeau Avenue south between Harrison Trail and Lakeshore Road. The second image illustrates the area to the north and south of Bennett Road between Harrison Trail and Lakeshore Road. Both of these show significant openings in the forest and individual trees with large round canopies can also be discerned. When compared to current aerial imagery, it is apparent that the current forest is much more closed than it was in 1954.

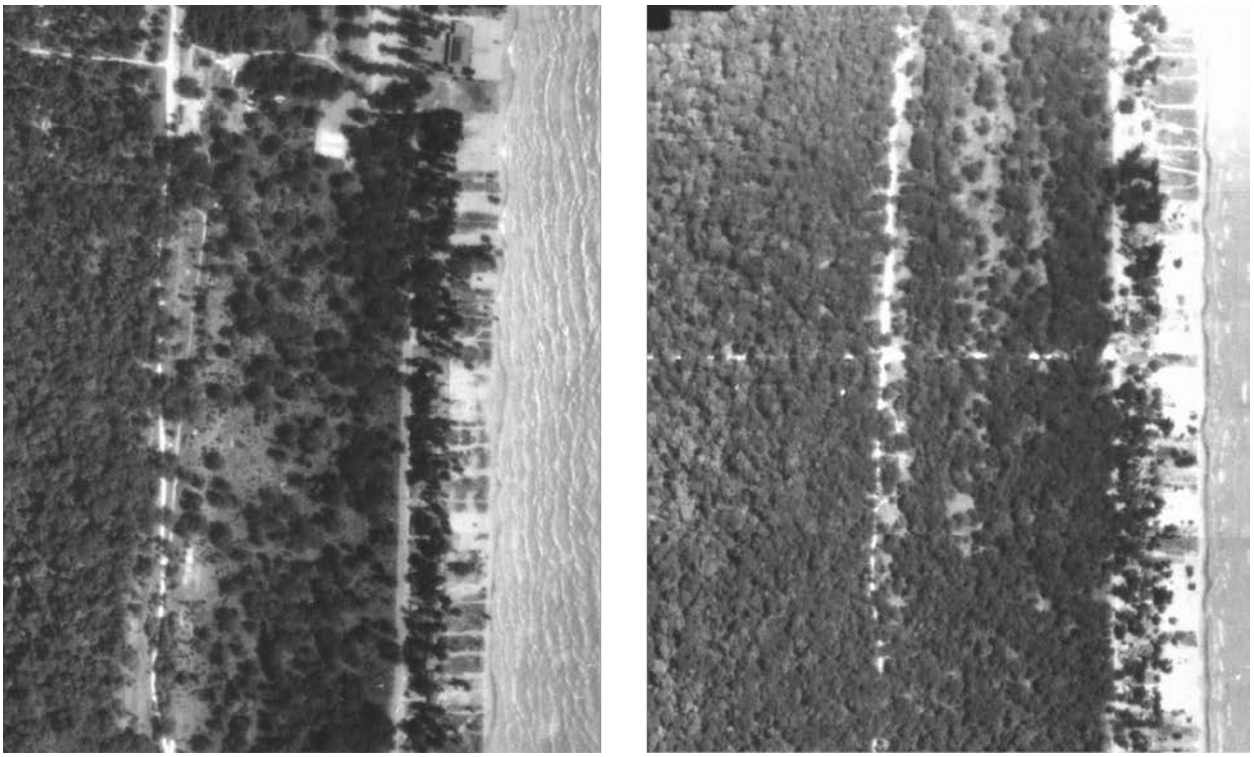

Figure 17. Aerial photographs from 1954 illustrating oak savannah/woodland

3.2.2 Determination of Areas Appropriate for Prescribed Burning

Based on historical aerial photography and the open-grown tree inventory, it became apparent that much of the east side of the Rondeau peninsula had been functioning savannah or woodland as recently as the 1950's, as suggested by the *Rondeau Vegetation Management Plan* (OMNR 2001). This conclusion is also supported by examining vegetation mapping from various authors beginning as early as 1928, who characterised varying areas of the eastern portion of the peninsula as "pine-oak", "oak-pine" and "oak dominated" (etc.). (Carman 1928, Bartlett 1958a, Kenney 1974, Dai *et al* .1975, Pratt 1975). (See section 3.4 for a summary of these previous vegetation surveys).

The area of degraded savannah extends from the beach-dune community to the west of Harrison Trail in many areas. In determining how much area to try to restore, however, the practical question of burn boundaries had to be addressed. As such, it was decided that the prescribed burn program would focus on the area between Harrison Trail and Lakeshore Road from the Pony Barn south (Figure 18). These areas were also specifically identified within the *Rondeau Vegetation Management Plan* (OMNR 2001) as areas to be included in the prescribed burn program.

Since that time, all of the blocks have been burned at least once, with some having been burned several times. A monitoring protocol was established to monitor the effects of burning on restoring these communities back towards savannah or woodland (Johnson *et al*. 2003). Monitoring has shown that some progress has been made towards opening up the forest canopy in some blocks, and increasing savannah grasses and forbs, but a full analysis of the data has not been conducted (Ontario Parks, unpublished data).

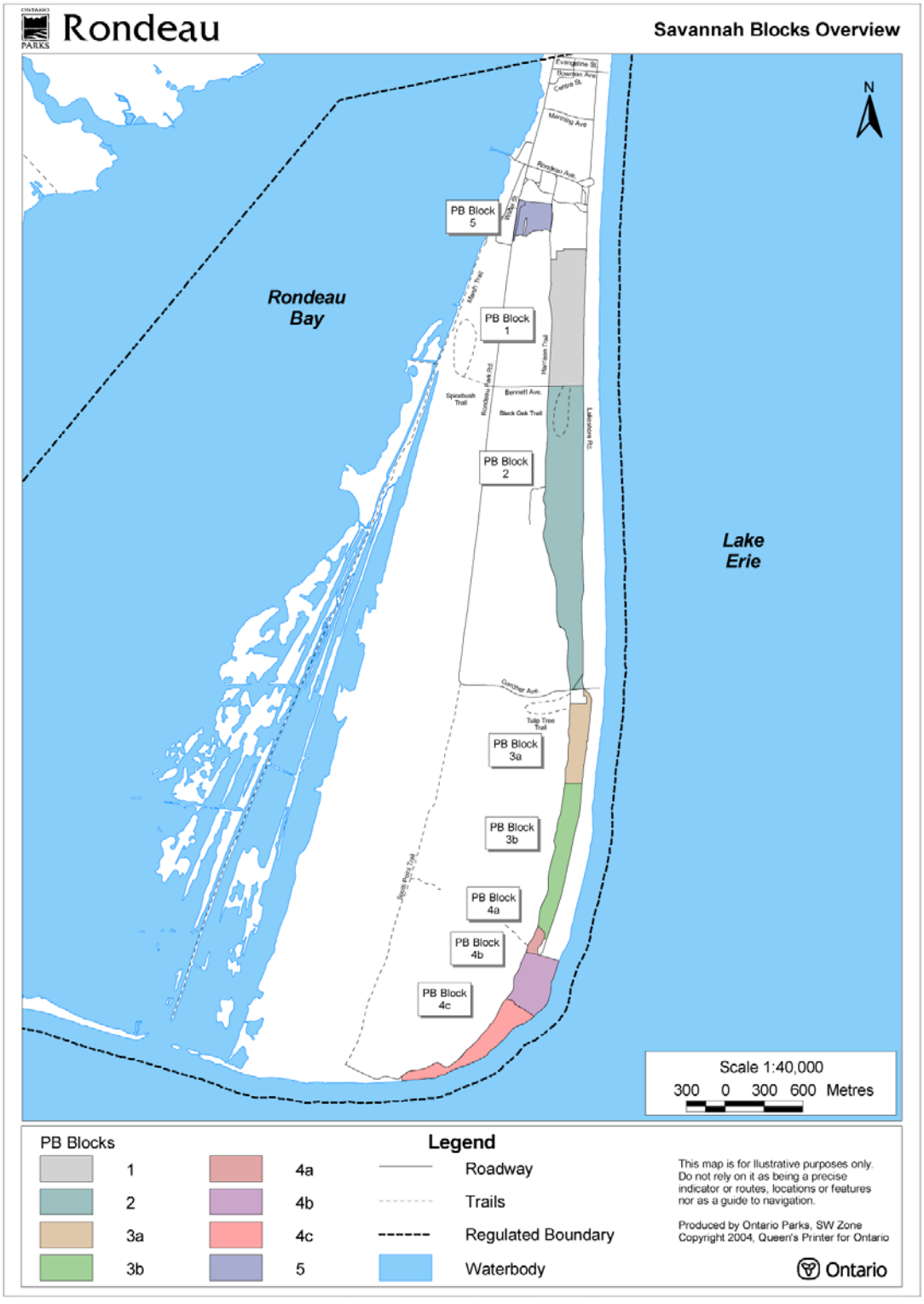

Figure 18. Location of burn blocks in Rondeau Provincial Park.

3.3 Other Influences on Vegetation Communities

3.3.1 Logging and Clearing

The towering Eastern White Pines and abundant oak were one of the things that attracted early explorers to Rondeau and inspired them to dub the peninsula *Pointe aux Pins*. Both pine and oak were used in the building and repair of sailing ships and Rondeau's forests were heavily utilized throughout the seventeen and eighteen hundreds. This ready supply of lumber was also what prompted Lt. Governor John Graves Simcoe to designate a portion of the peninsula as a naval ordinance or land guard in 1793, thereby preserving the timber for the exclusive use of the crown (see section 2.2.1). Thus, the Rondeau peninsula has a long history of timber exploitation. From 1795 to 1894 (the year the park was regulated), live timber was high-graded and dying or fallen timber salvaged on a regular basis (Mann 1978). As late as 1910, it was common to see walnut stumps that were 1.5 m across, and more than one furniture company removed large numbers of Black Walnut logs from the park (OMNR 1973, 1981). Sherlock (1977) conducted a pollen analysis of the sediments of Rondeau Bay and noted a decline in walnut pollen after about 1850. Other species that were heavily exploited include oaks, hickories, Butternut (*Juglans cinerea*), Tuliptree, Eastern White Pine, Wild Black Cherry and several species of ash (Bartlett 1958a).

After establishment of the park in 1894, almost all timber extraction was limited by statute to fallen or dead standing wood (Mann 1978, Killan 1993). Mann noted, however, that 800 Eastern White Pine were removed from the park in 1907, but did not indicate what these were used for. The first Superintendent, Isaac Gardiner, felt that the statute was too limiting and wanted to take advantage of the vast stands of timber. In a letter to his superior, A.S. Hardy, in 1894, Gardiner spoke of the amount of dead and dying timber in the park and suggested that the park should build a saw mill for processing wood for use within the park (Gardiner 1895). He later suggested that if the government would allow him to cut all standing trees that have come to maturity, that the bush would be left in a better state of preservation and that they could sell wood for revenue and use some of the lumber for improvements within the park. Eventually, the government bought into Gardiner's plan and dispatched forestry expert Edmund J. Zavitz in 1908 to survey and mark the mature trees with the intention of tendering them

to the highest bidder. Public opposition to the plan was so strong, however, that the idea was quickly abandoned (Ryan 1970, Killan 1993).

The desire to manage the park for timber did not end with Gardiner. During his forest survey of the park in 1928, Ralph Carman noted almost 90,000 board feet of dead standing or fallen trees and recommended that these be utilized. After becoming Superintendent, Carman proceeded to build the mill that Gardiner had first suggested and proceeded to cut timber for the market, cottagers and use within the park. The mill was used most heavily through the 1930's, but was maintained and operated until 1957 (OMNR 1981).

In 1934, a large wind storm toppled thousands of trees throughout the park. Rather than let them rot, the Ontario Government established relief camps in the park and salvaged almost 5000 cords of wood and 500 000 feet of logs. Another major windstorm in 1941 also resulted in an organized salvage operation during the winters of 1941/42 and 1942/43 (OMNR 1981). Fallen timber from subsequent wind storms was also salvaged, but in most cases, was restricted to areas adjacent to roads and trails (Ryan 1970).

Current park policy restricts the removal of fallen trees to those that are on roads or in day use areas, the campground or on cottage leaseholds. When a tree falls over a trail, the portion of the tree that is on the trail itself may be cut out and moved aside, but no portion of the tree may be salvaged (OMNR 1991, 2001).

In the decades prior to and just after establishment of the park, large areas were cleared and under-brushed to create a manicured and aesthetically pleasing environment for park visitors and to provide areas for picnicking, camping and other leisure activities. Further clearing was done for cottage leaseholds, campgrounds and park buildings (OMNR 2001). A large portion of the south-eastern section of the park was developed for camping and was in operation from 1958 to 1985. After 1985, campground infrastructure began to deteriorate and was slowly removed. During that time, the area was allowed to regenerate on its own. A portion of it is now included in the prescribed burn program and is maintained as an oak savannah, which is most likely the original community in that location.

3.3.2 Grazing

In a letter to A.S. Hardy in 1894, Isaac Gardiner indicated that it “has been the custom for large numbers of cattle to be driven on to the Pointe to graze, and in many cases they were turned out in the spring, and allowed to remain without intermission until the fall” (Gardiner 1895). Other records also indicate that the caretakers assigned to watch over the Rondeau peninsula after being land guarded (Isaac Swarthout and his successor Mark Soper) had allowed cattle and swine to graze on the point for decades (OMNR 1973). Apparently, it was common to see upwards of 700 cattle in the park during the summer (OMNR 1973, OMNR 1981). Gardiner observed that the animals had pawed up large areas of grass which allowed the sand to be blown away. He recommended to his superiors that grazing within the park be disallowed (Gardiner 1895), which they agreed to. Although most farmers complied with the new rule, Gardiner had to confiscate the cattle of one local farmer in 1899 (OMNR 1981).

3.3.3 Dutch Elm Disease

In the 1960’s, Dutch Elm disease spread through Ontario killing most of the mature White Elm in its path. In Rondeau, this resulted in a significant change in dominant tree species (OMNR 2001). Both Carmen (1928) and Bartlett (1958a) indicated that White Elm was a significant component of the forest, and the dominant tree in some areas. Later studies (i.e., Kenney 1974, Pratt 1975, Haggith 1982), however, barely mentioned White Elm and the absence of elm from their inventories is somewhat conspicuous. Elm is still found within the park today, but rarely grows to any size before succumbing to the disease. They do live long enough to reproduce, however, and will therefore continue to be a part of the park’s flora.

3.3.4 Planting of Trees, Shrubs and Garden Plants

Trees have undoubtedly been planted at Rondeau since before the establishment of the park, and continue to be planted to this day. Some of the trees that have been planted, however, include invasive species such as Black Locust (*Robinia pseudo-acacia*), White Mulberry (*Morus alba*), Tree-of-heaven (*Ailanthus altissima*), Manitoba Maple (*Acer negundo*), Norway Maple (*Acer platanoides*), European White Poplar (*Populus alba*) and Scots Pine (*Pinus sylvestris*). These species have escaped development zones and cottage lots and now threaten the indigenous flora of the park. Invasive species are very

difficult to kill and once they have spread throughout the park, the problem becomes much more difficult.

Non-native shrubs were also planted on cottage leaseholds and in development areas of the park, and subsequently spread to other areas of the park. Perhaps the worst of these has been Japanese Barberry (*Berberis thunbergii*) which has spread to virtually every part of the park. Tartarian Honeysuckle (*Lonicera tatarica*), Autumn Olive (*Elaeagnus umbellata*) and Multiflora Rose (*Rosa multiflora*) have also escaped cultivation and are spreading rapidly, particularly into oak savannah and oak woodland habitats.

Other non-native tree species that have been planted in the park include Jack Pine (*Pinus banksiana*), Austrian Pine (*Pinus nigra*), White Spruce (*Picea glauca*), Norway Spruce (*Picea abies*) and Blue Spruce (*Picea pungens*). Although some of these are native to Canada and none are considered invasive, these species are not part of the natural flora of the park. Some of these species were planted extensively on cottage lots and in the campground.

One of the most significant planting events occurred in 1907 when B.E. Fernow and J.H. White from the University of Toronto, under direction from Edmund J. Zavitz, had students from the University of Toronto Forestry School plant over 7000 trees in the area east of Harrison Trail behind the present day churches. Many of the trees were non-native species such as Scots Pine and Black Locust or trees not normally found in the park, such as Jack Pine (Mann 1978, Killan 1993). Some of these have acted as a seed source, allowing them to spread to other areas of the park.

Aside from trees and shrubs, a number of garden species have escaped cultivation and become established within the park, including Orange Day-lily (*Hemerocallis fulva*), Common Mullein (*Verbascum thapsus*), Garlic Mustard (*Alliaria petiolata*), Creeping Bellflower (*Campanula rapunculoides*), Yucca (*Yucca filamentosa*), White Clover (*Trifolium repens*) and others. Two of the more recent discoveries of non-native invasive plants were of Japanese Knotweed (*Fallopia japonica*) and Jetbead (*Rhodotypos scandens*). Japanese Knotweed is particularly aggressive and is capable of spreading rapidly (Remaley and Swearingen 2005). Previously un-detected at Rondeau, there was evidence of only a few stalks from previous growing seasons, yet the three patches found in 2004 ranged in size from 200 to 400 m2. Jetbead is quite new to southwestern

Ontario, only recently having been found outside of cultivation (M. Oldham, pers. comm.).

3.3.5 Windthrow

Being surrounded by water, the Rondeau peninsula is plagued by wind from all directions. That, combined with the shallow sandy soils and high water table, has resulted in frequent windthrows (OMNR 1981, Larson and Waldron 2000). Although trees are often windthrown during storms, there have been a number of major windthrow events. The first documented event was a large windstorm in 1934. The number of downed trees in the park was so high that relief camps were set up to salvage the wood (OMNR 1981). Wood from a September 1941 wind storm was also salvaged (OMNR 1981).

Other significant windstorm events were documented from 1950 and the winters of 1971/72 and 1974/75. These storms occurred during years of high water levels (OMNR 1981). Ice storms have also caused thousands of trees to fall in Rondeau, such as the major ice storm of March 1977.

The most recent significant wind storm occurred on the evening of July 21, 1998 when a large thunderstorm complex crossed southern Ontario. Winds as high as 130 km/hr were recorded in Windsor and gusts as high as 180 km/hr were recorded in Erieau. Within the park, thousands of trees were uprooted or broken off. Damage was localized within the park, with some areas experiencing a loss of upwards of 50% of the trees, while other areas received very little damage. The localized effect is thought to have been caused by thunderstorm microbursts; cold winds that descend at high speeds from the storm's apex and spread rapidly outward when they hit the ground (Larson and Waldron 2000).

Larson and Waldron (2000) documented the level of deforestation in one area of the park using a point-quarter sampling technique and then related their results to a number of natural and anthropogenic factors that likely contributed to the severity of the blowdown event. They concluded that there were 4 main factors contributing to extent of damage: 1) Continuing high water levels since the 1970's which caused deeper roots of mesic trees to die, reducing stability and also increasing root rot by *Armillaria*; 2) The generally fine-grained sandy soils that do not provide a great deal of stability; 3) Past disturbances including logging and previous windstorms (including 4 between 1976 and

1982) which opened the canopy and made the forest more susceptible to successive blowdown events; and 4) The high number of older trees in the heavier affected areas which may have already been prone to rot and insect infestations. This last factor was largely attributed to the high deer population and subsequent overbrowsing which has dramatically reduced tree regeneration, leaving few young and medium aged trees.

3.3.6 Other Influences

A variety of smaller impacts on the vegetation of the park have been noted. For instance, Carman (1928) noted damage to pine from collecting pitch. It has also been documented that Eastern Red Cedar was harvested for the manufacture of pencils (OMNR 1973).

3.4 Previous Vegetation Surveys

There have been numerous studies done on the vegetation of Rondeau Provincial Park, including several major forest inventories beginning as early as 1928. Each of these inventories developed a forest classification for the Park and described the dominant species in each of the communities. These classifications were the earlier equivalents to the current day Ecological Land Classification (ELC) which has become an OMNR standard for classifying natural habitats (Lee *et al*. 1998). These earlier studies will be valuable for comparing with the current ELC classification for Rondeau (Chapter 4).

The previous classifications vary considerably in their level of complexity from Carman's (1928) four broad vegetation communities to Pratt's eighteen communities (Pratt 1975). The following is a synopsis of the major forest inventory projects and the resulting community types.

3.4.1 Ralph Carman 1928

In response to the increased public use of the park, the lack of reproduction in various species of trees, high deer numbers and erosion of the south beach, Ralph Carman was given the task of completing a report on the *Forest Conditions and Administration of Rondeau Provincial Park*. He conducted his field work during the winter of 1928 and completed his report in April. His report was well received, and Carman was subsequently appointed Superintendent of the park later that year (Carman 1928, Killan 1993).

Carman divided the park's natural habitats into three forested communities and the marsh. The marsh was not actually surveyed, but it was mapped along with the forest communities and represents all of the un-forested wetland areas in the park. The forest survey was completed by tallying all trees, saplings and shrubs on a series of east-west transects that were 10 m wide and spaced 400 m apart. Trees were identified and compiled by species, size class and general abundance. His survey focussed on trees and several shrub species, but did not include herbaceous plants or grasses.

From his data, Carman identified three forested communities within the park including the very open "Park" type, an "Oak-Pine" type and a "Hardwood type" (Figure 19). He described the Park type as being dominated by Red, White and Black Oaks in an open savannah-like community. This community was restricted to the north end of the park and a narrow strip west of Lakeshore Road to Bennett Avenue, where most of the development and public access was focussed. Much of this area had been under-brushed and otherwise developed, leaving only the mature trees as the natural component to this community.

The Oak-Pine type was dominated by Red, White and Black Oak and Eastern White Pine, with a minor component of White Ash and Hop Hornbeam. This community was located in a narrow strip on the east side of the park adjacent to the beach, along Lakeshore Road. Much of this area has been developed for cottages.

The Hardwood community was described as a complex mixture of tolerant hardwoods including American Beech, Sugar Maple, soft maple, Basswood, American Elm, Yellow Birch (*Betula alleghaniensis*), Blue Beech and some Black Maple (*Acer nigrum*). Carman separated the Hardwood community into three blocks, each of which had different percentages of the dominant species and a different moisture regime. He did not, however, map these sub-blocks as distinct communities. The three blocks were the west block, the north-east block and the south-east block.

Carman defined the west block as the entire forested area to the west of Rondeau Park Road, and characterized it as having "an exceptionally large amount of thin area which is under water at various times of the year and quite wet for the remaining time. The wet places are long and narrow and are separated by sand ridges running the full length of the peninsula". He found that the wet areas (now referred to as sloughs) were dominated by (in order of significance) Yellow Birch, White Elm, Black Ash (*Fraxinus*

nigra) and soft maples, while the ridges had American Beech, Blue Beech, Basswood, Sugar Maple, White Ash and Red Oak.

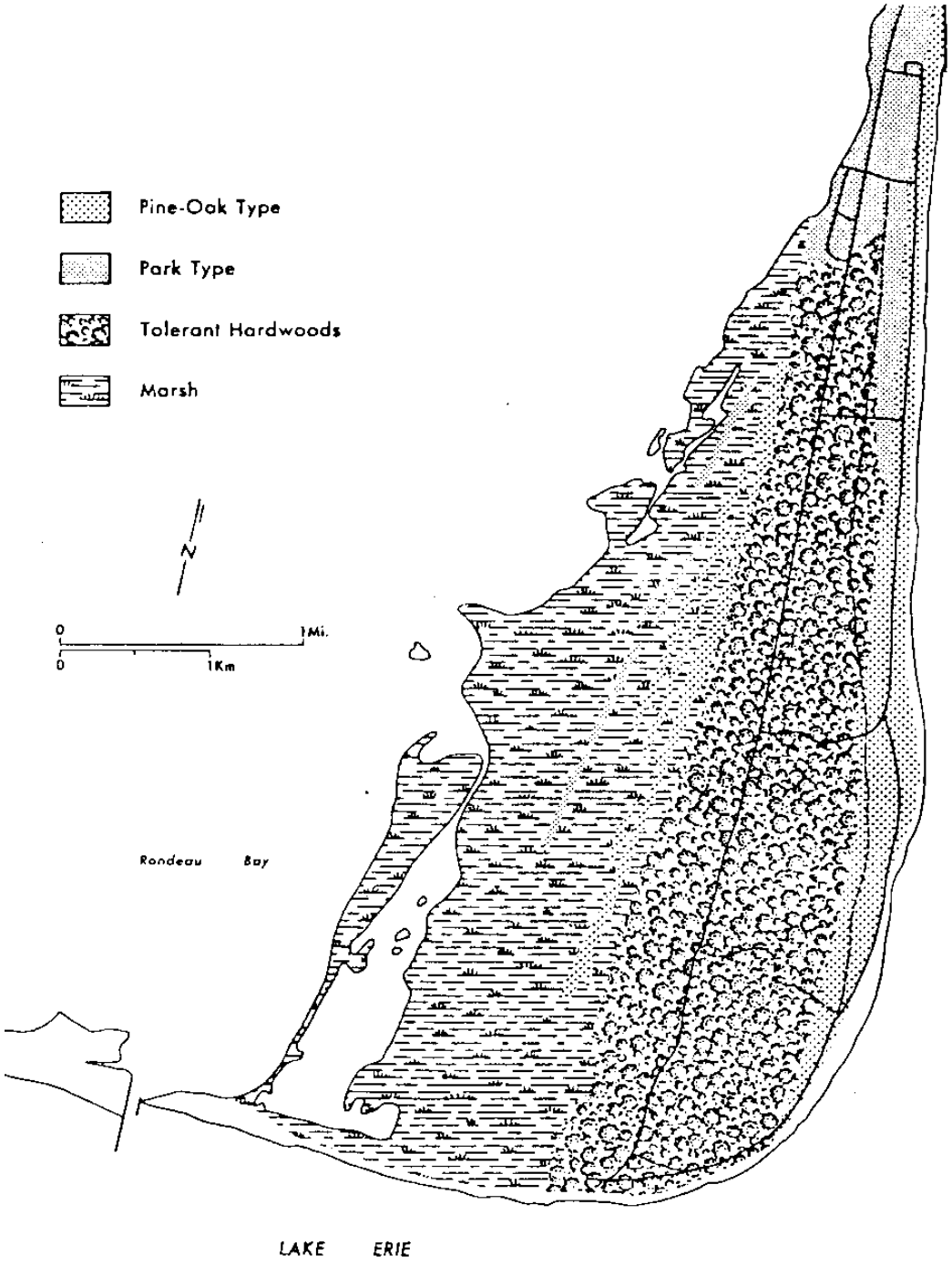

Figure 19. Forest classification by Carman

The north-east block was defined as the forested area to the east of Rondeau Park Road, north of the “Cross Road”, which was presumably Gardiner Avenue. Along Rondeau Park Road, the conditions in this block were similar to the west block, but became drier, and thus free of Black Ash and soft maples as one moved to the east. In the drier areas, the forest was dominated by Butternut, Black Walnut, hickories, Tuliptree and some Eastern White Pine.

The south-east block was located east of Rondeau Park Road, south of the Cross Road and also showed a gradient from a moist forest similar to the west block, to a drier forest in the east. This forest was somewhat younger than the north-east block, which Carman attributed to fire and culling. This section was dominated by Blue Beech and Hop Hornbeam, with significant quantities of American Beech, soft maples, White and Black Ash and White Elm.

3.4.2 Charles Bartlett 1958

By the mid 1930’s, deer numbers had begun to rise again after an active period of deer culling in the late teens and early 20’s. Park managers were concerned about the lack of forest regeneration and another period of culling ensued, resulting in a much reduced deer herd by the late 1940’s. Charles Bartlett was tasked with assessing the current state of the forest and forest recovery as a result of the lower deer numbers. Bartlett conducted field work between 1952 and 1954, with his forest survey being conducted in the summer and fall of 1952. He summarized his results in his report, *A Study of Some Deer and Forest Relationships in Rondeau Provincial Park* (Bartlett 1958a). Bartlett focussed heavily on deer, browse surveys and forest conditions, and established a deer exclosure survey. He also provided a discussion on deer management from 1900 to 1958.

Bartlett conducted surveys in 160 quadrats at 6 chain (119 m) intervals on 17 transects (running east-west) spaced 400 m apart. All trees, poles and saplings were sampled, along with seedlings, herbaceous plants and percent canopy.

Based on his surveys, Bartlett broke the park into two main forest communities – Pine-oak and Hardwood. He further subdivided these main categories into dry (ridge) and swamp forests. He also subdivided the hardwoods into transition forests and tolerant hardwoods. His final scheme had five forest types including the Oak openings and Pine-Oak forests similar to Carman’s classification. Bartlett, however, divided the hardwoods

into Tolerant Hardwoods, Transitional and Swamp Forests. Each of these divisions was further broken down into geographic areas of the park where the species composition varied slightly from those in other areas of the park. Table 5 summarizes Bartlett's classification. Bartlett did not map his classification; however, the classification by Kenney (1974) was largely based on Carman's work and Kenney did provide a map (see 3.4.4).

Table 5. Forest types of Rondeau Provincial Park as described by Bartlett (1958a)

Forest Type	Area	Species Composition
Oak Openings		Black Oak dominated with Black Walnut and Eastern White Pine.
Pine-Oak	North East	Red Oak/Eastern White Pine dominated with Black Oak, Black Walnut and White Ash and some Sugar Maple and American Beech.
	South East	Eastern White Pine dominated with significant component of Red Oak and some Eastern Red Cedar, Red Ash, White Oak, White Ash and American Beech.
	South West (marsh ridges)	Red Oak/Black Oak dominated with Shagbark Hickory (*Carya ovata*) and Eastern White Pine.
Transition	North East	Red Oak/Tuliptree dominated with Bitternut Hickory (*Carya cordiformis*), Red maple and American Elm and some Basswood, Hop Hornbeam, White Oak, Sugar Maple and White Ash.
	South East	American Beech/Red Oak dominated with Eastern White Pine, Basswood and Red Maple, with some White Ash, Shagbark Hickory, Wild Black Cherry, Sassafras, Large-toothed Aspen (*Populus grandidentata*) and Hop Hornbeam.
	South West	American Beech/White Ash dominated with Yellow Birch, Red Oak and Basswood and some Eastern White Pine, Red Maple, Shagbark Hickory, Wild Black Cherry, American Elm, Sugar Maple and Black Ash.
Tolerant Hardwoods	North	Sugar Maple/American Beech dominated with Red Oak, White Ash, Red Maple, American Elm, Hop Hornbeam and Basswood.
	South	Basswood/American Beech dominated with American Elm and some Black Ash, Tuliptree, Sugar Maple, Hop Hornbeam, Large-toothed Aspen, Sassafras and Shagbark Hickory.
Swamp Type	In eastern transition forest	American Elm dominated with Red Oak, Sugar Maple, Red Maple, Black Ash and Red Ash.

Forest Type	Area	Species Composition
	In tolerant hardwoods	Red Maple/American Elm dominated with Basswood, Sugar Maple, Black Ash, Red Ash, American Beech and Yellow Birch.
	In western transition forest	Red Maple/American Elm dominated with Red Oak, Sugar Maple, Black Ash, Yellow Birch and Tuliptree.

3.4.3 Gary Bradfield 1972

Bradfield (1972) used multivariate statistical techniques and other numerical methods to describe and classify the vegetation communities growing on a strip of open beach on South Point. Statistical methods included ordination, cluster analysis, discriminant analysis and trend surface analysis. Data were obtained by systematic sampling and included frequency counts of species in quadrats and measurements of various environmental variables.

This was largely a statistical exercise to see if the statistical methods would differentiate between a number of similar communities. The exercise appeared to be successful as Bradfield's analysis detected many of the same communities as Faull (1907) who first described the various beach communities at Rondeau. Bradfield identified four main communities:

Vegetation Type 1.Shore Line Community

A few isolated stands of mainly succulent annuals growing close to the shoreline on recently deposited sand and gravel. Typified by 60% bare ground with the surface being regularly washed by storm waves. The common species were Sea Rocket (*Cakile edentula*) and Seaside Spurge (*Chamaesyce polygonifolia*), with Canada Wild Rye (*Elymus canadensis*), Sagewort Wormwood (*Artemisia campestris* ssp. *caudata*), Little Bluestem (*Schizachyrium scoparius*), White Sweet Clover (*Melilotus alba*), Switch Grass (*Panicum virgatum*) and Sand-grass (*Triplasis purpurea*).

Soils were characterized as alkaline with very high concentrations of calcium. Soils were also generally high in potassium, low to very low in phosphorous, nitrate nitrogen, ammoniacal nitrogen and magnesium. Texture was classified as coarse sand.

Vegetation Type 2. Middle Beach Community

This community was defined as the relatively broad expanse of vegetation along the lake front growing on the windward slopes and tops of the youngest beach ridges. Bare ground ranged from 20 to 60% and the vegetation was dominated by Sagewort Wormwood and dense tussocks of Little Bluestem and Beach Grass (*Ammophila breviligulata*), with White Sweet Clover, Switch Grass and Canada Wild Rye.

Soils were characterized as alkaline but slightly less so than those of type 1. They were very high in calcium, medium to high in potassium and low to very low in nitrate nitrogen and ammoniacal nitrogen, phosphorous and magnesium. Soils were also of a less coarse material than in type 1.

Vegetation Type 3. Wet Slack Community

This community was described as a relatively narrow and species rich vegetation zone located in the depression between the middle and upper beaches where the soil remained damp throughout the entire growing season. Ground cover was almost complete and composed of Switch Grass, Baltic Rush (*Juncus balticus*), White Sweet Clover, Little Bluestem and goldenrod (*Solidago* spp.), with some Canada Bluegrass (*Poa compressa*), Arrow-leaved Aster (*Symphyotrichum urophyllum*), Heath Aster (*Symphyotrichum ericoides*), Turkeyfoot (Big Bluestem) (*Andropogon gerardi*), Hairy Yellow Evening-primrose (*Oenothera biennis*), Woodland Strawberry (*Fragaria vesca*), Elliptic Spike-rush (*Eleocharis elliptica*), Sagewort Wormwood, Western Poison Ivy (*Toxicodendron radicans*), Common Scouring-rush (*Equisetum hyemale* var. *affine*), Greenish Sedge (*Carex viridula* ssp. *viridula*) and Switch Grass.

The soils had a low pH, were high in calcium and potassium and low in phosphorous, nitrate nitrogen, ammoniacal nitrogen and magnesium. The sandy soils in this community had the highest percentage of silt and clay of the four types.

Vegetation Type 4. Upper Beach Community

This community was located on the leeward slopes of the oldest ridge and partially filled slack adjacent to the edge of the pine-oak forest. Bare ground ranged from 20-40%. Canada Blue Grass was abundant with Little Bluestem, Switch Grass and Sagewort Wormwood also being common.

Soils were alkaline with similar pH to type 2. They were high in calcium, medium in potassium and low to very low in nitrate nitrogen, ammoniacal nitrogen, phosphorous

and magnesium. Texture was described as medium course sand with particles smaller than in the other three types.

3.4.4 Matsy Kenney 1974

Matsy Kenney, Management Forester for Chatham District, prepared a background report on the forest of Rondeau for presentation to the Rondeau Advisory Committee during the management planning process in the mid-1970's. Her report was largely based on earlier works, particularly that of Charles Bartlett (1958a), and did not constitute new field work nor a new classification scheme. However, since her classification was very similar to Bartlett's and he did not map his forest communities, her work allows us to more fully understand Bartlett's classification. Furthermore, Kenney adjusted the classification to more accurately reflect the species composition of each forest type as they were at the time of her report. The changes in species composition between the early 1950's and the mid-1970's is presumed to be the result of the gradual shift to those species that are less palatable to deer (Bartlett 1958b). As well, Dutch Elm Disease swept through the park in the period between these two reports, dramatically altering the species composition within the park (OMNR 2001). Bartlett's report included elm as one of the major tree species in the swamp type forests, but is not even mentioned in Kenney's report.

Although Kenney included the same overall forest types as Bartlett (renamed in some cases), she did not include all of the forest sections that Bartlett did. Table 6 summarizes the forest types and their species composition and Figure 20 illustrates their locations within the park.

Kenney also discussed succession and how it related to the various tree species that were shade tolerant, moderately tolerant or intolerant. She also outlined some of the influences on the forest (snowmobiling, high water levels, deer) and provided some forest management alternatives.

Table 6. Forest types of Rondeau Provincial Park as described by Kenney (1974).

Forest Type	Section	Species Composition
Open Oak		Black Oak/Red Oak dominant with Eastern White Pine and Eastern Red Cedar scattered throughout.
Oak-Pine		Red and White Oak, Eastern White Pine and White Ash with minor components of Black Oak and Eastern Red Cedar.
Beech-Maple	Northern Section	Sugar Maple, Black Maple, American Beech and Yellow Birch dominant with Black Walnut and Bitternut Hickory. Scattered Tuliptrees, Red Oak and Sassafras are also found.
	Southern Section	Sugar Maple, Basswood, American Beech and Shagbark Hickory, with scattered Tuliptrees, Red Oak and Sassafras.
Sloughs		Silver Maple (*Acer saccharinum*), Black, Red and White Ash and Buttonbush (*Cephalanthus occidentalis*).
Transition	Northern	Black and Red Oak, Black Walnut, Butternut and Eastern White Pine in the east, gradually replaced by Sugar Maple and American Beech in the west.
	Southern	Black and Red Oak, Black Walnut, Butternut and Eastern White Pine in the east, gradually replaced by White Ash in the west.

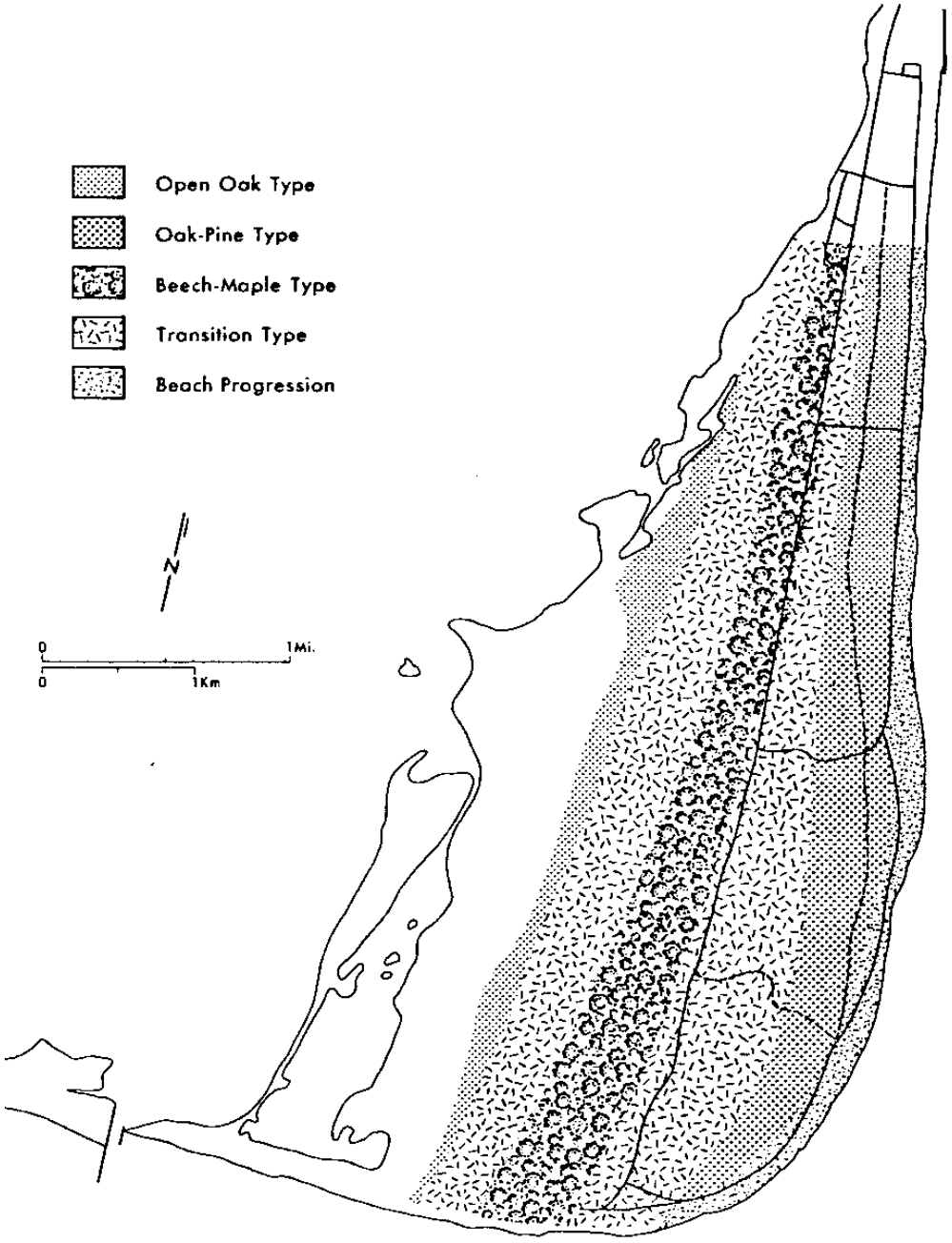

Figure 20. Forest classification by Kenney

3.4.5 T.S. Dai, D.G. Stevens and D.W. Smith 1975

In 1975, W.E. Coates and Associates were contracted by the Ministry of Natural Resources to produce a *Background Report on Rondeau Provincial Park* (1977) as part of the management planning process. They in turn contracted Four Seasons Ecological Consultants (Dai, Stevens and Smith) to conduct field surveys and complete a report on the park's vegetation communities, which they completed in 1975. The results of their work are provided in their own report (Dai *et al*. 1975) and summarized in W.E. Coates and Associates (1977).

Dai *et al*. (1975) completed their report based on a review of existing literature, aerial photo interpretation and ground surveys. They developed their own classification of the park's vegetation communities by recognising three structural types – forest, wetland and beach. Each of these structural types was then further subdivided into a number of communities based on dominant species. Table 7 summarizes the structural types and vegetation communities recognized by Dai *et al*., and Figure 21 illustrates their locations within the park. Note that they did not recognize any beach/dune communities along the south beach.

Dai *et al*. (1975) indicated that the Vegetation Types found within the park reflect the environmental conditions prevailing at and since the time of vegetation colonization, and provided a detailed discussion on how succession would have established the vegetation communities that are found at Rondeau. They indicate that two types of vegetation succession occurred in the park - wetland succession and dry succession. According to their theory, the oldest ridge in the park would be the one occupied by Rondeau Park Road, and that wetland succession occurred west of this ridge while areas to the east would have developed through dry or sand dune succession.

They described wetland succession as beginning with deeper water (1-2 m) and submerged aquatic plants such as Water-milfoil (*Myriophyllum heterophyllum*), Common Coontail (*Ceratophyllum demersum*), etc. These plants promote deposition of silt because the rate of water movement is reduced in the vegetation patches, and the vegetation screens out and removes silt from the water. As the water becomes a bit shallower, colonies of floating plants such as Large Yellow Pond-lily (*Nuphar advena*), Fragrant Water-lily (*Nymphaea odorata*) and others would colonize and the broad leaves of these plants would shade the waters surface, resulting in the death of the submerged aquatics. Dead submerged aquatics and tissues from dead floating plants

would sink to the bottom and decay, accumulating layers of organic materials that would raise the bottom substrate. The resulting shallower water allows for the development of the cattail (*Typha spp*.) marsh. Deposition of silt and organic material would continue, and eventually the bottom substrate would build up over the water table and become suitable habitat for sedges and grasses. Open water eventually disappears and the soil becomes suitable for colonization by shrubs and trees. Shrub swamps or thickets develop in wet and muddy depressions as the pioneer elements of a forest and finally a wooded swamp develops with water-tolerant trees such as Silver Maple, Black and Red Ash and Yellow Birch.

Dry succession begins with the open strand or beach, which is colonized by early dune vegetation such as Golden Puccoon, Sagewort Wormwood and Little Bluestem. Then, as plants die and organic matter builds up in the soils developing an increasingly mature soil profile, the habitats progressed through the dune grassland, followed by an open oak-pine woodland, oak and oak-pine forest and eventually the final stable condition of mature forest communities including the mixed deciduous and the climax hard maple with beech and Basswood association.

Table 7. Vegetation communities of Rondeau by Dai *et al*. (1975)

Structure Type	Vegetation Communities	Description
Beach	Strand	Earliest vegetation along water front on east beach. Sea Rocket, Sagewort Wormwood and Golden Puccoon (*Lithospermum caroliniense*).
	Sand Dune	Beach dune that has been colonized by dune grasses including Beach Grass, Great Lakes Sand Reed (*Calamovilfa longifolia* var. *magna*), Little Bluestem; forbs (Golden Puccoon) and a few trees including Eastern Cottonwood (*Populus deltoides*) and Balsam Poplar (*Populus balsamifera*)
	Dune Grassland	Flat dune in SE corner of park, mainly grasses with little tree cover. Beech Grass, Great Lakes Sand Reed, Little Bluestem, Golden Puccoon, Sea Rocket and Eastern Cottonwood.
Forests	Mixed Deciduous-coniferous	Two distinct types – Oak Forest and Mixed Oak-Pine Forest
	Oak Dominant	NE portion of park, and in patches on west side. Dominated by Black, Red and White Oak, with some Bur Oak (*Quercus macrocarpa*). Low numbers of Easter Red Cedar and Eastern White Pine. Understory of Witch-hazel (*Hamamelis virginiana*), *Viburnum spp*. and dogwoods.
	Mixed Oak and Pine	Eastern side of park. Red and White Oak and Eastern White Pine dominated, with White Ash, Black Oak and Eastern Red Cedar also common. Understory of various woody shrubs and many of the grasses and forbs from the Sand Dune community.
	Maple-beech-basswood	Central portion of forest with high canopy. Two types – hard maple-beech forest and hard maple-basswood forest.
	Hard maple-beech forest	Narrow strip in mid-southern section of Park along south end of Rondeau Road. Sugar Maple and American Beech dominant with smaller numbers of White Ash, Basswood, Tuliptree, Sassafras and Red Oak. Understory of dry upland shrubs.

Structure Type	Vegetation Communities	Description
	Hard maple-basswood	Along and on both sides of Rondeau Road. Sugar Maple, Basswood and hickory dominated with Black Walnut, American Beech, Red Oak, Tuliptree, Sassafras, Blue Beech and Butternut and an understory of dry upland shrubs mixed with wetter species including Early Meadow-rue (*Thalictrum dioicum*), *Circaea sp*. and Sweet Cicely (*Osmorhiza claytoni*).
	Mixed deciduous	Central portion of Park, mainly in north end. Little species dominance with the greatest species diversity including Black Walnut, various hickories, Tuliptree, Hop Hornbeam, Sassafras, Basswood, American Beech, Sycamore, Yellow Birch, Black and Red Ash, various oaks and Sugar Maple. Rich understory with several ferns and flowering plants.
	Soft maple-ash	Hydric community in the sloughs in middle region of park. Dominated by Silver Maple and Black or Red Ash. Tuliptree and Sassafras also common. Shrub layer of Buttonbush, dogwood and Spicebush.
Wetland		Occupies western half of Park. Several communities based on water depth.
	Floating aquatic	1-2m deep water, mainly east of Marsh Trail. Mixture of Large Yellow Pond-lily, Fragrant Water-lily, pondweed, Water Smartweed (*Persicaria amphibia*) and Common Duckweed (*Lemna minor*).
	Cattail Marsh	Covers most of western section of wetland. Extensive pure stands of cattails and Giant Bur-reed (*Sparganium eurycarpum*), bulrushes *Scirpus spp*.), Common Reed (*Phragmites australis* ssp. *australis*) and Southern Wild Rice (*Zizania aquatica*).
	Sedge meadow	Colonies of a number of species of sedges along shore lines and in shallow water along with rushes and willow-herbs
	Dogwood-willow-buttonbush	Shrub thicket or shrub swamp on higher sections of marsh and underwater ridges including Common Winterberry (*Ilex verticillata*) and cattails.

Structure Type	Vegetation Communities	Description
	thicket	
	Submerged Aquatic	Mixture of Water Milfoil, Coontail, pondweeds (*Potamogeton spp*.) and Canada Water-weed (*Elodea canadensis*)

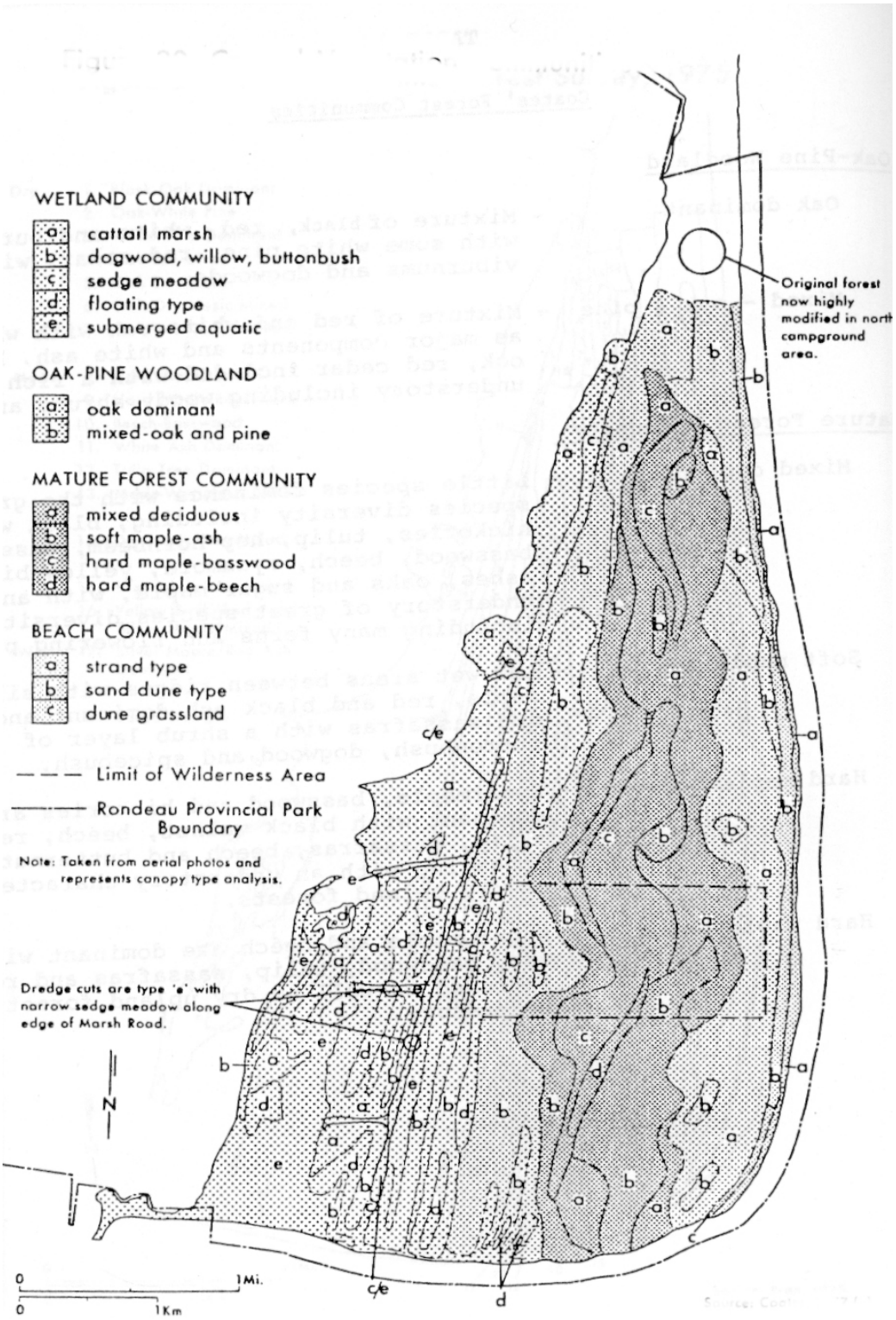

Figure 21. Vegetation communities designated by Dai *et al*. 1975.

3.4.6 Paul Pratt 1975

In 1975, park managers decided that an up-to-date methodical survey of the park's forest was needed to provide a benchmark for comparison with both future and previous studies (such as Carman 1928 and Bartlett 1958a). The study was conducted in February and March of 1975 by a four-person field crew and the results summarized later that year by Pratt in his *1975 Forest Inventory of Rondeau Provincial Park*.

The primary survey consisted of a 10% forest cruise conducted along eighteen, 30 m wide transects which ran in an east-west direction and were spaced 300 m apart. All trees and shrubs with a diameter at breast height (dbh) of 10 cm or more were recorded by diameter class and species for each 60 m section of the transect. At the end of each 60 m section, a 1.8 X 1.8 m regeneration plot was surveyed in which all trees, shrubs and seedlings were tallied by species and height class.

A rough map was made of the location of all sloughs, ridges and exceptionally large trees. All fallen trees over 10 cm dbh were also recorded by diameter class and species. Since the survey was done in the winter, data collection focused on trees and shrubs and not herbaceous plants. A limited amount of deer browse data were also collected using methods similar to Bartlett (1958a).

The data were analysed by separating overstory trees (greater than 40 cm dbh) from understory composition, and graphically summarizing the results on a 1:4000 scale map. The completed classification resulted in 18 communities, grouped by moisture regime (Dry, Mesic and Wet). Table 8 summarizes the dominant tree composition of each of the forest communities, and Figure 22 illustrates their distribution within the park.

The fallen tree data indicated that the basal area of the fallen trees accounted for 5.7% of the standing live trees. The predominant species blown down were Silver and Red Maple, Basswood and Red Oak, all of which also represented the greatest basal area in the remaining standing trees.

Regeneration plots indicated that Hop Hornbeam, Blue Beech, hard maple, White Ash and American Beech had high regeneration rates, while all other species showed significantly lower rates. Soft maples, Basswood and the oaks were present in very low numbers along with Shagbark Hickory, Wild Black Cherry, Sassafras and Yellow Birch.

Sycamore, Butternut, Black Walnut and Eastern White Pine were absent from the regeneration plots.

The deer browse survey showed a much heavier reliance on Hop Hornbeam, Blue Beech, Spicebush and dogwood spp. and a much lower reliance on hard maple than in previous surveys. This indicates a shift in browsing habits from typically favoured species such as hard maples to less palatable species. Pratt suggested that this shift in browsing habits may actually be the result of the higher level of regeneration in the non-palatable species and the corresponding drop in abundance of normally preferred browse.

Table 8. Vegetation communities assigned by Pratt 1975.

Moisture Requirement	Forest Community	Composition
Dry	Black Oak dominant	Black Oak dominated with White Oak, White Ash and Eastern White Pine associates and an understory of Black Oak, White Ash and Basswood
	Oak-White Pine	Eastern White Pine, Black Oak and Red Oak with an understory of Black Oak, White Ash and Eastern White Pine
	White Pine dominant	Eastern White Pine dominant with Black Oak, White Ash and American Beech associates and an understory of White Ash, Eastern White Pine and Basswood
	Oak –Sassafras	Mixed oaks with some Sassafras and an understory of Sassafras with some mixed oaks
	Oak dominant	On the east side of park an overstory of Red Oak, Black Oak or rarely White Oak and an understory of White Ash, Basswood and Hop Hornbeam. On west side an overstory of Red, White or Black Oak with an understory of Red Oak and Red and White Ash.
	Oak-Dry mesic mixed	In the east, overstory of oak, Tuliptree, Eastern White Pine with an understory of Blue Beech and Hop Hornbeam. In the west and south, Red Oak and American Beech dominate the overstory. High species diversity.
	Oak-wet mesic mixed	High species diversity. In east, overstory is Red Oak with White Ash and/or Basswood occasionally and some Black Walnut and/or Butternut and an understory of Basswood, White Ash or Soft Maple. In the west, overstory is Red Oak, soft maples or Red Ash with an understory of Red Ash and Yellow Birch.
Mesic	Hard maple-beech	The classical climax forest which is restricted to the higher ridges in the central portion of the park. Relatively low species diversity.

Moisture Requirement	Forest Community	Composition
	Hard maple-Basswood	Sugar Maple and Basswood with some American Beech as an associate.
	Beech-Basswood	American Beech and Basswood with a variety of associates.
	White Ash dominant	White Ash with minor associates such as oak, Basswood, Eastern White Pine or Tuliptree.
	Tuliptree dominant	Overstory of Tuliptree and Red Oak with White Ash, Black Walnut and/or Bitternut Hickory. Strong understory component of Tuliptree.
	Mesic-wet mesic mixed	Mixture of White Ash, Sugar Maple, Basswood and American Beech.
	Dry mesic-wet mixed	Mixture of dry to wet forest types
	Wet mesic-wet mixed	Forested sloughs of soft maples, Red Ash or Yellow Birch with White Ash or Basswood.
	Yellow Birch/Red Ash/Silver Maple mixed	Ash/soft maple forest with Yellow Birch
Wet	Silver Maple/Red Ash dominant	Soft maple and Red Ash dominant sloughs
	Large sloughs	Open sloughs without tree cover.

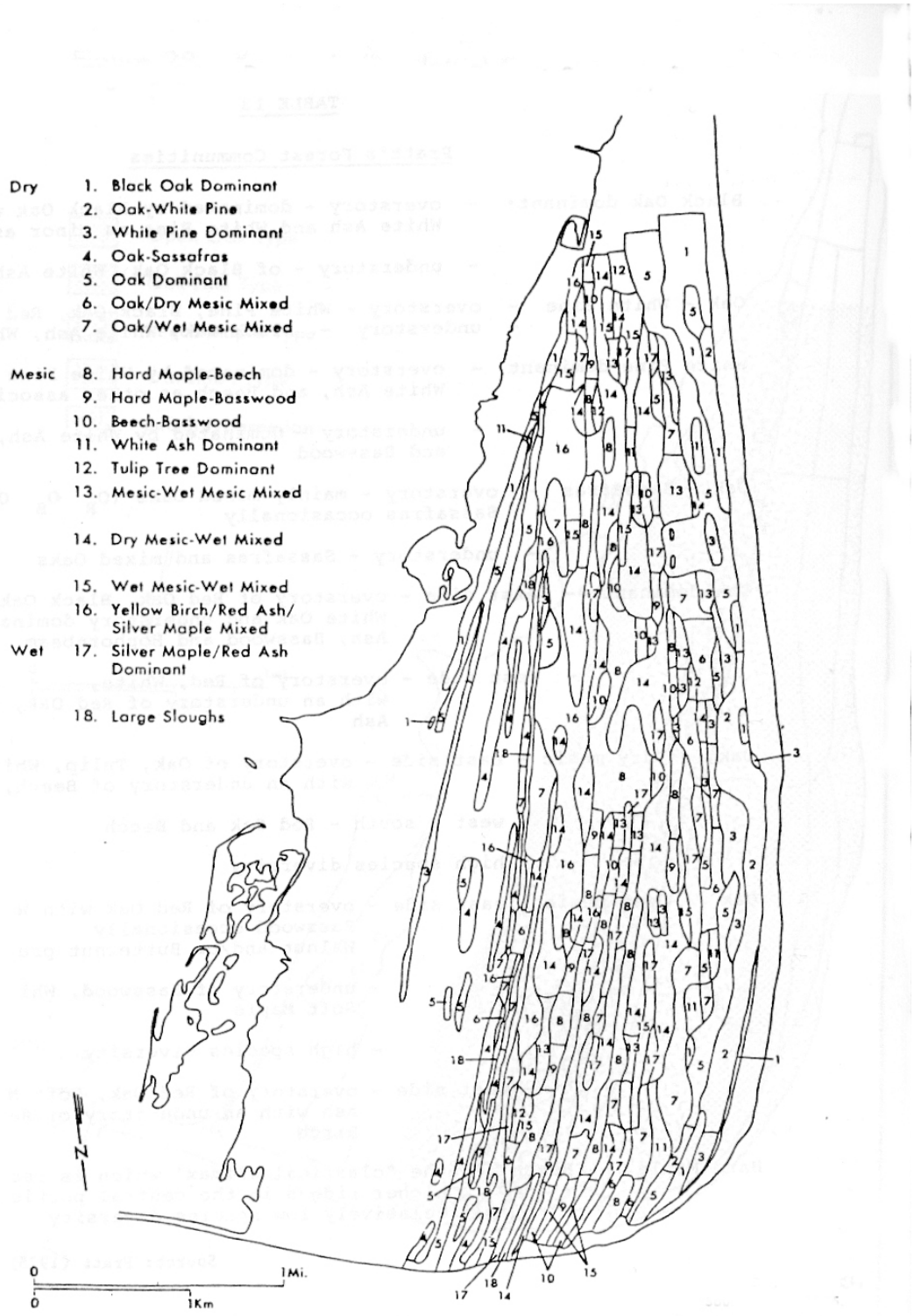

Figure 22. Forest classification by Pratt. (From Mann 1978)

3.4.7 Edward Haggith 1982

Edward Haggith conducted an assessment of the composition and structure of a segment of the Rondeau forest for his MSc. thesis at the University of Toronto. He utilized 78-10X20 m plots, each with 20-1X1 m quadrats, which were distributed equally throughout the dry, mesic and wet forest communities identified by Pratt (1975). Within each quadrat he conducted a regeneration study where all living tree seedlings less than 1.4 m in height were tallied by species, and every living or standing dead tree greater than 1.4 m in height was identified and the dbh, status (dead or living) and height recorded.

Haggith then analysed the data using detrended correspondence analysis based on species composition and stand height. The analysis indicated that there were three distinct forest communities in Rondeau - Blue Beech, Black Oak and Sugar Maple. He further subdivided the Black Oak community into a number of sub-communities. Table 9 lists the three communities and four sub-communities along with their dominant species. Unfortunately, Haggith did not map his forest communities.

The analysis also found that the lower portion of the canopy had a lower species diversity than the upper canopy – indicating a lack of regeneration for some tree species. He attributed this to selective browsing by White-tailed Deer. Haggith theorized that due to the lack of regeneration in some species, there will be a slow shift in the forest composition with the eventual disappearance of Shagbark Hickory, Black Walnut, Eastern White Pine, Wild Black Cherry, White Oak, Red Oak, Black Oak and Sassafras. Instead, the forest will become dominated by Sugar maple, Blue Beech, White Ash and Hop Hornbeam with a much reduced diversity (Haggith 1981, 1982).

Haggith also found that the height of the canopy in the lowland Blue Beech community was decreasing. This appeared to be the result of the loss of typically taller tree species that have disappeared from the canopy and were replaced by the predominantly shorter Blue Beech, which is generally considered to be a sub-canopy species.

Table 9. Forest communities of Rondeau by Haggith 1982.

Community	Sub-community	Dominant Species
Blue Beech		Overstory of Blue Beech, White Ash, Black Walnut, Tuliptree, White Oak and Basswood. Understory dominated by Blue Beech, with Tuliptree, White Ash, Bitternut Hickory and Basswood.
Black Oak		
	Black Oak	Overstory dominated by Black Oak and Eastern White Pine, understory of White Ash, Hop Hornbeam and Choke Cherry.
	Hop Hornbeam	Overstory of Hop Hornbeam and Black Oak, with understory of Hop Hornbeam, Choke Cherry (*Prunus virginiana*) and some White Ash and Sugar Maple.
	White Ash	Overstory of White Ash, Black Oak and a few Eastern White Pine and an understory dominated by White Ash with some Sugar Maple, Tuliptree, Choke Cherry and Sassafras.
	Transition	Overstory of Sugar Maple, White Ash, Eastern White Pine, Hop Hornbeam and Black Oak, with an understory of Sugar Maple, Hop Hornbeam, American Beech and some Blue Beech , Tuliptree and Basswood.
Sugar Maple		Overstory a mix of Sugar Maple, American Beech, White Ash, Hop Hornbeam, Eastern White Pine, Wild Black Cherry, Red Oak and Basswood and an understory dominated by Sugar Maple with American Beech, Hop Hornbeam and Basswood.

Chapter 4: Methods

This report summarizes information obtained during targeted field work initiated specifically for this purpose, as well as research and monitoring efforts conducted by Ontario Parks or other OMNR staff and other individuals, governmental organizations

and ENGOs. Every attempt was made to gather and obtain existing data from park files or other sources. Work specifically initiated as part of the Life Science Inventory includes an Ecological Land Classification (ELC), some focussed botanical inventories and a small mammal trapping study.

Other ongoing monitoring and research conducted by park staff and included in the LSI includes breeding bird surveys, salamander cover board monitoring, annual butterfly count data, turtle mark/recapture and radio telemetry studies and Fowler's Toad (*Anaxyrus fowleri*) monitoring.

Studies conducted or lead by individuals other than Ontario Parks staff include the Marsh Bird Monitoring Program, Breeding Bird Atlas and numerous university M.Sc. and PhD. research projects.

Methods for some of these initiatives are provided here while others can be found in documents as referenced.

Chapters 5-7 provide a discussion of the life science values in the park, and checklists of the various taxa are provided in the appendices. Species in the checklists are ranked by their provincial S-ranks as defined by the Natural Heritage Information Centre (summarized in Appendix 1). Species identified as Special Concern, Threatened or Endangered under the *Endangered Species Act (2007)* are also listed with their status as shown on the current *Species at Risk in Ontario List* (SARO list).

4.1 Current Field Investigations

4.1.1 Ecological Land Classification and Botanical Surveys

Field work for the Ecological Land Classification (ELC) was carried out during the spring, summer and fall of 2003. During the winter of 2002-2003, North-South Environmental was contracted to delineate polygons based on desktop interpretation of the 2001 ortho-rectified air photos. Small-scale maps with ortho-photographs and polygon lines were prepared for field work and shapefiles were loaded onto a Trimble GeoExplorer GPS unit to assist field staff with navigation to each pre-delineated polygon.

Each polygon in the park was visited and assessed using the standard methods outlined in the *Ecological Land Classification for Southern Ontario* (Lee *et al*. 1998).

Data were collected for each polygon and the polygon was assigned to the ELC Ecosite or Vegetation Type level as appropriate using the community names and codes found in the updated list in catalogue 8 (Lee 2008). Any changes in polygon boundaries were noted (adjustments to boundary on the ground or splitting/joining of polygons) on the paper maps to be corrected on the GIS at a later date.

As field work progressed, it became apparent that some of the Ecosite/Vegetation Types were very common and found throughout the park. As such, the community descriptions provided in this report (Chapter 5) represent a compilation of conditions across the polygons for each type. However, after several of each community type were well surveyed, new polygons that were obviously of the same types were not fully sampled, but rather were quickly evaluated to confirm the community type and to look for new plant species to be included in the community description.

Data were summarized by community type and community descriptions developed that would reasonably represent all polygons of each community type in the park (Chapter 5). Adjusted polygon lines were updated in the GIS and the attribute tables populated with community types to facilitate mapping.

Botanical surveys were conducted as part of the ELC field work, with additional focused surveys carried out by David Bradley. These surveys were intended to help bolster the species lists for the ELC but also had some focus on searches for regionally or provincially significant plant species.

4.1.2 Small Mammal Trapping Survey

In 2003, a small mammal trapping project was conducted to increase our knowledge of the small mammal species found within the park, and to determine which species were associated with various habitat types. The study included a total of over 2500 trap nights at 21 sites covering all of the major habitat types from forest to woodland, savannah, dune, thicket and meadow marsh communities (Figure 23).

In order to allow for comparison with other small mammal studies, and in particular the Ontario Ministry of Natural Resources Wildlife Assessment Program (WAP), the Rondeau study used methods that were consistent with the WAP methodologies (Sugar *et al*. 2003). For a complete summary of methods used in the Rondeau study, see Dobbyn and Pasma (2003).

Each trapline consisted of 20 traps, organised in pairs. Each pair of traps was placed within 2 m of each other, and the distance between pairs was approximately 10 m. The pairing of traps was done to help prevent trap saturation as a result of recaptured individuals. Traps used in the study were non-folding aluminum Sherman live traps (H.B. Sherman Traps, Inc., Tallahassee, Florida) with dimensions of 3 X 3.5 X 9 inches. Each transect was sampled for two, three-night periods, separated by 1-5 nights for a total of 6 trap nights per transect.

4.1.3 Breeding Bird Surveys

Breeding bird surveys were initiated within the park in 1991 to assess the impacts of the hyperabundant deer population on various song bird species and populations. Surveys were conducted in 1991 and 1993 by the Long Point Bird Observatory (now Bird Studies Canada) (Bowles and Gartshore 1992, Gartshore 1994). The original study included fifteen sites of five stations each. In 1998, regular monitoring of thirteen of the original fifteen sites was resumed as part of the Prothonotary Warbler monitoring program conducted in the park by the recovery team and coordinated by Bird Studies Canada (Figure 24). From 2000 to 2005, monitoring of the same sites was carried out by the park biologist.

Monitoring was conducted using methods based on the Canadian Wildlife Service's *Forest Bird Monitoring Program* (FBMP) (Cadman *et al*. 1998, Schalk *et al*. 2002). Permanent stations were established in 1991 and have been maintained since that time to ensure consistency. Stations are marked with a permanent blue tag and usually three colours of flagging tape (pink/yellow/blue). Flagging tape was refreshed each or every other year and blue tags were replaced as necessary or moved from fallen trees to the closest standing live tree. Directions to each site and station can be found in Dobbyn (2006).

Surveys were conducted on favourable mornings (no rain or winds) beginning at approximately 0530h and finished before 1000h (generally by 0900h). Ten-minute point counts were conducted at each of the survey points twice during the breeding season (May 24 to July 10) with a minimum of six days between successive counts. Normally, two sites (10 stations) would be surveyed in a single morning by one birder. After an initial minute of quiet following arrival at the station, the ten-minute point count (unlimited distance) would begin. All birds detected by sight or sound were recorded on a data card on which a circle was drawn representing a 100 m radius circle from the

station centre. Birds were recorded on the data card in a position meant to represent their relative location in the forest using the standard four letter code for each species. Particular attention was paid to whether each bird was (or appeared to be) within or outside of the 100 m radius.

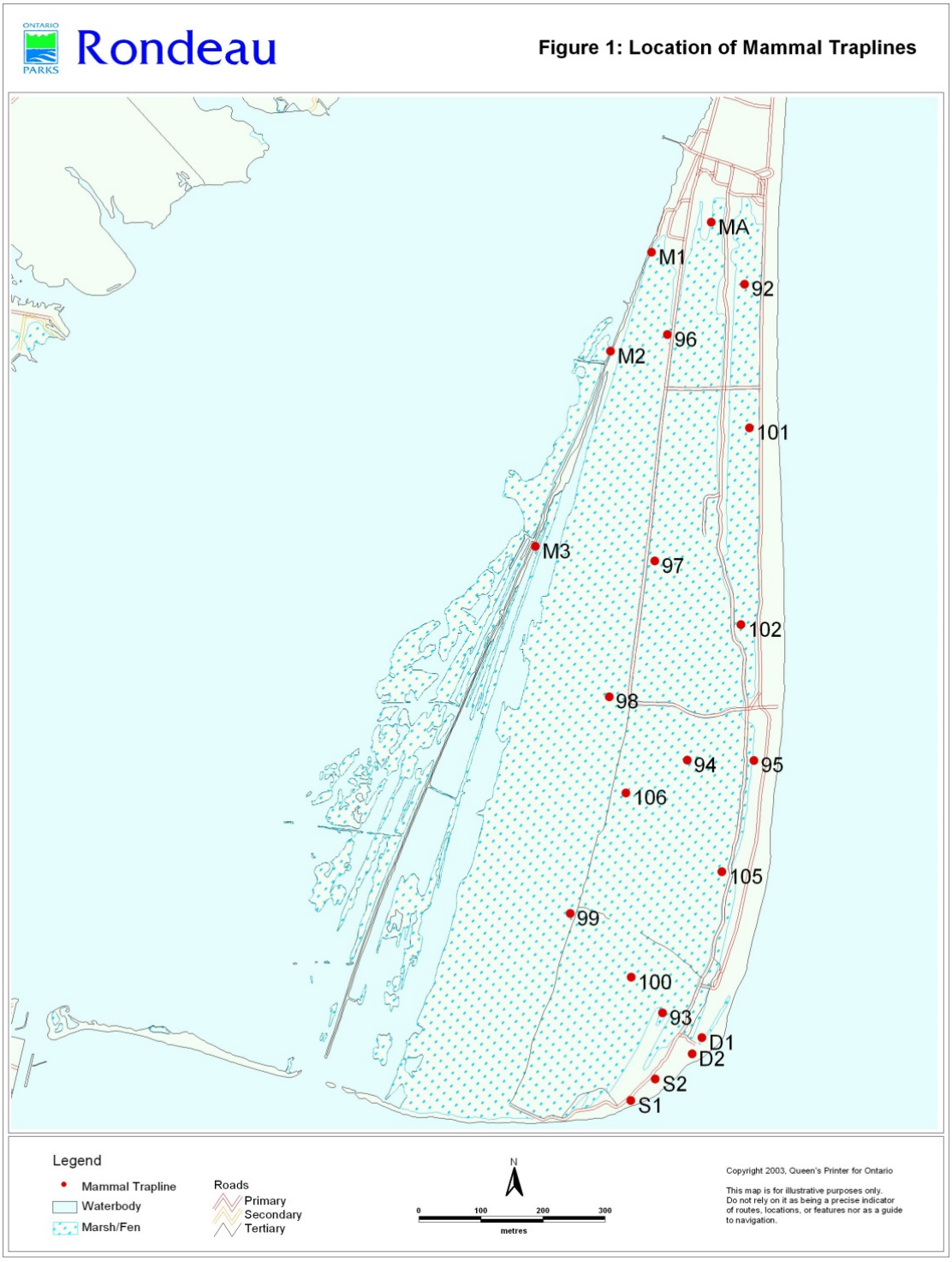

Figure 23. Location of traplines (From Dobbyn and Pasma 2003)

Use of the circle data card allowed for better tracking of individuals of one species, e.g., birds that moved during the ten-minute point count were shown as moving on the data card by means of an arrow. Beginning in 2001, birds were also recorded relative to which five-minute interval of the full ten-minute point count in which they were *first* detected. An “a” denoted the first five-minute interval and a “b” the second five-minute interval.

After each morning, birds were summarized for each station within and outside the 100 m radius and in the first or second five-minute interval (four categories) for submission to the FBMP program. For park purposes, the data were further grouped to represent the maximum number of individuals of each species detected on either count for each station. For a complete description of methods and instructions for establishing sites, see Cadman *et al*. (1998) and/or Schalk *et al*. (2002).

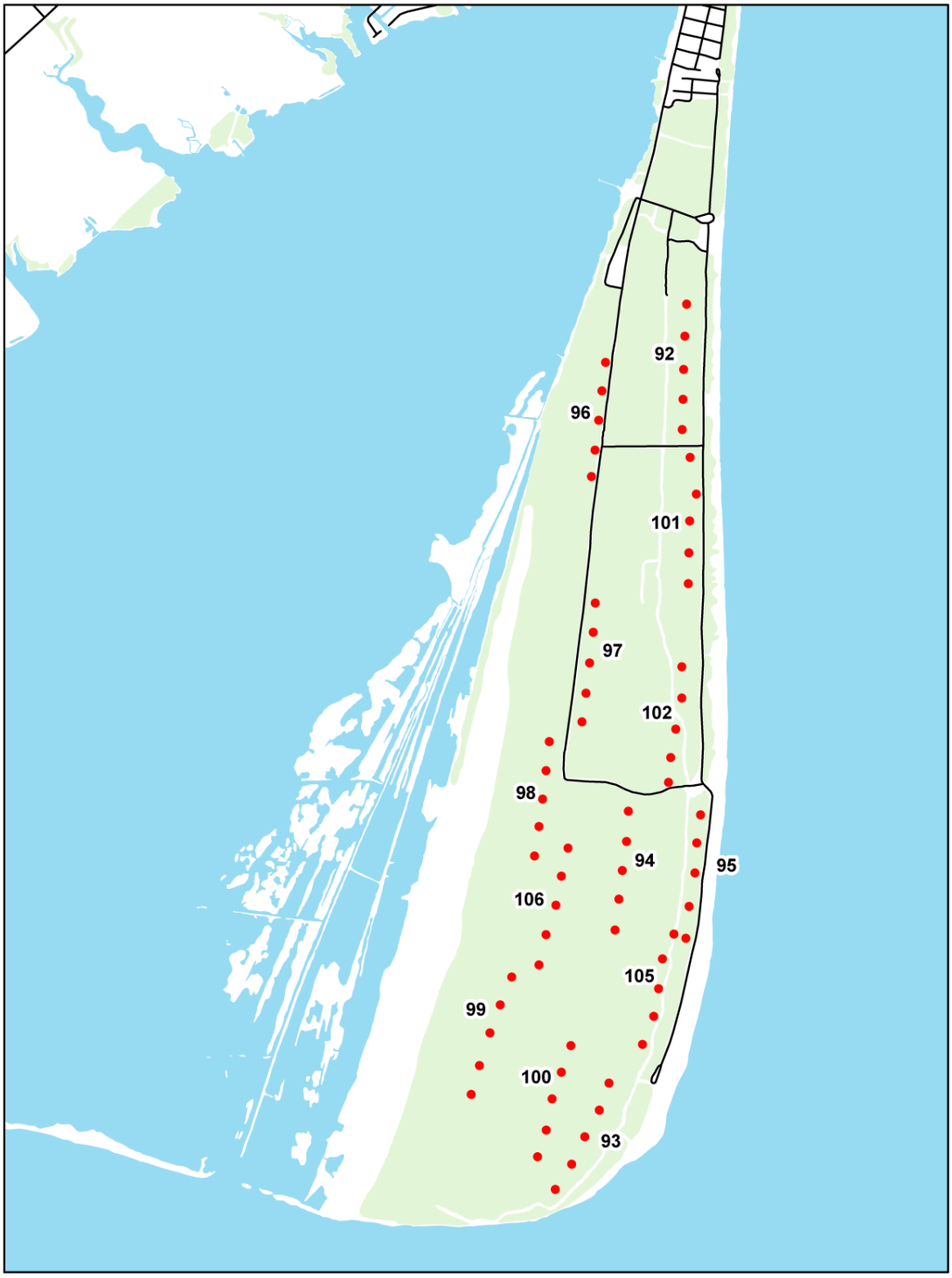

Figure 24. Location of current Forest Bird Monitoring plots within Rondeau

4.1.4 Salamander Coverboard Survey

In 2002, a salamander coverboard study was implemented within the park. Methods followed Sugar *et al.* (2001), except that boards were placed in transects spaced 10 m apart rather than in grids (due to the ridge/slough topography of the park). Originally, four sites of 50 cover boards were established in 2002, but an additional five sites of 50 boards were added for the 2005 season. Sites coincided with the Forest Bird Monitoring routes with the first coverboard being placed at FBMP station A, and then boards placed 10 m apart following the FMBP route in a southerly direction. The initial four salamander sites were at FBMP sites 94, 96, 99 and 106 and the new sites were established at FBMP sites 95, 97, 101, 102 and 105 (see Figure 23).

Coverboards used in the program were of the “Davis” modified design which uses a base board with two boards (each half the size of the bottom board) on top with spacers between the top and bottom boards (Figure 25). The lumber used was barn board grade (unplaned).

Coverboards were monitored at varying intervals in time to try and assess the best season and visit interval. Originally, boards were monitored every 2-3 weeks during the summer months; however, in 2004, monitoring was conducted every 7-10 days from the beginning of April until the end of September to determine when the peak numbers of salamanders were detected and to determine if a longer interval of time could be used. Based on the results it was determined that monitoring could be limited to approximately 5-6 times per year beginning in April, but with a slight concentration in August and September.

At each visit, each coverboard was first checked for the presence of animals between the top and bottom boards by quickly but carefully lifting off the top two boards, and then checking under the entire coverboard by flipping up the bottom board. All animals were noted by species and where they were within the coverboard (e.g., in the wider space or the narrower space between the boards or under the entire coverboard). Animals were disturbed and handled as little as possible, and left in place if it was safe to replace each board without crushing them. Coverboard monitoring has provided records for three species of salamanders as well as for several frog and snake species and the Common Five-lined Skink (*Plestiodon fasciatus*).

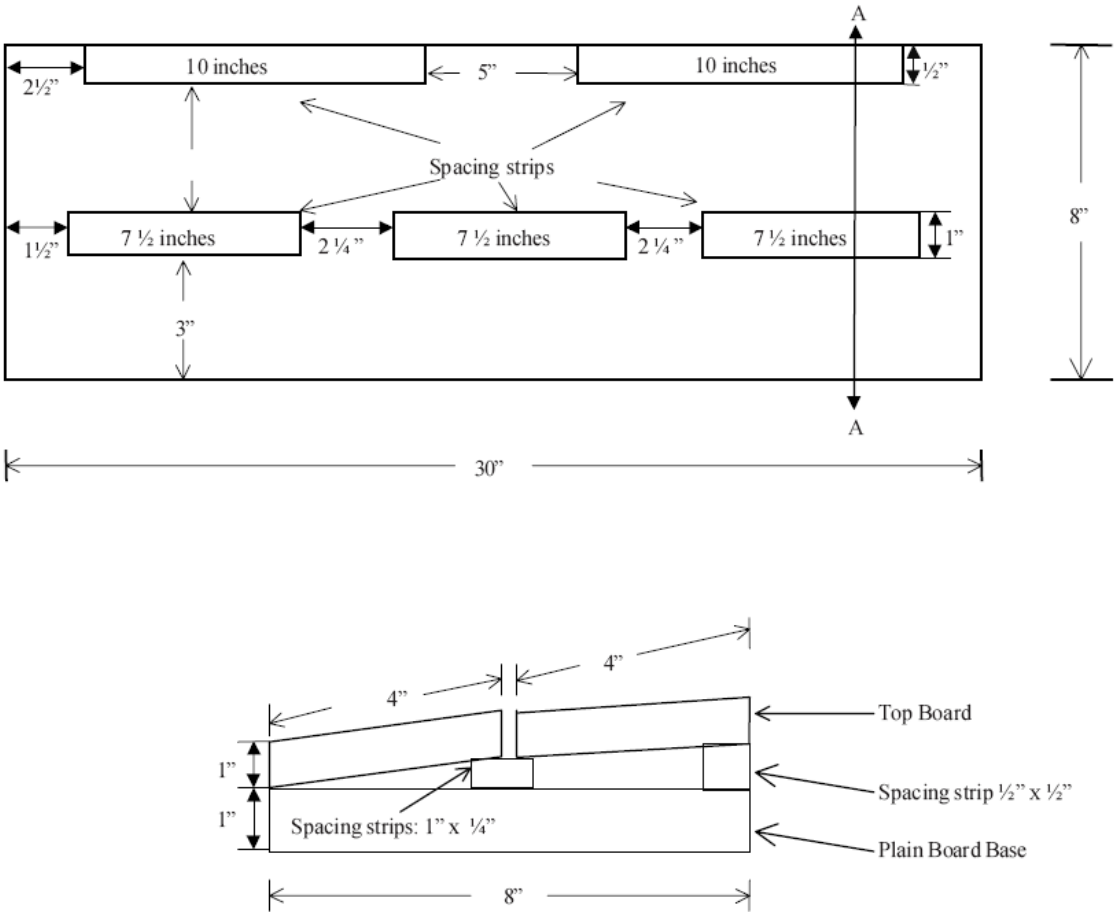

Figure 25. The Davis style salamander cover board.

4.2 Other Monitoring or Inventory Projects

4.2.1 Turtle Studies

Mark/recapture and radio-telemetry studies have been conducted on various turtle species within the park which have assisted in determining preferred habitats and home range size, and some findings are included in Chapter 7. Methods can be found in other reports (Dobbyn and Smith 2005, Dobbyn and Marchand 2007).

4.2.2 Fowler's Toad

Ontario Parks staff have been involved with the Fowler's Toad Recovery Team for several years and have coordinated monitoring for toads within the park. Monitoring by park staff was initiated in 2004 and is ongoing. A summary of the ongoing monitoring is provided in Chapter 7 and further detail including monitoring methods can be found in Dobbyn (2005a).

4.2.3 Butterfly Count

Rondeau Provincial Park has been participating in the North American Butterfly Association's volunteer-based annual "July 1st Butterfly Count" since 1999. The Rondeau count typically occurs on the second Sunday in July with between 16 and 30 observers. For information on the NABA count, methods and criteria see NABA (2011). Count results have contributed to the park butterfly checklist and the status of some species within the park, which are presented in Chapter 7 and Appendix 7.

4.2.4 Opportunistic or Incidental Data

Other faunal records have been obtained through opportunistic and incidental observation, or short focussed field trips. As well, first time occurrences of all taxa are recorded at the park and most additional occurrences of Species at Risk and other provincially significant species are tracked. The park also benefits from visitor sightings which are submitted at the Visitor Centre.

4.3 Other Ecological Inventory or Research Projects

4.3.1 Breeding Bird Atlas

The Atlas of the Breeding Birds of Ontario has been a two-time project where volunteers surveyed 10X10 km UTM grid squares (Square) actively searching for evidence of breeding birds in order to provide a snap-shot in time of breeding bird distribution in Ontario. The first atlas was based on field work between 1981 and 1985 and the second one between 2001 and 2005 (Cadman *et al*. 1987, Cadman *et al*. 2007). Rondeau Provincial Park sits at the cusp of four 10X10 km UTM squares and was rigorously sampled during both atlas time periods. Bird Atlas methodologies called for a minimum of twenty hours of sampling in each Square, however, most Squares in the south received much more effort, including those at Rondeau.

Surveys were conducted by searching for the best possible evidence of breeding for each species detected in the Square. Breeding evidence was broken down into the three broad categories of Possible, Probable and Confirmed. Different types of evidence were assigned to each of these categories, e.g., a single male singing in suitable habitat would constitute Possible breeding evidence, but if the same male (presumed) was observed signing in the same general location on two occasions at least one week apart, then this would be considered a territorial male and suggest Probable breeding. Most activities that showed evidence of a pair, nest or potential nest were considered Probable breeding while evidence of eggs, young or feeding behaviour were considered Confirmed breeding evidence. Complete methods can be found in Cadman *et al*. (1987) and Cadman *et al*. (2007).

A great deal of information on breeding birds within Rondeau was acquired through the efforts of the two atlases, some of which has been used in this report (Chapter 7). Of note, however, is that during the first atlas, one of the Rondeau Squares (17MS28 – Rondeau Bay) had the highest number of recorded bird species during the atlas period in the entire province (146) (Cadman *et al*. 1987).

4.3.2 Marsh Bird Monitoring Program

The Marsh Bird Monitoring Program (MMP) is coordinated by Bird Studies Canada (BSC) as a bi-national monitoring program with the United States Environmental Protection Agency. The program is similar to the Forest Bird Monitoring Program in that it uses point counts to document the presence of birds that are primarily restricted to marsh habitats. Two surveys are conducted each year between May 20 and July 5, with at least ten days between visits. The MMP differs from the FBMP in that surveys can be done within the first 4-5 hours of the morning or the last four hours before sunset. The protocol also incorporates tape playback to elicit response from otherwise normally cryptic species or species that are primarily active at night. Eight species are considered the focal species of the program, which consist of American Bittern (*Botaurus lentiginosus*), American Coot (*Fulica americana*), Black Rail (*Laterallus jamaicensis*), Common Moorhen (*Gallinula chloropus*), King Rail, Least Bittern, Pied-billed Grebe (*Podilymbus podiceps*) and Virginia Rail (*Rallus limicola*) (MMP 2008).

The Marsh Bird Monitoring Program also has an amphibian monitoring component whereby point counts are used to document the presence of frogs. The frog surveys are conducted beginning a half hour after sunset and are conducted three times between

April 1 and June 15 (in the southern portion of the province) with at least 15 days between visits (MMP 2008b).

At Rondeau, the MMP has established seven bird monitoring routes and three amphibian routes. Full information on methods can be found in MMP (2008, 2008b).

4.3.3 External Research

A significant number of research projects have been conducted at Rondeau by external individuals and organizations, with an emphasis on graduate student projects. Between 2000 and 2010, 103 research authorizations have been issued to external researchers for work within the park. All research authorizations require that Ontario Parks receive reports on findings and copies of raw data which can be used for internal information purposes and for advising management decisions. Results of many of these studies have been consulted during the development of this report, and appropriate information included herein. Information on methods and full findings can be found within the sources cited with the data.

Chapter 5: Life Science Features – Vegetation Communities

A total of 102 unique Vegetation Types within 48 Ecosites were identified in 463 polygons in Rondeau Provincial Park. Of these, 86 of the Vegetation Types and 46 of the Ecosites represent the prevailing condition and have been mapped. The remaining seventeen communities are found only as complexes and/or inclusions, or could not be mapped (i.e., submerged communities in Rondeau Bay were large but could not be mapped from aerial imagery).

Wetlands had the highest number of unique community types, but the total area of communities was split roughly a quarter each for terrestrial and wetland, with aquatic (generally Rondeau Bay and Lake Erie) comprising the remaining half. Table 10 provides a breakdown of the number of communities by System (Terrestrial, Wetland and Aquatic), while Table 11 summarizes the total area of all communities by System, Class and Series. Table 13 provides a complete list of all community types documented within the park. An * in Table 3 denotes that the community is found only as a complex

or inclusion and is not mapped. Figures 26 and 27 illustrate Class and Series level ELC mapping respectively, and Ecosite and Vegetation Type level mapping is illustrated on the foldout map (back cover).

A number of the vegetation communities at Rondeau are considered provincially significant as denoted by S-ranks of S1, S2 or S3 by the Natural Heritage Information Centre. In total, nineteen communities have been identified as provincially significant, of which twelve are identified as S1. Significant communities have been identified with their S-rank in bold within the Vegetation Type field of Table 14. A further three communities are identified as S3S4 indicating that these communities may be provincially significant but that insufficient data exist at this time to confirm their status. Most of the significant communities are in the beach/dune and savannah/woodland classes.

Sections 5.1 to 5.4 provide community descriptions for all community types documented within Rondeau. It is important to note that an ELC mapping exercise is a snapshot in time. Field work for this evaluation was conducted in 2003 and was based on 2002 ortho-imagery. As such, there may already be some significant changes. For example, Common Reed has been expanding significantly throughout the marsh and some shallow marsh and meadow marsh communities may have been converted to Common Reed types. Conversely, an active spray program to control Common Reed has been conducted in some areas of the park which may have converted some existing or new Common Reed types back to a more natural type. Prescribed burning has also had a significant impact on some communities, and may be changing some forest types back to woodland or savannah and increasing the number of tallgrass species, effectively reverting these areas back into the natural fire-dependent tallgrass communities which were found prior to the policy of full fire suppression.

It is recommended that an updated ELC be conducted from time to time (i.e., every 15-20 years) and that updates of some community types be done more often (marsh communities and those communities subject to anthropogenic disturbance [dunes] or undergoing active management [prescribed burning, invasive species management]). Updates may not require an in-depth botanical inventory, but rather a simple classification evaluation to confirm or update the community type.

The community descriptions follow the Ecological Land Classification for Southern Ontario (Lee *et al*. 1998) and its latest update (Lee 2008). There were some Vegetation Types within the park that were not found in the current catalogue (Lee 2008), so in those cases, appropriate community names were created and added to the catalogue. These types generally have numbers of 20 or above. For example, the current catalogue does not list a Common Reed Shallow Marsh community on organic soils. Therefore, the *Common Reed Organic Shallow Marsh Type* has been created and assigned a Vegetation Type code of MASO1-20.

Vegetation is characterized in layers (strata) including the Canopy (generally, trees in forested communities), sub-canopy (trees with occasional shrubs), Understory (saplings, shrubs, vines) and Ground Layer (herbaceous plants and graminoids). In many instances, vines in the Understory (i.e., Western Poison Ivy and Virginia Creeper) intersperse with species in the Ground Layer and even occupy space that would have been used by the herbaceous species, but are included in the understory as woody vines.

Table 10. Breakdown of ELC Classes, Series, Ecosites and Vegetation Types

System and Total Areas	Number of Classes	Number of Series	Number of Ecosites	Number of Vegetation Types
Terrestrial (natural and naturalized)	7	12	25	38
Terrestrial (Constructed)	1	4	5	7
Wetland	2	4	13	49
Aquatic	2	3	5	8
Total	**12**	**23**	**48**	**102**

Table 11. Area (ha) of community by Community Series and Class

SYSTEM	CLASS	SERIES	Area (ha)
Terrestrial (857.6 ha)	Shoreline	Open Shoreline	16.9
Terrestrial (857.6 ha)	Sand Barren and Dune	Open Sand Barren and Dune	80.9
Terrestrial (857.6 ha)	Sand Barren and Dune	Shrub Sand Barren and Dune	5.6
Terrestrial (857.6 ha)	Sand Barren and Dune	Treed Sand Barren and Dune	12.5
Terrestrial (857.6 ha)	Meadow	Graminoid Meadow	4.7
Terrestrial (857.6 ha)	Meadow	Mixed Meadow	1.0
Terrestrial (857.6 ha)	Thicket	Deciduous Thicket	6.8
Terrestrial (857.6 ha)	Savannah	Deciduous Savannah	23.0
Terrestrial (857.6 ha)	Savannah	Mixed Savannah	1.0
Terrestrial (857.6 ha)	Woodland	Deciduous Woodland	89.7
Terrestrial (857.6 ha)	Woodland	Mixed Woodland	2.5
Terrestrial (857.6 ha)	Forest	Deciduous Forest	514.5
Terrestrial (857.6 ha)	Constructed	Commercial and Institutional	3.2
Terrestrial (857.6 ha)	Constructed	Green Lands	34.2
Terrestrial (857.6 ha)	Constructed	Residential	41.7
Terrestrial (857.6 ha)	Constructed	Transportation and Utilities	19.4

Wetland (775.3 ha)	Swamp	Deciduous Swamp	142.8
Wetland (775.3 ha)	Swamp	Thicket Swamp	108.9
Wetland (775.3 ha)	Marsh	Meadow Marsh	163.7
Wetland (775.3 ha)	Marsh	Shallow Marsh	360.0
Aquatic (1669.3 ha)	Open Aquatic	Open Water	1663.5
Aquatic (1669.3 ha)	Shallow Water	Submerged Shallow Aquatic	N/A
Aquatic (1669.3 ha)	Shallow Water	Floating-leaved Shallow Aquatic	5.7
Total Area			**3302.2**

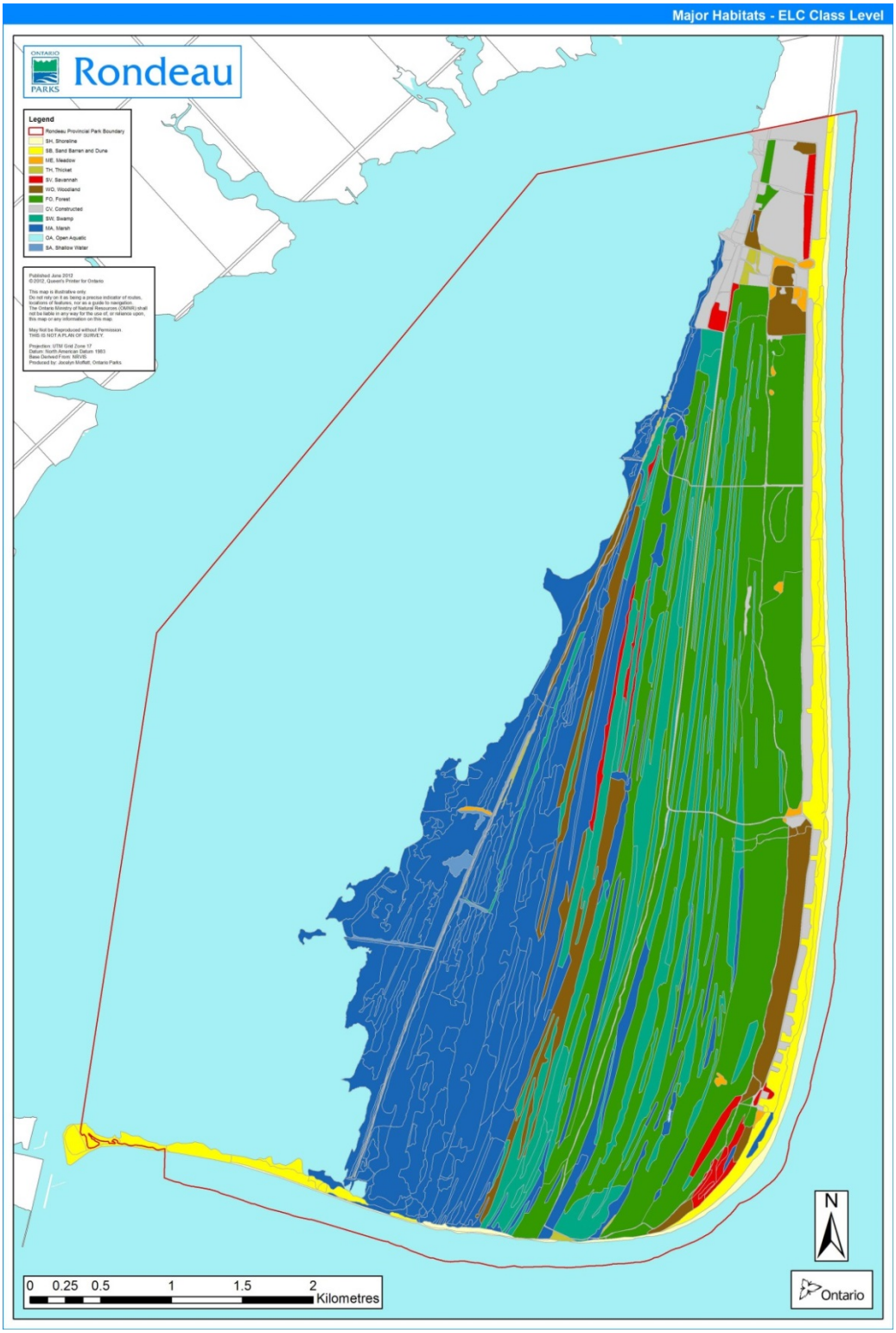

Figure 26. ELC Classes

Table 12. ELC community types of Rondeau Provincial Park. (N.B. an * denotes communities that are found only as complexes or inclusions and/or communities that could not be mapped. NHIC S-ranks have been added in bold within the VEGTYPE field when a community has been identified as being provincially significant as denoted by an S-rank of S1-S3)

SYSTEM	CLASS	SERIES	ECOSITE	VEGTYPE	Veg Code
Terrestrial	Shoreline	Open Shoreline	Mineral Open Shoreline Ecosite	Sea Rocket Sand Open Shoreline Type **S2S3**	SHOM1-2
Terrestrial	Sand Barren and Dune	Open Sand Barren and Dune	Open Sand Dune Ecosite	Little Bluestem - Switchgrass - Beachgrass Open Graminoid Sand Dune Type **S2**	SBOD1-1
Terrestrial	Sand Barren and Dune	Shrub Sand Barren and Dune	Shrub Sand Dune Ecosite	Willow Shrub Sand Dune Type	SBSD1-3
Terrestrial	Sand Barren and Dune	Treed Sand Barren and Dune	Treed Sand Dune Ecosite	Cottonwood Treed Sand Dune Type **S1**	SBTD1-1
Terrestrial	Sand Barren and Dune	Treed Sand Barren and Dune	Treed Sand Dune Ecosite	Mixed Anthropogenic Treed Sand Dune Type	SBTD1-21
Terrestrial	Meadow	Graminoid Meadow	Dry - Fresh Graminoid Tallgrass Prairie Ecosite	Dry Big Bluestem Graminoid Tallgrass Prairie Type **S1**	MEGM1-2
Terrestrial	Meadow	Graminoid Meadow	Dry - Fresh Graminoid Tallgrass Prairie Ecosite	Dry Indian Grass Tallgrass Prairie Type * **S1**	MEGM1-3
Terrestrial	Meadow	Graminoid	Dry - Fresh	Dry Mixed	MEGM1-4

SYSTEM	CLASS	SERIES	ECOSITE	VEGTYPE	Veg Code
		Meadow	Graminoid Tallgrass Prairie Ecosite	Graminoid Tallgrass Prairie Type **S1**	
Terrestrial	Meadow	Graminoid Meadow	Dry - Fresh Graminoid Meadow Ecosite	Canada Blue Grass Graminoid Meadow Type	MEGM3-2
Terrestrial	Meadow	Mixed Meadow	Dry - Fresh Mixed Meadow Ecosite	Dry - Fresh Graminoid - Goldenrod Mixed Meadow Type	MEMM3-1
Terrestrial	Meadow	Mixed Meadow	Dry - Fresh Mixed Meadow Ecosite	Dry - Fresh Mixed Meadow Type	MEMM3-2
Terrestrial	Thicket	Deciduous Thicket	Dry - Fresh Deciduous Shrub Thicket Ecosite	Gray Dogwood Deciduous Shrub Thicket Type	THDM2-4
Terrestrial	Thicket	Deciduous Thicket	Dry - Fresh Deciduous Shrub Thicket Ecosite	Dry - Fresh Raspberry Deciduous Shrub Thicket Type *	THDM2-8
Terrestrial	Thicket	Deciduous Thicket	Dry - Fresh Deciduous Shrub Thicket Ecosite	Dry - Fresh Barberry Deciduous Shrub Thicket Type *	THDM2-12
Terrestrial	Thicket	Deciduous	Dry - Fresh	Native	THDM4-1

SYSTEM	CLASS	SERIES	ECOSITE	VEGTYPE	Veg Code
		Thicket	Deciduous Regeneration Thicket Ecosite	Deciduous Regeneration Thicket Type	
Terrestrial	Thicket	Deciduous Thicket	Fresh - Moist Deciduous Thicket Ecosite	Gray Dogwood Deciduous Thicket Type	THDM5-1
Terrestrial	Thicket	Deciduous Thicket	Fresh - Moist Deciduous Thicket Ecosite	Fresh - Moist Spicebush - Blue Beech Deciduous Shrub Thicket Type *	THDM5-3
Terrestrial	Thicket	Deciduous Thicket	Fresh - Moist Deciduous Thicket Ecosite	Fresh - Moist Willow Deciduous Shrub Thicket Type *	THDM5-4
Terrestrial	Savannah	Mixed Savannah	Dry - Fresh Tallgrass Mixed Savannah Ecosite	Dry Black Oak - Pine Tallgrass Savannah Type **S1**	SVMM1-2
Terrestrial	Savannah	Deciduous Savannah	Fresh - Moist Tallgrass Deciduous Savannah Ecosite	Fresh - Moist Big Bluestem Deciduous Savannah Type **S1**	SVDM2-20
Terrestrial	Savannah	Deciduous Savannah	Dry - Fresh Deciduous Savannah Ecosite	Dry - Fresh Black Oak Tallgrass Savannah	SVDM3-23

SYSTEM	CLASS	SERIES	ECOSITE	VEGTYPE	Veg Code
				Type **S1**	
Terrestrial	Savannah	Deciduous Savannah	Fresh - Moist Deciduous Savannah Ecosite	Fresh - Moist Black Oak Deciduous Savannah Type **S1**	SVDM4-20
Terrestrial	Savannah	Deciduous Savannah	Fresh - Moist Deciduous Savannah Ecosite	Fresh - Moist Oak - Green Ash Deciduous Savannah Type	SVDM4-21
Terrestrial	Woodland	Mixed Woodland	Dry Pine - Oak Tallgrass Deciduous Woodland Ecosite	Dry White Pine - Oak Tallgrass Mixed Woodland Type **S1**	WOMM1-1
Terrestrial	Woodland	Deciduous Woodland	Dry - Fresh Oak Tallgrass Deciduous Woodland Ecosite	Dry Black Oak - White Oak Tallgrass Woodland Type **S1**	WODM1-1
Terrestrial	Woodland	Deciduous Woodland	Dry - Fresh Oak Deciduous Woodland Ecosite	Dry Black Oak Woodland Type **S1**	WODM3-2
Terrestrial	Woodland	Deciduous Woodland	Fresh - Moist Deciduous Woodland Ecosite	Fresh - Moist Oak - Sassafras Deciduous Woodland Type	WODM5-23
Terrestrial	Woodland	Deciduous	Fresh -	Fresh -	WODM5-24

SYSTEM	CLASS	SERIES	ECOSITE	VEGTYPE	Veg Code
		Woodland	Moist Deciduous Woodland Ecosite	Moist Green Ash Deciduous Woodland Type	
Terrestrial	Woodland	Deciduous Woodland	Fresh - Moist Tallgrass Deciduous Woodland Ecosite	Fresh - Moist Oak Tallgrass Woodland Type **S1**	WODM6-1
Terrestrial	Forest	Deciduous Forest	Dry - Fresh Oak Deciduous Forest Ecosite	Dry - Fresh Black Oak Deciduous Forest Type **S3**	FODM1-3
Terrestrial	Forest	Deciduous Forest	Dry - Fresh Oak - Maple - Hickory Deciduous Forest Ecosite	Dry - Fresh Oak - Hardwood Deciduous Forest Type	FODM2-4
Terrestrial	Forest	Deciduous Forest	Fresh - Moist Sugar Maple Deciduous Forest Ecosite	Fresh - Moist Sugar Maple - Lowland Ash Deciduous Forest Type	FODM6-1
Terrestrial	Forest	Deciduous Forest	Fresh - Moist Sugar Maple Deciduous Forest Ecosite	Fresh - Moist Sugar Maple - Hardwood Deciduous Forest Type	FODM6-5
Terrestrial	Forest	Deciduous Forest	Fresh - Moist Lowland Deciduous	Fresh - Moist Green Ash - Hardwood	FODM7-2

SYSTEM	CLASS	SERIES	ECOSITE	VEGTYPE	Veg Code
			Forest Ecosite	Lowland Deciduous Forest Type *	
Terrestrial	Forest	Deciduous Forest	Fresh - Moist Lowland Deciduous Forest Ecosite	Fresh - Moist Black Walnut Lowland Deciduous Forest Type **S2S3**	FODM7-4
Terrestrial	Forest	Deciduous Forest	Fresh - Moist Oak - Maple - Hickory Deciduous Forest Ecosite	Fresh - Moist Oak - Hardwood Deciduous Forest Type	FODM9-6
Terrestrial	Forest	Deciduous Forest	Fresh - Moist Carolinian Deciduous Forest Ecosite	Fresh - Moist Sugar Maple - Beech Carolinian Deciduous Forest Type	FODM10-1
Terrestrial	Forest	Deciduous Forest	Fresh - Moist Carolinian Deciduous Forest Ecosite	Fresh - Moist Oak Carolinian Deciduous Forest Type	FODM10-2
Terrestrial	Constructed	Green Lands	Recreational Open Space	Recreational Open Space	CGL_4
Terrestrial	Constructed	Transportation and Utilities	Highway	Paved Road	CVI_1-3
Terrestrial	Constructed	Transportati	Highway	Cart Track	CVI_1-4

SYSTEM	CLASS	SERIES	ECOSITE	VEGTYPE	Veg Code
		on and Utilities			
Terrestrial	Constructed	Transportation and Utilities	Disposal	Garbage and Recycling	CVI_2-1
Terrestrial	Constructed	Transportation and Utilities	Disposal	Vegetation Compost	CVI_2-2
Terrestrial	Constructed	Residential	Low Density Residential	Low Density Residential	CVR_1
Terrestrial	Constructed	Commercial and Institutional	Institutional	Institutional	CVC_1
Wetland	Swamp	Deciduous Swamp	Ash Mineral Deciduous Swamp Ecosite	Black Ash Mineral Deciduous Swamp Type	SWDM2-1
Wetland	Swamp	Deciduous Swamp	Ash Mineral Deciduous Swamp Ecosite	Green Ash Mineral Deciduous Swamp Type	SWDM2-2
Wetland	Swamp	Deciduous Swamp	Maple Mineral Deciduous Swamp Ecosite	Silver Maple Mineral Deciduous Swamp Type	SWDM3-2
Wetland	Swamp	Deciduous Swamp	Maple Mineral Deciduous Swamp Ecosite	Swamp Maple Mineral Deciduous Swamp Type	SWDM3-3
Wetland	Swamp	Thicket Swamp	Dogwood Mineral	Silky Dogwood	SWTM2-2

SYSTEM	CLASS	SERIES	ECOSITE	VEGTYPE	Veg Code
			Deciduous Thicket Swamp Ecosite	Mineral Deciduous Thicket Swamp Type **S3S4**	
Wetland	Swamp	Thicket Swamp	Dogwood Mineral Deciduous Thicket Swamp Ecosite	Gray Dogwood Mineral Deciduous Thicket Swamp Type **S3S4**	SWTM2-3
Wetland	Swamp	Thicket Swamp	Willow Mineral Deciduous Thicket Swamp Ecosite	Pussy Willow Mineral Deciduous Thicket Swamp Type *	SWTM3-5
Wetland	Swamp	Thicket Swamp	Mineral Deciduous Thicket Swamp Ecosite	Buttonbush Mineral Deciduous Thicket Swamp Type **S3**	SWTM5-1
Wetland	Swamp	Thicket Swamp	Mineral Deciduous Thicket Swamp Ecosite	Winterberry Mineral Deciduous Thicket Swamp Type * **S3S4**	SWTM5-6
Wetland	Swamp	Thicket Swamp	Mineral Deciduous Thicket Swamp Ecosite	Spicebush Mineral Deciduous Thicket Swamp Type **S3**	SWTM5-9
Wetland	Swamp	Thicket	Organic	Buttonbush	SWTO5-1

SYSTEM	CLASS	SERIES	ECOSITE	VEGTYPE	Veg Code
		Swamp	Deciduous Thicket Swamp Ecosite	Organic Deciduous Thicket Swamp Type **S3**	
Wetland	Marsh	Meadow Marsh	Graminoid Mineral Meadow Marsh Ecosite	Canada Blue-joint Graminoid Mineral Meadow Marsh Type	MAMM1-1
Wetland	Marsh	Meadow Marsh	Graminoid Mineral Meadow Marsh Ecosite	Cattail Graminoid Mineral Meadow Marsh Type	MAMM1-2
Wetland	Marsh	Meadow Marsh	Graminoid Mineral Meadow Marsh Ecosite	Reed Canary Grass Graminoid Mineral Meadow Marsh Type	MAMM1-3
Wetland	Marsh	Meadow Marsh	Graminoid Mineral Meadow Marsh Ecosite	Narrow-leaved Sedge Graminoid Mineral Meadow Marsh Type *	MAMM1-9
Wetland	Marsh	Meadow Marsh	Graminoid Mineral Meadow Marsh Ecosite	Common Reed Graminoid Mineral Meadow Marsh Type	MAMM1-12
Wetland	Marsh	Meadow	Graminoid	Rush	MAMM1-13

SYSTEM	CLASS	SERIES	ECOSITE	VEGTYPE	Veg Code
		Marsh	Mineral Meadow Marsh Ecosite	Graminoid Mineral Meadow Marsh Type	
Wetland	Marsh	Meadow Marsh	Graminoid Mineral Meadow Marsh Ecosite	Rice Cut-grass Graminoid Mineral Meadow Marsh Type	MAMM1-14
Wetland	Marsh	Meadow Marsh	Graminoid Mineral Meadow Marsh Ecosite	Bulrush Graminoid Mineral Meadow Marsh Type	MAMM1-15
Wetland	Marsh	Meadow Marsh	Graminoid Mineral Meadow Marsh Ecosite	Mixed Graminoid Graminoid Mineral Meadow Marsh Type	MAMM1-16
Wetland	Marsh	Meadow Marsh	Graminoid Mineral Meadow Marsh Ecosite	Broad-leaved Sedge Graminoid Mineral Meadow Marsh Type *	MAMM1-17
Wetland	Marsh	Meadow Marsh	Forb Mineral Meadow Marsh Ecosite	Jewelweed Forb Mineral Meadow Marsh Type	MAMM2-1
Wetland	Marsh	Meadow Marsh	Forb Mineral Meadow Marsh Ecosite	Mixed Forb Mineral Meadow Marsh Type	MAMM2-4

SYSTEM	CLASS	SERIES	ECOSITE	VEGTYPE	Veg Code
Wetland	Marsh	Meadow Marsh	Mixed Mineral Meadow Marsh Ecosite	Mixed Mineral Meadow Marsh Type	MAMM3-1
Wetland	Marsh	Meadow Marsh	Graminoid Organic Meadow Marsh Ecosite	Canada Blue-joint Graminoid Organic Meadow Marsh Type	MAMO1-1
Wetland	Marsh	Meadow Marsh	Graminoid Organic Meadow Marsh Ecosite	Cattail Graminoid Organic Meadow Marsh Type	MAMO1-2
Wetland	Marsh	Meadow Marsh	Graminoid Organic Meadow Marsh Ecosite	Rice Cut-grass Graminoid Organic Meadow Marsh Type	MAMO1-4
Wetland	Marsh	Meadow Marsh	Graminoid Organic Meadow Marsh Ecosite	Common Reed Graminoid Organic Meadow Marsh Type *	MAMO1-20
Wetland	Marsh	Meadow Marsh	Graminoid Organic Meadow Marsh Ecosite	Bulrush Graminoid Organic Meadow Marsh Type	MAMO1-21
Wetland	Marsh	Meadow Marsh	Forb Organic Meadow Marsh	Jewelweed Forb Organic Meadow	MAMO2-1

SYSTEM	CLASS	SERIES	ECOSITE	VEGTYPE	Veg Code
			Ecosite	Marsh Type	
Wetland	Marsh	Shallow Marsh	Graminoid Mineral Shallow Marsh Ecosite	Cattail Mineral Shallow Marsh Type	MASM1-1
Wetland	Marsh	Shallow Marsh	Graminoid Mineral Shallow Marsh Ecosite	Bulrush Mineral Shallow Marsh Type	MASM1-2
Wetland	Marsh	Shallow Marsh	Graminoid Mineral Shallow Marsh Ecosite	Broad-leaved Sedge Mineral Shallow Marsh Type	MASM1-5
Wetland	Marsh	Shallow Marsh	Graminoid Mineral Shallow Marsh Ecosite	Wild Rice Mineral Shallow Marsh Type	MASM1-6
Wetland	Marsh	Shallow Marsh	Graminoid Mineral Shallow Marsh Ecosite	Bur-reed Mineral Shallow Marsh Type *	MASM1-8
Wetland	Marsh	Shallow Marsh	Graminoid Mineral Shallow Marsh Ecosite	Canada Blue-joint Graminoid Mineral Shallow Marsh Type	MASM1-9
Wetland	Marsh	Shallow Marsh	Graminoid Mineral Shallow Marsh	Rice Cut-grass Mineral Shallow	MASM1-10

SYSTEM	CLASS	SERIES	ECOSITE	VEGTYPE	Veg Code
			Ecosite	Marsh Type	
Wetland	Marsh	Shallow Marsh	Graminoid Mineral Shallow Marsh Ecosite	Spike-rush Mineral Shallow Marsh Type	MASM1-11
Wetland	Marsh	Shallow Marsh	Graminoid Mineral Shallow Marsh Ecosite	Common Reed Mineral Shallow Marsh Type	MASM1-12
Wetland	Marsh	Shallow Marsh	Graminoid Mineral Shallow Marsh Ecosite	Reed Canary Grass Mineral Shallow Marsh Type	MASM1-14
Wetland	Marsh	Shallow Marsh	Graminoid Organic Shallow Marsh Ecosite	Cattail Organic Shallow Marsh Type	MASO1-1
Wetland	Marsh	Shallow Marsh	Graminoid Organic Shallow Marsh Ecosite	Bulrush Organic Shallow Marsh Type	MASO1-2
Wetland	Marsh	Shallow Marsh	Graminoid Organic Shallow Marsh Ecosite	Narrow-leaved Sedge Organic Shallow Marsh Type	MASO1-5
Wetland	Marsh	Shallow Marsh	Graminoid Organic Shallow Marsh	Broad-leaved Sedge Organic	MASO1-6

SYSTEM	CLASS	SERIES	ECOSITE	VEGTYPE	Veg Code
			Ecosite	Shallow Marsh Type	
Wetland	Marsh	Shallow Marsh	Graminoid Organic Shallow Marsh Ecosite	Spike-rush Organic Shallow Marsh Type	MASO1-8
Wetland	Marsh	Shallow Marsh	Graminoid Organic Shallow Marsh Ecosite	Bur-reed Organic Shallow Marsh Type	MASO1-9
Wetland	Marsh	Shallow Marsh	Graminoid Organic Shallow Marsh Ecosite	Rice Cut-grass Organic Shallow Marsh Type	MASO1-10
Wetland	Marsh	Shallow Marsh	Graminoid Organic Shallow Marsh Ecosite	Common Reed Organic Shallow Marsh Type	MASO1-20
Wetland	Marsh	Shallow Marsh	Graminoid Organic Shallow Marsh Ecosite	Mixed Graminoid Graminoid Organic Shallow Marsh Type	MASO1-21
Aquatic	Open Aquatic	Open Water	Pond Ecosite	Pond	OAWPO
Aquatic	Open Aquatic	Open Water	Lacustrine Ecosite	Lake	OAWLA
Aquatic	Open Aquatic	Open Water	Shallow Marsh Pond Ecosite	Shallow Marsh Pond Type	OAOPO
Aquatic	Shallow	Submerged	Submerged	Pondweed	SAS1-1

SYSTEM	CLASS	SERIES	ECOSITE	VEGTYPE	Veg Code
	Water	Shallow Aquatic	Shallow Aquatic Ecosite	Submerged Shallow Aquatic Type *	
Aquatic	Shallow Water	Submerged Shallow Aquatic	Submerged Shallow Aquatic Ecosite	Stonewort Submerged Shallow Aquatic Type *	SAS1-3
Aquatic	Shallow Water	Submerged Shallow Aquatic	Submerged Shallow Aquatic Ecosite	Water Milfoil Submerged Shallow Aquatic Type *	SAS1-4
Aquatic	Shallow Water	Submerged Shallow Aquatic	Submerged Shallow Aquatic Ecosite	Naiad Submerged Shallow Aquatic Type *	SAS1-9
Aquatic	Shallow Water	Floating-leaved Shallow Aquatic	Floating-leaved Shallow Aquatic Ecosite	Water Lily - Bullhead Lily Floating-leaved Shallow Aquatic Type	SAF_1-1

5.1 Community Descriptions - Terrestrial Systems (Natural and Naturalized)

Terrestrial systems consist of upland open, shrub, and treed communities. The average wetness index is typically greater than zero. Plant communities consist mainly of facultative, facultative upland, and upland plant species. The water table is rarely above the substrate. Vernal pooling composes less than 20% coverage. The substrates in Rondeau consist of mineral soil with organic material depth (far) less than 40 cm. The moisture regime is typically less than 5.

The terrestrial systems in Rondeau consist of shoreline, sand barren and dune, meadow, savannah, woodland and forest classes. Due to the ridge and slough configuration of the park, many terrestrial systems are interspersed with wetland systems.

5.1.1 Shoreline Class (SH)

Open Shoreline Series (SHO)

Rondeau is located on a sand spit and is surrounded on three sides by shoreline, two of which are dominated by sand or sand/cobble beaches. The east shore facing Lake Erie is generally sandy beach and exposed to wave and wind action. The south shore is a combination of small cobble/gravel beaches and sandy beaches, and is also exposed to wave and wind action. In general, substrate sizes become larger as you move from north and west to the southeast due to increasing wave energy. Significant portions of the south shoreline have succumbed to erosion and continue to be quite dynamic in nature.

Mineral Open Shoreline Ecosite (SHOM1)

These shorelines consist of unconsolidated mineral substrates. Dominant materials are less than 2 mm in diameter and the dominant substrate is sand. Plant cover varies from patchy and barren to open meadow but neither tree nor shrub cover exceeds 25%. These are active communities affected by aeolian processes and wave action. Active deposition is still occurring on the east beach, and the shoreline is moving eastward.

Sea Rocket Sand Open Beach Type (SHOM1-2)

This beach type extends almost the entire length of the park on the east and south sides of the peninsula, with only a few gaps along south beach which are classified in the Sand Barren and Dune Class. Vegetation is patchy and is dominated by Sea Rocket. Also found in these areas are *Sagewort Wormwood and Beach Grass*. On the inland edge of this community, Beach Grass becomes more prevalent and in many areas, particularly along the eastern shoreline, the open shoreline community transitions into the *Beach Grass - Sagewort Wormwood Open Graminoid Sand Dune Type* which is a narrow community that could not be mapped, but represents the transition between the open beach and the *Little Bluestem - Switchgrass - Beach Grass Open Dune Type*.

5.1.2 Sand Barren and Dune Class (SB)

Substrates in these communities are active, subject to aeolian processes, and their stability is variable. Generally, these communities are found just inland of the open beach type, but along south point where erosion has recently removed the open beach, these communities are now immediately adjacent to the lake and are being eroded by wave action, as well.

There is little to no accumulation of organic materials which leads to low nutrient availability. Vegetation Types in this class are subject to drought and temperature extremes. Vegetation cover varies from patchy and barren to more closed and treed. The dunes experience successional vegetation patterns in which fore-dunes contain patchy vegetation and primary and secondary dunes contain increasingly more frequent and diverse vegetation cover.

Open Sand Barren and Dune Series (SBO)

Sand substrates are covered with less than 25% tree cover and less than 25% shrub cover.

Open Sand Dune Ecosite (SBOD1)

Active rolling sand hills (< 2 m high) are formed by shoreline and aeolian processes. The stability of the substrate is most variable in open areas, where vegetation is absent. In the *Open Sand Dune Ecosite* there is little to no accumulation of organic matter and there is low nutrient availability. Vegetation is dominated by graminoid species and cover varies from barren and scattered to more continuous cover.

Little Bluestem - Switch Grass - Beach Grass Open Dune Type (SBOD1-1)

In Rondeau, long extensive stands of *Little Bluestem - Switch Grass- Beach Grass Open Dune* are found along the secondary sand dunes of the east and south shores of the park. All communities are found on sand substrates. Occasionally, there are open sandy areas mixed in as inclusions. Generally, tree cover is absent to very sparse, but in some areas tree cover (generally Black Oak) begins to increase on the westerly portion of this community along the east side of the park. This represents a transition zone and illustrates the gradual succession of the dune community to the savannah (SVDM3) and woodland (WODM) communities that would have been found immediately west of the dune communities in the absence of the cottages, and what is still found in the south-eastern portion of the park. Despite this increasing tree cover, the understory

in these transition areas remains the same as the rest of the community, still being dominated by dune grass species including Beach Grass, Little Bluestem and Switch Grass. This community is also complexed with the *Beach Grass - Sagewort Wormwood Open Graminoid Sand Dune Type*, which represents the transition between the open beach community and this one.

This vegetation community can be subdivided into two main types.

Type A: This community is only found along the south beach in the park, where the lack of moisture and strong winter winds keep the vegetation cover below 35%. It is a relatively rare community that experiences a low diversity of species. Of the species that are present, Little Bluestem, Indian Grass (*Sorghastrum nutans*), Sagewort Wormwood, Seaside Spurge and Russian Thistle (*Salsola kali*) dominate.

Type B: This community is found on the secondary dune, inland from the fore-dune, and is somewhat established, yet still subject to aeolian processes. Beach Grass is present on the easterly edge of this community where it is dominant on the foredune, but diminishes in importance and may even be absent in areas of the secondary dune. Vegetation cover is generally greater than 70%. Dominant species include Switch Grass, Little Bluestem, Beach Grass, Golden Puccoon, Indian Grass, Canada Wild Rye, Canada Bluegrass, Wild Bergamot (*Monarda fistulosa*), Big Bluestem, Common Mullein, Butterfly Weed (*Asclepias tuberosa*), Giant Goldenrod (*Solidago gigantea*), Common Milkweed (*Asclepias syriaca*), Common Evening Primrose, Black-eyed Susan (*Rudbeckia hirta*), Common Reed, Sagewort Wormwood, Cylindrical Blazing Star (*Liatris cylindracea*), and Riverbank Grape (*Vitis riparia*). Occasional trees are generally very widely spaced, small, and represent less than 10% cover. Species include Black Oak, Eastern Cottonwood and Common Hoptree (*Ptelea trifoliata*).

Beach Grass - Sagewort Wormwood Open Graminoid Sand Dune Type (SBOD1-3)

This community has not been mapped as it is represented as the complex and transition zone between the *Sea Rocket Sand Open Beach Type* and the *Little Bluestem - Switch Grass - Beach Grass Open Dune Type*. It is located on the foredune where Beach Grass increases in percent cover from the open beach, to a point where it represents 40-60% ground cover dominated almost entirely by Beach Grass with minor amounts of Sagewort Wormwood. Further east, the dominance of Beach Grass diminishes as it transitions to the *Little Bluestem - Switchgrass - Beach Grass Open Dune Type*.

Shrub Sand Barren and Dune Series (SBS)

Sand substrates are covered with less than 25% tree cover and greater than 25% shrub cover which varies from clumped or patchy to more continuous.

Shrub Sand Dune Ecosite (SBSD1)

Willow Shrub Sand Dune Type (SBSD1-3)

This vegetation community is located only along the South Point sand spit. Sand substrates contain a mixture of shrub, forb and graminoid species.

Canopy closure is greater than 60% and dominated by Sandbar Willow (*Salix exigua*) with some Eastern Cottonwood (mostly young saplings). Understory cover ranges between 26% and 60% with Giant Goldenrod and to a lesser extent, Small-flowered Evening Primrose (*Oenethera parviflora*). The ground layer is dominated by Silverweed (*Potentilla anserina* ssp. *anserina*), however, it only has a cover of between 10% and 25%. Other species that can be found in this community in varying frequencies include Silky Dogwood (*Cornus amomum* ssp. *obliqua*), Clammy Weed (*Polanisia dodecandra* var. *dodecandra*), Seaside Spurge and Common Reed.

Treed Sand Barren and Dune Series (SBT)

Sand substrates with greater than 25% tree cover.

Treed Sand Dune Ecosite (SBTD1)

Cottonwood Treed Sand Dune Type (SBTD1-1)

This vegetation community is only found along the South Point sand spit. Sand substrates support a canopy of between 25-60% cover which is dominated exclusively by Eastern Cottonwood saplings. The sub-canopy is sparse (10% cover) and contains Sandbar Willow. The understory contains approximately equal abundances of Giant Goldenrod and Switch Grass, which account for 25-60% cover.

Other species found in this vegetation type include Silverweed, Little Bluestem, Beach Pea (*Lathyrus japonicus*), White Sweet Clover, Small-flowered Evening Primrose, Indian Hemp (*Apocynum cannabinum*), Canada Thistle (*Cirsium arvense*), Woolly Yarrow (*Achillea millefolium* ssp. *lanulosa*), Narrow-leaved Wall Rocket (*Diplotaxus tenuifolia*), Common Mullein, Canada Goldenrod (*Solidago canadensis*), Bittersweet Nightshade (*Solanum dulcamara*) and Riverbank Grape.

Mixed Anthropogenic Treed Sand Dune Type (SBTD1-21)

This vegetation community is found in a few small pockets along the east beach within the *Little Bluestem - Switch Grass- Beach Grass Open Dune* community where trees have been planted, generally as an extension to adjacent cottage lot(s). The community would have been open dune, but with the planting of trees it has become a treed dune community of anthropogenic origin with various native and non-native planted trees. Species include Sugar Maple, Black Locust, European White Poplar, Manitoba Maple, Black Oak and any number of other introduced species. The understory is often similar to the *Little Bluestem - Switch Grass- Beach Grass Open Dune* community, or in some cases, has been planted with or had Kentucky Bluegrass (*Poa pratensis* ssp. *pratensis*) and other turf grasses spread into the community. Some of these communities may have been eliminated or reduced through park efforts to remove non-native tree species in the dunes in 2010.

5.1.3 Meadow Class (ME)

Communities that are classified within the *Meadow Class* are typically found on mineral soils. Tree and shrub establishment is inhibited by the environment or have been removed by land use practices, natural disturbance or are recovering from cultural disturbance. A prescribed burn program has been initiated in Rondeau in order to preserve some of the meadows within the park. Most of the meadow communities listed below have been exposed to regular burning since 2001. Vegetation is dominated by herbaceous species. Tree and shrub cover comprise less than 25% cover in these communities.

Graminoid Meadow Series (MEG)

These communities are dominated by various grass and grass-like species.

Dry - Fresh Graminoid Tallgrass Prairie Ecosite (MEGM1)

Communities dominated by distinctive flora that have been classified as “tallgrass" species.

Dry Big Bluestem Graminoid Tallgrass Prairie Type (MEGM1-2)

These communities are found as small pockets of open prairie grassland within the park. These pockets are quite rare. Shrubs and trees are rare in these areas, representing less than 15% cover. Vegetation is dominated by Big Bluestem and contains many herbaceous associated species, including Butterfly Milkweed, Canada

Bluegrass, Golden Puccoon, strawberry, Black-eyed Susan, Cylindrical Blazing Star, Starry False Solomon's-seal (*Maianthemum stellatum*), Common Milkweed, Western Poison Ivy, Azure Aster (*Symphyotrichum oolentagiense*), Canada Anemone (*Anemone canadensis*), Thyme-leaved Sandwort (*Arenaria serpyllifolia*), Giant Goldenrod, Round-headed Bush-clover (*Lespedeza capitata*), Wild Bergamot, Common Evening Primrose, Canada Tick Trefoil (*Desmodium canadense*) and Indian Hemp.

Dry Indian Grass Tallgrass Prairie Type (MEGM1-3)

Found only as inclusions or complexes in the similar *Dry Big Bluestem Graminoid Tallgrass Prairie Type*. Examples can be found just south of the campground, east of the playground area and in a small prairie meadow just west of the visitor centre. These rare open meadow communities are dominated by Indian Grass. Associate species are similar to those found in the *Dry Big Bluestem Graminoid Tallgrass Prairie Type.*

Dry Mixed Graminoid Tallgrass Prairie Type (MEGM1-4)

This community is represented by an open meadow located on the north side of Gardiner Road, adjacent to the Visitor Centre. It contains a mixture of Graminoid Tallgrass prairie species that include Switch Grass, Indian Grass, Big Bluestem, Giant Goldenrod, Butterfly Weed, Common Milkweed and Black-eyed Susan.

Dry - Fresh Graminoid Meadow Ecosite (MEGM3)

Canada Blue Grass Graminoid Meadow Type (MEGM3-2)

This community is represented by only one small area near the north end of the Rondeau Peninsula. The community is dominated by Canada Bluegrass and lacks some of the typical tallgrass prairie forb species.

Mixed Meadow Series (MEM)

These meadow communities are dominated by a mixture of graminoid and forb species.

Dry - Fresh Mixed Meadow Ecosite (MEMM3)

Dry - Fresh Graminoid - Goldenrod Mixed Meadow Type (MEMM3-1)

This community is represented by a single polygon (361). It is characterized by dry-fresh substrates that contain a mixture of graminoid and forb species. Tree and shrub cover is no greater than 15%. This site was historically used as a dump site for organic waste (i.e., tree clippings, lawn cuttings, etc.) and therefore contains frequent non-native species. A colony of aggressive Tree-of-heaven was present at the time of the survey,

but has since been reduced by active management. Other dominant species (most of which are non-native) include Canada Bluegrass, Kentucky Bluegrass, Giant Goldenrod, Western Poison Ivy, Woolly Panic Grass (*Dichanthelium acuminatum*), Doubtful Goat's-beard (*Tragopogon dubius*), Wild Carrot (*Daucus carrotus*), White Sweet Clover, Black Medick (*Medicago lupulina*), Common Mullein, American Stinging Nettle (*Urtica dioica* ssp. *gracilis*), Common Milkweed, Bouncing Bet (*Saponaria officinalis*) and Switch Grass. Also present in a section of the meadow is a Raspberry Thicket.

Dry - Fresh Mixed Meadow Type (MEMM3-2)

This community is restricted to a single polygon (797e) which is a ridge in the marsh, likely created by spoils from the marsh cut dredge. It is dominated by narrow-leaved sedges, with Raspberry spp., Grass spp., Marsh Fern (*Thelypteris palustris*), Indian Hemp, various thistles, hawkweeds, Stinging Nettle, Canada Blue-joint (*Calamgrostis canadensis*), Blue Vervain (*Verbena hastata*), Buttonbush, Riverbank Grape, Gray Dogwood (*Cornus foemina* ssp. *racemosa*), Common Milkweed and Silverweed.

5.1.4 Thicket Class (TH)

Communities that are classified within the thicket class are located on mineral soils. Tree establishment has been inhibited by the environment or removed by land use practices. These areas are subject to natural disturbance or are recovering from cultural disturbance (e.g., clearing or pasture). Many thickets in Rondeau are located in the southeast end of the peninsula where a campground was historically located.

Vegetation in thicket communities is characterized by greater than 25% shrub cover and less than 25% tree cover. Shrub cover varies from scattered and patchy to continuous and is typically dominated by more invasive (native and non-native) species.

Deciduous Thicket Series (THD)

Thicket communities are dominated by (>75%) deciduous shrub species.

Dry - Fresh Deciduous Shrub Thicket Ecosite (THDM2)

Substrates have dry-fresh moisture regimes and are dominated by deciduous shrub species.

Gray Dogwood Deciduous Shrub Thicket Type (THDM2-4)

This deciduous shrub thicket type is located on the tip of the south point of the Rondeau

peninsula adjacent to Marsh Trail where heavy erosion is occurring. Substrates are sandy and dry.

Vegetation is dominated by Gray Dogwood. Other shrubs present are Riverbank Grape, Sandbar Willow, Multiflora Rose and Hawthorn spp. (*Craetaegus* spp.) Plant species found on the ground layer include Kentucky Bluegrass, Switch Grass, Canada Goldenrod, Western Poison Ivy, Common Mullein, Wild Strawberry, Common Reed, Field Horsetail (*Equisetum arvense*), Giant Goldenrod, Little Bluestem and Garlic Mustard.

Dry - Fresh Raspberry Deciduous Shrub Thicket Type (THDM2-8)

These sites are generally small and represented only as complexes within other larger Vegetation Types. They are often situated where there are gaps in the forest canopy, or on raised ridges in the marsh. Dominant shrub species are Wild Red Raspberry (*Rubus idaeus*) and Black Raspberry (*Rubus occidentalis*). Riverbank Grape and Western Poison Ivy are also abundant. Rarely, there are patches of Common Blackberry (*Rubus allegheniensis*). These communities are not mapped but found in polygons 19, 51, 425, 767 and 948.

Dry - Fresh Barberry Deciduous Shrub Thicket Type (THDM2-12)

These small communities are barberry deciduous shrub thickets represented only as complexes within other larger Vegetation Types (polygons 51, 767 and 948). Most often, they are located where there are gaps in the forest canopy due to blowdown (usually *in Fresh - Moist Sugar Maple - Hardwood Deciduous Forest Type*). Generally, barberry thickets are found in more shaded areas than are raspberry thicket types. Japanese Barberry is the dominant vegetation species with various graminoid species in the ground layer.

Dry - Fresh Deciduous Regeneration Thicket Ecosite (THDM4)

Dry - Fresh Native Deciduous Regeneration Thicket Type (THDM4-1)

This community is represented by sites with shrub hedgerow communities with some larger trees intermixed. Shrubs were planted many years ago, and now a number of native tree species have established themselves in this community. Also, management efforts have been initiated to replace all non-native species with native shrub species.

Species include Bridal Wreath Meadowsweet (*Spirea X vanhouttei*), Morrow Honeysuckle (*Lonicera morrowii*), European Highbush Cranberry (*Viburnum opulus*), Nannyberry (*Viburnum lentago*), Canada Bluegrass, Black Oak, Green Ash (*Fraxinus pennsylvanica var*. *subintegerrima*) and White Ash.

Fresh - Moist Deciduous Thicket Ecosite (THDM5)

Substrates have fresh-moist moisture regimes and are dominated by deciduous shrub species.

Gray Dogwood Deciduous Shrub Type (THDM5-1)

This shrub thicket type is commonly found along many of the elevated sand ridges on the west side of the South Point of the peninsula. Some extensive stands can also be found regenerating in the old campsites that were located at the south end of the point.

The canopy (which contains less than 25% cover) is composed of, in order of abundance, Black Oak, White Oak and Sassafras. The understory is dominated by Gray Dogwood (greater than 60% cover). Occasionally, Silky Dogwood is found as a co-dominant. On the ground layer, relatively equal amounts of Reed Canary Grass (*Phalaris arundinacea*), Marsh Fern and Stinging Nettle are present.

Fresh - Moist Spicebush - Blue Beech Deciduous Shrub Thicket Type (THDM5-3)

This vegetation type is found only as a complex or inclusion in other Vegetation Types, and has not been associated with any individual polygons. It is most prevalent in the forest west of Rondeau Park Road where the forested communities are merging with the marsh communities. It is also found as a complex within other larger communities, along the edges of some of the moist sloughs.

The dominant canopy species is Spicebush with lesser quantities of Blue Beech. On the ground layer Spotted Jewelweed (*Impatiens capensis*) is most abundant with Sensitive Fern (*Onoclea sensibilis*) also present in relatively large numbers.

Fresh - Moist Willow Deciduous Shrub Thicket Type (THDM5-4)

This vegetation community is found only as a complex or inclusion in other Vegetation Types (polygons 40c, 72 and 194). It is found at the interface between the prevailing Vegetation Type and the South Beach sand bar. Dominant vegetation species are Sandbar Willow, Switch Grass, White Sweet Clover, Silverweed, Giant Goldenrod, Seaside Spurge and Small-flowered Evening Primrose.

5.1.5 Savannah Class (SV)

Savannah communities are characterized by between 25% and 35% tree cover. These natural areas typically have distinctive floras. Occasionally, they can be dominated by more invasive herbaceous, shrub and tree species. Tree cover is typically scalloped or clumped. Mineral soils are shallow, generally less than 15 cm deep. The savannah ecosystems at Rondeau are generally located on the southeast end of the point of the peninsula as well as on the northeast side, which is currently allocated for campground and day use.

Mixed Savannah Series (SVM)

The mixed savannah communities are composed of a mixture of deciduous and coniferous trees and a variety of tallgrass herbaceous plant species. Represented by a single Ecosite and Vegetation Type.

Dry - Fresh Tallgrass Mixed Savannah Ecosite (SVMM1)

Dry Black Oak - Pine Tallgrass Savannah Type (SVMM1-2)

This community is located in a section of the South Point area of the Rondeau peninsula. Substrates are dry shallow mineral soils.

The canopy (25% cover) is composed of a mixture of deciduous and coniferous trees. Black Oak is most abundant, followed by Eastern Red Cedar. Eastern White Pine is also present in the canopy in limited numbers. A sparse sub-canopy (20% cover) is composed of younger Black Oak and Eastern Red Cedar. Shrubs such as Gray Dogwood and Tartarian Honeysuckle are found in the sparse understory (10-15% cover). On the ground layer (> 60% cover), various herbaceous species and grass species are present. These include Goldenrod spp.(*Solidago* spp.), Kentucky Bluegrass, Garlic Mustard, Wild Columbine (*Aquilegia canadensis*), Woolly Yarrow (*Achillea millefolium* ssp. *lanulosa*), Aster spp., Starry False Solomon's-seal, Canada Blue-joint (*Calamagrostis canadensis*) and Common Mullein.

Deciduous Savannah Series (SVD)

Deciduous Savannah communities are dominated by deciduous tree species.

Fresh - Moist Tallgrass Deciduous Savannah Ecosite (SVDM2)

Fresh - Moist Big Bluestem Deciduous Savannah Type (SVDM2-20)

Communities in this type were re-evaluated in 2008 following several years of active management. Most of the polygons have undergone several prescribed burns, while the remaining ones were subjected to an accidental fire. These communities are similar to the *Dry - Fresh Black Oak Tallgrass Savannah Type* (below), but with a co-dominance of Eastern White Pine in the canopy. As a result of burning, these communities have an understory/ground layer dominated by Big Bluestem. Herbaceous species include Woodland Sunflower (*Helianthus divaricatus*), Butterfly Weed, Wild Bergamot, Virginia Mountain-mint (*Pycnanthemum virginianum*), Hairy Mountain-mint (*Pycnanthemum verticillatum* var. *pilosum*) and Black-eyed Susan.

Dry - Fresh Deciduous Savannah Ecosite (SVDM3)

Dry - Fresh Black Oak Tallgrass Savannah Type (SVDM3-23)

In Rondeau, an extensive patch of *Dry Black Oak Tallgrass Deciduous Savannah* can be found along the east side of the campgrounds, on the west side of Lakeshore Road. This community was used for day use purposes prior to 1993 (picnic, play area, etc.), and was dominated by Kentucky Bluegrass. It was released from mowing in 1993 and then actively managed through prescribed burning starting in 2001. This community is the result of these restoration efforts.

Vegetation species in this community include Black Oak and, to a lesser extent, White Oak in the canopy layer (25-35% cover). In 2003, the community had an understory (10-25% cover) being composed of predominantly Gray Dogwood and in lesser frequencies, Wild Red Raspberry. The prescribed burn program has reduced most of the shrub cover and now the ground layer consists almost entirely of Big Bluestem with minor components of Giant Goldenrod, Butterfly Weed, Black-eyed Susan, Round-headed Bush Clover, Indian Hemp, Marsh Fern, Common Milkweed, Woolly Panic Grass, Field Horsetail, Wild Bergamot, Canada Bluegrass and Riverbank Grape.

Fresh - Moist Deciduous Savannah Ecosite (SVDM4)

The vegetation profile of these communities is virtually the same as the Dry - Fresh Black Oak Tallgrass Savannah Type, however, the abundance and variety of tallgrass species is less. Also, the substrates have a somewhat damper moisture regime.

Fresh - Moist Black Oak Deciduous Savannah Type (SVDM4-20)

The largest of the three polygons (1229) identified as this type of community was once used for day-use purposes and was then released from mowing. It has been part of the prescribed burn program since 2003. This community is on fresh soils and is often inundated for an extended period of time in the spring. Dominant canopy species are Black and White Oak, with White Ash and some Sassafras.

The understory and ground layer are comprised of Common Elderberry (*Sambucus nigra* ssp. *canadensis*), Western Poison Ivy, *Carex* spp., Cleavers (*Galium aparine*), horsetail spp., goldenrod spp, Bracken Fern (*Pteridium aquilinum*), Sensitive Fern, Virginia Creeper and Wild Red Raspberry. Big Bluestem and Indian Grass are found in patches, particularly in polygon 1229 which has been burned several times.

Fresh - Moist Oak - Green Ash Deciduous Savannah Type (SVDM4-21)

This community is found on a few drier sand ridges that are located on the west side of the peninsula, close to Marsh Trail. These elevated sand ridges form long strips where Black Oak and White Pine dominate. The understory vegetation is not as typical of a tallgrass prairie (possibly due to fire suppression), but many prairie species are found.

The canopy (25-30% cover) is predominantly Black Oak, with some White Oak and White Pine associated with it. The sub-canopy (10-25% cover) is composed of Green Ash. The understory contains approximately 10-25% cover and includes Gray Dogwood, Wild Red Raspberry, Black Raspberry, Snowberry (*Symphoricarpos albus*) and Common Reed. In the ground layer, which contains greater than 60% cover, Giant Goldenrod, Azure Aster, Common Strawberry, Canada Bluegrass, Wild Columbine, Garlic Mustard, Western Poison Ivy, Woolly Yarrow, Wild Geranium (*Geranium maculatum*), Starry False Solomon's-seal, Butterfly Weed, Wild Bergamot, Woodland Sunflower, Switch Grass, Big Bluestem and Little Bluestem can all be found in varying densities.

5.1.6 Woodland Class (WO)

Communities classified as 'woodland' contain between 35% and 60% tree cover. They are semi-closed treed communities and represent the successional transition zone between savannah and forest. Substrates are mineral soils that are less than 15 cm deep with intermediate levels of environmental limitations, such as fire or drought, or various cultural disturbances.

Mixed Woodland Series (WOM)

The Mixed Woodland Series represents woodlands that contain both coniferous and deciduous tree species.

Dry Pine - Oak Tallgrass Deciduous Woodland Ecosite (WOMM1)

Dry White Pine - Oak Tallgrass Mixed Woodland Type (WOMM1-1)

This community contains sand substrates with a moisture regime of 1 and is found in only a few locations in the park. Because of a slight disparity in vegetation composition, it has been divided into two types.

Type A: Represented by a single polygon, a mature woodland located on the east side of South Point. Tree cover is denser at the north end of the polygon and becomes

sparser towards the south. Canopy cover is between 25-60% and the most abundant species in the canopy is Black Oak followed by Eastern Red Cedar and then Eastern White Pine. The sub-canopy (25-60% cover) is composed of Black Oak with lesser amounts of Eastern Red Cedar. Occasionally, Hop Hornbeam can be found in the sub-canopy as well. Gray Dogwood is the dominant species in the understory (10-25% cover), with Riverbank Grape, Snowberry, Virginia Creeper and Morrow Honeysuckle also present. The ground layer consists of greater than 60% cover and the most abundant species is Kentucky Bluegrass, followed by Giant Goldenrod and then Azure Aster. Also found in the ground layer are Starry False Solomon's-seal, Wild Columbine, Woolly Yarrow, Garlic Mustard, Helleborine (*Epipactis helleborine*) and Common Mullein.

Most trees in this community are mid-sized (10-24 cm dbh). Standing snags are occasional and variable in size, but are rarely larger than 50 cm dbh. Deadfall is abundant within the 10-24 cm dbh size class, occasionally less than 10 cm, and occasionally between 25-50 cm dbh, but rarely surpassing 50 cm dbh.

Type B: This community is found in the northern end of the park. The canopy (25-60% cover) contains equally dominant Black Oak and Eastern White Pine with occasional Eastern Cottonwood. The sub-canopy (25-60% cover) consists of Black Oak being dominant over Green Ash, with some Hop Hornbeam. The understory contains species such as Black Raspberry and Hop Hornbeam. In the ground layer (> 60% cover), grass spp., are most abundant, then Giant Goldenrod and Azure Aster. Associate species in the ground layer include Starry False Solomon's-seal, Black-fruit Mountain-ricegrass (*Piptatherum racemosum*), Western Poison Ivy, Mayapple (*Podophyllum peltatum*), Wild Geranium, Black-Eyed Susan, Canada Mayflower (*Maianthemum canadense*), Kentucky Bluegrass, Sweet Cicely and Fragrant Bedstraw (*Galium triflorum*).

Deciduous Woodland Series (WOD)

These woodland communities are dominated by deciduous tree species.

Dry - Fresh Oak Tallgrass Deciduous Woodland Ecosite (WODM1):

Dry Black Oak - White Oak Tallgrass Woodland Type (WODM1-1)

This community is represented by the woodland through which the Black Oak Trail runs.

Sand substrates have a moisture regime of 1. The canopy layer (25-60%cover) is dominated by Black Oak, but also contains Green Ash and some White Oak. Hop Hornbeam dominates the sub-canopy (10-25% cover), however, Chokecherry is also present. The understory (25-60% cover) contains a high density of Gray Dogwood, followed by Wild Red Raspberry. Also present in the understory is Morrow Honeysuckle, Black Raspberry, Western Poison Ivy and Virginia Creeper. The Ground layer (> 60% cover) contains predominantly Kentucky Bluegrass and Wood Betony (*Pedicularis canadensis*), as well as Azure Aster, Common Strawberry, Wild Columbine, Downy Yellow Violet, Starry False Solomon's-seal, Woodland Sunflower and Pointed-leaved Tick-trefoil (*Desmodium glutinosum*).

Dry - Fresh Oak Deciduous Woodland Ecosite (WODM3)

Dry Black Oak Woodland Type (WODM3-2)

This type is found just south of the churches in a disturbed woodland, and along Marsh Trail. It contains sand substrates with a moisture regime of one.

The canopy is composed of Black Oak (dominant) as well as Tree-of-Heaven in the polygon south of the churches. The sub-canopy is composed of Eastern Red Cedar and Staghorn Sumac (Rhus typhina), with a number of introduced species such as White Mulberry. The understory contains young White Mulberry, Morrow Honeysuckle, Riverbank Grape, and Western Poison Ivy. The ground layer is mostly composed of Giant Goldenrod, Kentucky Bluegrass and Garlic Mustard.

Fresh - Moist Deciduous Woodland Ecosite (WODM5)

Fresh - Moist Oak - Sassafras Deciduous Woodland Type (WODM5-23)

This community is represented by a single polygon (425) and has a canopy closure of 25-60% dominated by White Oak, followed by Red Oak and Sassafras. The sub-canopy (25-60%) is dominated by Sassafras. Understory vegetation is dominated by Narrow-leaved Meadowsweet (*Spiraea alba*) and Wild Red Raspberry. The ground layer is composed of various sedges, grasses, bedstaws, Marsh Fern, Curly Dock (*Rumex crispus*), Giant Goldenrod, Common Milkweed, Common Reed and Virginia Creeper.

Fresh - Moist Green Ash Deciduous Woodland Type (WODM5-24)

This woodland community is represented by one area in the north end of the park as a

hedgerow between Rondeau Road and a small creek on the western edge of the Campground.

The canopy (25-60% cover) is dominated by Green Ash, but also contains Tuliptree, Tree-of-heaven, White Pine and Northern Catalpa (Catalpa speciosa). The sub-canopy is composed of White Mulberry. The understory contains Gray Dogwood, Red-osier Dogwood (Cornus sericea), Common Elderberry, Riverbank Grape and Black Raspberry. On the ground layer, a variety of native and non-native species can be found, such as Canada Goldenrod, Western Poison Ivy, Smooth Brome Grass (Bromus inermis), Fringed Loosestrife (Lysimachia ciliata) and Wild Blue-flag Iris (Iris versicolor), but is dominated by Jewelweed.

Fresh - Moist Tallgrass Deciduous Woodland Ecosite (WODM6)

Fresh - Moist Mixed Oak Tallgrass Woodland Type (WODM 6-1)

Two types of this community exist in Rondeau. They are separated based on the presence and abundance of American Beech in the canopy layer.

Type A: On sandy soil substrates, the canopy (20-60% cover) is dominated by Black Oak, then White Oak and then Green Ash. Also represented in the canopy layer in various numbers are Black Walnut, Tuliptree and Basswood. The sub-canopy (10-25% cover) is dominated by Green Ash with some Sassafras. In the understory (10-25% cover), Gray Dogwood is more abundant than Wild Red Raspberry. Also found in the understory are Virginia Creeper, Spicebush, Narrow-leaved Meadowsweet and Riverbank Grape. The ground layer (> 60% cover) is dominated by Giant Goldenrod and then by Field Horsetail. Associated ground layer species include Fragrant Bedstraw, Canada Anemone, Wild Geranium, Starry False Solomon’s-seal, Canada Bluegrass, Spotted Joe-Pye-Weed (*Eupatorium maculatum*), Common Blue Violet, Sensitive Fern, Large-leaved Wood-aster (*Eurybia macrophylla*), Pointed-leaved Tick-trefoil, Early Meadow-rue and Woodland Sunflower.

Type B: The canopy (25-60% cover) is composed of approximately equal densities of Black Oak and American Beech. Basswood, Tuliptree, Green Ash and Black Walnut are also present in the canopy. The sub-canopy (10-25% cover) is dominated by approximately equal densities of Sassafras and Green Ash followed by Hop Hornbeam. Blue Beech is also found in the sub-canopy layer. The understory (10-25% cover) is dominated by Gray Dogwood. Present in a much lower density is Buttonbush. The

understory also contains Spicebush, Silky Dogwood and Wild Red Raspberry in varying densities. The ground layer (>60 % cover) is dominated by a variety of grass species with abundant Giant Goldenrod. Also present in the ground layer are Canada Blue-joint, Marsh Fern, Virginia Creeper, Showy Tick-trefoil, Spotted Joe-Pye-Weed, Western Poison Ivy, Starry False Solomon's-seal, Wild Columbine, Mayapple, Fragrant Bedstraw and Field Horsetail.

5.1.7 Forest Class (FO)

Almost all of the terrestrial communities in the park have small to large shallow depressions in which the water table is close to the surface (i.e., vernal pools) and/or are close to the regular north-south sloughs that run throughout the entire park. As such, it is common to find species such as Canada Blue-joint, Marsh Fern and Sensitive Fern in the understory of these forest communities. Even though these species are indicative of wetlands, they are restricted to the shallow depressions in the forest or are found along the boundaries between the forest and slough communities.

Deciduous Forest Series (FOD)

These forests are dominated by deciduous tree species.

Dry - Fresh Oak Deciduous Forest Ecosite (FODM1)

Dry - Fresh Black Oak Deciduous Forest Type (FODM1-3)

This forest type has a limited distribution along the east side of the park. Substrates are sand. The forest is mature, with most trees between 10 and 24 cm dbh, but with occasional trees less than 10 cm or between 25 and 50 cm; but only rarely exceeding 50 cm dbh.

The canopy (25-60% cover) is dominated by Black Oak followed by Green Ash. Other species in the canopy include Sugar Maple, Eastern White Pine, American Beech and Tuliptree. The sub-canopy (10-25% cover) is dominated by Hop Hornbeam followed by Blue Beech. In the understory (10-25% cover), Gray Dogwood is the most abundant species followed by Black Raspberry and then Japanese Barberry. Silky Dogwood and Snowberry are also present in the understory. The ground layer (> 60% cover) is dominated by Black-fruit Mountain-ricegrass, then Large-leaved Wood-aster, then Giant Goldenrod. Also present in the ground layer are Canada Mayflower, Starry False Solomon's-seal, Azure Aster, Wild Columbine, Wild Geranium, Common Reed, Western

Poison Ivy, Common Strawberry and Woolly Yarrow. There is a sparse canopy in some areas, which are associated with a denser understory.

Dry - Fresh Oak - Maple - Hickory Deciduous Forest Ecosite (FODM2)

Dry - Fresh Oak - Hardwood Deciduous Forest Type (FODM2-4)

This forest type contains dry-fresh mineral soils. The canopy (25-60% cover) is composed of Black Oak, Red Oak and a mixture of hardwood tree species such as Basswood, Sugar Maple, Black Walnut and White Ash. The understory, sub-canopy and ground layer composition is virtually the same as FODM1-3.

Fresh - Moist Sugar Maple Deciduous Forest Ecosite (FODM6)

Fresh - Moist Sugar Maple - Lowland Ash Deciduous Forest Type (FODM6-1)

The forest type is characterized by fresh-moist sand substrates and canopy closure ranging from 25-60%. The dominant canopy species are American Beech followed by (in order of dominance) Green Ash, Hop Hornbeam and Sugar Maple. Other tree species in the canopy include Basswood, Swamp (Freeman's) Maple (*Acer x freemanii*) and Tuliptree. The sub-canopy (25-60% cover) is dominated by American Beech followed by Hop Hornbeam. Hop Hornbeam is also the most abundant species in the understory (10-25% cover). Blue Beech is also frequently found in the understory along with Wild Red Raspberry and Gray Dogwood. The ground layer contains greater than 60% cover and is dominated by Mayapple, then Garlic Mustard and then Giant Goldenrod. Associated species also present in the ground layer in varying abundance include Downy Yellow Violet, Fragrant Bedstraw, White Trillium, Canada Mayflower, Field Horsetail, Sensitive Fern, Western Poison Ivy, Wild Columbine, Bloodroot (*Sanguinaria canadensis*), Slender Stinging Nettle and Spotted Jewelweed.

Fresh - Moist Sugar Maple - Hardwood Deciduous Forest Type (FODM6-5)

This forest community is widespread within the Rondeau forest. Fresh-moist sandy soils predominate however, due to the pattern of ridges and sloughs, a range of moisture regimes can be found with conditions being wetter in the depressions and drier on the ridges.

The forest is usually mature, with all stages of succession present. Trees less than 10 cm dbh and up to 25 cm are common, with occasional trees between 25 and 50 cm and

even greater than 50 cm dbh. Deadfall and standing snags are abundant in a wide range of sizes. Few standing snags are greater than 50 cm or less than 10 cm dbh.

Canopy closure in this community is greater than 60% and is dominated by American Beech and Sugar Maple and to a lesser extent, Basswood. Other species that can be found in the canopy in various frequencies include Tuliptree, White Ash and Green Ash.

The sub-canopy ranges from 25 to 60% closure with the most abundant species being American Beech. Also found in the sub-canopy, in order of decreasing abundance, are Blue Beech, Hop Hornbeam and Sugar Maple.

Understory closure ranges from 25 to 60%, with Spicebush being the most common species followed by Blue Beech, then Wild Red Raspberry and Japanese Barberry. Other species that may be found in the understory include American Elm, Sassafras, Purple-flowering Raspberry (*Rubus odoratus*), Black Raspberry and Gray Dogwood.

The ground layer (>60% coverage) is dominated by Sensitive Fern, followed by Giant Goldenrod and then Common Blue Violet. Other associated species found on the ground layer in varying frequencies include (but are not limited to) Sharp-lobed Hepatica (*Anemone acutiloba*), Downy Yellow Violet, White Trillium, Cut-leaved Toothwort (*Cardamine concatenata*), Virginia Creeper, Canada Mayflower, Hairy Solomon's-seal (*Polygonatum pubescens*), Fragrant Bedstraw, Maidenhair Fern (*Adiantum petatum*), Lady Fern (*Athyrium filix-femina*), White Baneberry (*Actaea pachypoda*), Mayapple, Christmas Fern (*Polystichum acrostichoides*), Sweet Cicely, Large-leaved Wood-aster, Jack-in-the-pulpit, Rattlesnake Fern (*Botrychium virginianum*), Early Meadow-rue, Wood Nettle, Starry False Solomon's-seal, Black-fruit Mountain-ricegrass, Bristly Greenbrier (*Smilax tamnoides*), Wild Columbine, Spinulose Wood Fern (*Dryopteris carthusiana*), Running Strawberry-bush (*Euonymus obovata*), Canada Tick-trefoil, Virginia Waterleaf (*Hydrophyllum virginianum*) and Riverbank Grape.

Many areas within this vegetation type have been impacted by severe windstorms (i.e., the 1998 windstorm) and as a result, there are many trees that have blown down creating gaps in the canopy. This allows more sunlight to reach the forest floor, thus allowing for the establishment of dense thickets of Japanese Barberry, Black Raspberry and Wild Red Raspberry.

Fresh - Moist Lowland Deciduous Forest Ecosite (FODM7)

Fresh - Moist Green Ash - Hardwood Lowland Deciduous Forest Type (FODM7-2)

This forest community is found as a complex within the *Fresh - Moist Oak - Hardwood Deciduous Forest Type* (FODM9-6) in only one polygon in the park (1164). It is associated with the low, moist depressions in between the sand ridges. The canopy layer is dense (> 60% cover) and is dominated by Green Ash, followed by Basswood and then Black Oak. Other species of hardwoods such as Sugar Maple, White Ash and Black Walnut can be found interspersed among these dominant species. The sub-canopy is composed almost exclusively of younger Green Ash (>60% cover). The understory (25-60% cover) is composed of Gray Dogwood and, in lesser abundance, Spicebush. In the ground layer (>60% cover), Fragrant Bedstraw is the dominant species, followed by Canada Blue-joint and then Fringed Loosestrife. Various other herbaceous species typical of lowland deciduous forest communities are present, as well.

Fresh - Moist Black Walnut Lowland Deciduous Forest Type (FODM7-4)

This forest type has similar vegetation composition as FODM7-2 however, the canopy is dominated by Black Walnut rather than Green Ash.

Fresh - Moist Oak - Maple - Hickory Deciduous Forest Ecosite (FODM9)

Fresh - Moist Oak - Hardwood Deciduous Forest Type (FODM9-6)

Some areas of the forest in this community type are quite open due to fallen trees, but overall canopy closure is greater than 60%. Trees are mostly in the 10 to 24 cm dbh size class and rarely exceed 50 cm. There is occasional deadfall and standing snags of all sizes but mostly between 10 and 50 cm dbh.

The vegetation in the canopy is dominated by varying amounts of Black and Red Oak, American Beech, Black Walnut and other hardwood species. Also present are Green Ash, Basswood, Sugar Maple, Swamp Maple, Sycamore, Eastern Cottonwood and Tuliptree. The sub-canopy is composed of approximately equal numbers of Black Oak, Red Oak and Green Ash (25-60% cover). Blue Beech and Sassafras can also be found in the sub-canopy. The understory (>60% cover) contains, in order of greatest abundance, Gray Dogwood, Morrow Honeysuckle and Wild Red Raspberry. Associated species found in various abundance in the understory are Japanese Barberry, Multiflora Rose and Spicebush. The ground layer (>60% cover) is dominated by Fragrant Bedstraw, Virginia Creeper and Giant Goldenrod. Also present in the ground layer are

Big Bluestem, Canada Mayflower, Common Blue Violet, Bloodroot, Western Poison Ivy, Canada Bluegrass, Fringed Loosestrife, Canada Blue-joint, Common Reed, Rattlesnake Fern, Lady Fern, Intermediate (Evergreen) Wood Fern (*Dryopteris intermedia*) and Maidenhair Fern.

Fresh - Moist Carolinian Deciduous Forest Ecosite (FODM10)

Fresh - Moist Sugar Maple - Beech Carolinian Deciduous Forest Type (FODM10-1)

This is the most common forest type found in the central portion of the park, and is represented by two main types, with the main difference being the abundance of Sugar Maple in the canopy layer, and the density of the canopy layer.

Type A: The canopy (25-60% cover) is dominated by Tuliptree, Basswood and Black Oak. Also present in the canopy are Shagbark Hickory, Green Ash, Sugar Maple and White Ash. The sub-canopy (25-60% cover) is dominated by Blue Beech, followed by Hop Hornbeam and then Green Ash. Sassafras is found occasionally in the sub-canopy, as well. The understory (25-60%) is dominated by Gray Dogwood and Japanese Barberry. Also present in the understory are other shrub species such as Nannyberry, Morrow Honeysuckle and Wild Red Raspberry.

Ground cover is variable, with some areas having almost no understory or ground layer vegetation while other sections have a very rich and diversified understory. For the most part, Giant Goldenrod is the dominant ground layer species, followed by Fragrant Bedstraw and Carex spp. Also present in the ground layer are Large-leaf Aster, Virginia Creeper, Hairy Solomon's-seal, White Avens (*Geum canadense*), Common Blue Violet, White Trillium, Black-fruit Mountain-ricegrass, Wild Columbine, Canada Anemone, Woolly Panic Grass, Virginia Waterleaf, Kentucky Bluegrass, Early Meadow-rue, Western Poison Ivy, Sensitive Fern, Woodland Sunflower, Starry False Solomon's-seal, Wood Nettle (*Laportea canadensis*), Maidenhair Fern, Enchanter's Nightshade (*Circaea lutetiana* ssp. *canadensis*), Sweet Cicely and Running Strawberry-bush.

Trees are predominantly saplings (<10cm dbh) or in the 10-24 cm dbh size class, with occasional individuals between 25-50 cm dbh, and only rarely > 50 cm dbh. Occasional snags are present throughout the forest and deadfalls are abundant.

Type B: Canopy closure in this community is greater than 60% and Tuliptree is the dominant species, followed by American Beech, then Sugar Maple and Basswood. The

sub-canopy (25-60%) is dominated by Blue Beech and then American Beech, followed by Hop Hornbeam and then Green Ash. In the understory (25-60%), Spicebush is the dominant species, followed by Blue Beech and Japanese Barberry. Wild Red Raspberry, Purple-flowering Raspberry and Gray Dogwood are also present. The ground layer (>60%) is dominated by, in order of greatest abundance, Maidenhair Fern, Giant Goldenrod and Canada Blue-joint. Various quantities of herbaceous forest species include Spotted Jewelweed, Field Horsetail, Marsh Fern, Virginia Waterleaf, Showy Tick-trefoil, Sweet Cicely, Mayapple, Lady Fern, Fragrant Bedstraw, Downy Yellow Violet, Canada Mayflower, Bittersweet Nightshade, Sensitive Fern, White Trillium, Large-leaved Wood-aster, Pointed-leaved Tick-trefoil, Hairy Solomon's-seal, Wild Columbine, Virginia Creeper, Horsebalm (*Collinsonia canadensis*), Bristly Greenbrier, Bloodroot, Western Poison Ivy, Woodland Sunflower and Spinulose Wood Fern.

Tuliptree is present in significant abundance. This ecological community is often associated with wet depressions and Green Ash Mineral Deciduous Swamps. It is very similar to Fresh - Moist Sugar Maple - Hardwood Deciduous Forest, however Tuliptree is more abundant in the canopy and American Beech is much less abundant. The community is represented by mature forest with all stages of succession present. All size classes of trees are represented, although large trees are less abundant than those between 10 and 50 cm dbh. Deadfall and logs are abundant.

Fresh - Moist Oak Carolinian Deciduous Forest Type (FODM10-2)

This forest community is very similar to FODM10-1 and includes a similar composition of vegetation species, with the exception that Oak tree species are more abundant than other hardwoods such as Sugar Maple and Beech.

5.2 Community Descriptions - Terrestrial Systems (Cultural)

These communities represent developed areas of the park, and thus, are anthropogenic in origin and serve a cultural purpose. The amount of natural function ranges from almost none (i.e., roads) to moderate (i.e., greenlands). The presence of vegetation is secondary to their purpose and is generally manipulated, and as such, little description of species composition is provided here.

5.2.1 Constructed Class (CV)

Greenlands (CGL)

Recreational (CGL_4)

Recreational areas such as mown lawns and other day-use areas within the park, and the park campgrounds. The campground areas do have natural buffer areas between sites and would represent various communities in the savannah class.

Transportation and Utilities (CVI)

Highway (CVI_1)

Paved Road (CVI_1-3)

These are major paved roads within the park.

Cart Track (CVI_1-4)

Secondary gravel roads in the park – some meant for public vehicle access and some not.

Disposal (CVI_2)

Garbage and Recycling Disposal (CVI_2-1)

Central garbage and recycling area in the north end of the park.

Vegetation Compost (CVI_2-2)

Tree, stump and leaf compost areas.

Residential (CVR)

Low Density Residential (CVR _1)

These are represented by cottage lots within the park. Cottage lots range from highly manicured with little to no natural vegetation to lots with abundant natural vegetation coverage with some ecosystem function.

Institutional (CVC)

Institutional (CVC_1)

These areas are represented by park infrastructure such as the park office, maintenance compound and the Visitor Center.

5.3 Community Descriptions - Wetland Systems

The wetland systems of Rondeau are composed of open, shrub and treed wetland communities. The average wetness index is greater than 0. In Rondeau, there are two main types of wetlands; the open marsh and the swamp forests which are typically located in low depressions (sloughs) throughout the forested area of the park. The water table is seasonally or permanently at, near or above the substrate surface. Substrates consist of mineral or organic soils with a moisture regime typically greater than 5. Wetland plant indicator species cover is generally greater than 50%.

5.3.1 Swamp Class (SW)

Communities designated within the swamp class are wetland communities with greater than 25% tree cover, supporting hydrophytic shrub and tree species. Vegetation tolerates variable flooding regimes, with water depth less than 2 m. Standing water or vernal pooling composes less than 20% coverage of these communities. Within Rondeau, they are found as long, narrow features between the regular north-south ridges of the peninsula.

Deciduous Swamp Series (SWD)

Deciduous swamp communities are characterized by greater than 25% cover by trees that are greater than 5 m in height, with deciduous trees comprising greater than 75% of the tree species within the canopy (generally in Rondeau these are represented by almost 100% deciduous trees). Common understory and ground cover species include Fowl Manna Grass (*Glyceria striata*), Spotted Jewelweed, bedstraws (*Galium* spp.), Stinging Nettle, Spicebush and dogwood. These areas are typically fern and sedge rich. Deciduous swamp is the most common swamp type found in Rondeau.

Ash Mineral Deciduous Swamp Ecosite (SWDM2)

Ash Mineral Deciduous Swamp is the dominant swamp Ecosite found in Rondeau. Soils are mineral and may contain accumulations of organic matter that reach a depth of between 20 and 40 cm. Some areas experience flooding and standing water year round, while others dry up and aerate by early to mid summer.

Canopy tree species include Black and Green Ash with Swamp Maple (*Acer x freemanii*) and Silver Maple, as well as a variety of wetland graminoid and forb species that are found in the understory and on the ground layer.

Black Ash Mineral Deciduous Swamp Type (SWDM2-1)

This community is represented by a single polygon, although it is found as a complex within other Silver Maple or Green Ash swamps. Mineral soils support standing water in the early spring and summer and the soil moisture regime is 6.

The canopy, which has a closure of less than 50%, is composed of predominantly Silver Maple and, at a lesser frequency, Swamp Maple. The sub-canopy has a closure of 65% and contains a combination of Black and Green Ash. Black Ash is more abundant in these communities than Green Ash. The ground layer (less than 60%) includes large amounts of Marsh Fern and, to a lesser extent, Sensitive Fern and Canada Blue-joint. Other species within this vegetation type are Silver Maple, Hop Sedge (*Carex lupulina*) and Bittersweet Nightshade.

Green Ash Mineral Deciduous Swamp Type (SWDM2-2)

This is a common community that is found in many of the low, narrow sloughs in the park. Substrates consist of mineral soils, often covered with decomposing organic matter. Fallen and decomposing logs are a common component of this vegetation type, providing microhabitats within the swamps. The ash species dominating these sites can be either Red or Green Ash (or sometimes combinations of both) with Black Ash as a common associate species. In a few locations, Pumpkin Ash (*Fraxinus profunda*) can also be found. This community is often complexed with the *Silver Maple Mineral Deciduous Swamp Type* and the two types often trade off in which is the prevailing condition.

This vegetation type occurs as two slightly different communities within the park, with the extent of vegetation cover in the understory as the major difference between the two.

Type A: This community is characterized by moist sloughs that are mostly inundated with shallow water during the early spring and summer and usually dry up by late summer. The ground cover is spotty, with many areas of open mud and no vegetation. The canopy and understory are primarily composed of many young Green Ash trees (10 to 25 cm dbh) with only an occasional large Green Ash being found. Generally, there are also some large isolated Silver and Swamp Maple (greater than 50 cm dbh) trees. Marsh Fern, Sensitive Fern, Tufted Loosestrife (*Lysimachia thrysiflora*), Stalked Water-

horehound (*Lycopus rubellus*) and various Sedge species can be found in the ground layer.

Type B: The second main type of Green Ash Mineral Deciduous Swamp found in Rondeau includes a canopy composed almost exclusively of young Green Ash (10-25 cm dbh), with a large amount of sunlight penetrating between the widely spaced trees, down to the ground layer. Maples are virtually absent, with only the occasional small seedling being found. Rarely, Black Ash trees can be found in the canopy, as well. The ground layer has a greater abundance of forb species (often with a dense understory of Canada Blue-joint and other graminoid species). Additional species found in the ground layer are Spotted Jewelweed, Sensitive Fern, Fringed Loosestrife, Tufted Loosestrife, Southern Water-plantain (*Alisma subcordatum*), Reed Canary Grass, Devil's Beggarticks (*Bidens frondosa*), Cut-leaved Water Horehound (*Lycopus americanus*), Smartweed (*Persicaria punctata*), Marsh Fern, Bittersweet Nightshade, Lady Fern, Intermediate Wood Fern (*Dryopteris intermedia*), Canada Blue-joint, Broad-leaved Cattail (*Typha latifolia*), Field Horsetail, Common Reed, Giant Goldenrod, Southern Blue-flag Iris (*Iris virginica*), Slender Stinging Nettle and Spicebush.

A third, restricted canopy type in the park is composed of Green Ash with White Willow (*Salix alba* var. *vitellina*) as a component of the species matrix. This is an isolated community found along a moist slough, which is located behind a row of cottages at the entrance to Marsh Trail. This community is too small to map, so it has been treated as a complex, as part of a larger Common Reed Graminoid Mineral Meadow Marsh along the Marsh Trail. The Golden Weeping Willows have seeded in from the neighbouring cottages. Standing water is usually present. The moisture regime for this community type is 6.

Maple Mineral Deciduous Swamp Ecosite (SWDM3)

The Maple Mineral Deciduous Swamp is the second most abundant swamp Ecosite found in Rondeau. The canopy is dominated by maple species. Standing water is present during the spring and often dries out by late summer. Various forb and graminoid species are found in the ground layer.

Silver Maple Mineral Deciduous Swamp Type (SWDM3-2)

Standing water is present on mineral soils during the spring and early summer, usually drying up in late summer. This community is located in long narrow depressions

between the sand ridges of forest. This community is often complexed with the Green Ash Mineral Deciduous Swamp Type and the two types often trade off in which is the prevailing condition.

The canopy, which has closure of between 25 and 60%, is composed predominantly of Silver Maple. Often, these Silver Maples exceed 50 cm dbh. Also in the canopy are small numbers of young Green Ash (10-25 cm dbh). In the sub-canopy, there are large numbers of young Green Ash and significantly fewer Black Ash. The sub-canopy has a closure of 25-60%. The ground layer (25-60%) is composed predominantly of Marsh Fern and to a lesser extent, Canada Blue-joint and Hop Sedge.

Additional species found in the layers of this vegetation type include Swamp Maple, Blue Beech, Red Maple, Broad-leaved Cattail, Common Reed, Blunt-leaved Bedstraw (*Galium obtusum*), Fringed Loosestrife, Tufted Loosestrife, Reed Canary Grass, Sensitive Fern, Southern Water-plantain, Spicebush, Bittersweet Nightshade, Stinging Nettle and Stalked Water-horehound.

Swamp (Freeman's) Maple Mineral Deciduous Swamp Type (SWDM3-3)

This community is located on mineral soils which support standing water during the spring and early summer, and usually dry up during the summer months.

Species that make up the canopy layer (25-60% closure) are dominated by Swamp Maple with significant components of Silver Maple and Green Ash. The sub-canopy (25-60%) is composed predominantly of Green Ash with much lower frequencies of Yellow Birch and Shagbark Hickory. The ground layer (25-60%) is composed of, in order of greatest abundance, Marsh Fern, Canada Blue-joint and Hop Sedge. Additional species that can be found in varying frequencies include Tufted Loosestrife, Broad-leaved Cattail, Bittersweet Nightshade, Black Raspberry, Common Reed, Sensitive Fern, Stalked Water-horehound, Spotted Jewelweed, Fowl Manna Grass and Spicebush.

Thicket Swamp Series (SWT)

Communities that are classified as thicket swamps typically experience variable flooding throughout the year, with the water depth not exceeding 2 m. Standing water or vernal pooling often represents greater than 20% of the ground cover. The representative vegetation of these communities is dominated by shrub species, rather than tree species.

Dogwood Mineral Deciduous Thicket Swamp Ecosite (SWTM2)

These thicket swamps are located on mineral soils and are dominated by dogwood shrub species. This is the most abundant type of thicket swamp found in the park.

Silky Dogwood Mineral Deciduous Thicket Swamp Type (SWTM2-2)

Mineral soils are generally wet, but standing water is rare during the spring in these communities. The canopy is composed of occasional trees representing less than 20% canopy closure and include Silver Maple, Basswood, Green Ash, Shagbark Hickory, Tuliptree, American Beech, Blue Beech and Hop Hornbeam. The understory (>60% closure) is dominated by Silky Dogwood, with lesser quantities of Gray Dogwood, Black Raspberry and Spicebush.

On the ground, a diversity of forb species is present. Most commonly found are Sedge spp., Virginia Creeper, Marsh Fern, Common Milkweed, Field Horsetail, Sensitive Fern, Canada Blue-joint, Western Poison Ivy, Broad-leaved Cattail, Spotted Joe-Pye Weed, Giant Goldenrod, Spotted Jewelweed, Common Reed, Southern Blue-flag Iris and Bittersweet Nightshade.

Gray Dogwood Mineral Deciduous Thicket Swamp Type (SWTM2-3)

This community is located on mineral substrates which experience variable water depths in the early spring, but dry up as the summer progresses. It has an overall moisture regime of 6.

The canopy is composed predominantly of Gray Dogwood which is present in much greater abundance than Spicebush. Other canopy species present in lesser numbers are Red-berried Elder (*Sambucus racemosa*) and Riverbank grape (in approximately equal abundances). Overall, the canopy represents greater than 60% closure. Occasionally, Black Raspberry is also present.

The understory (10-20% closure) of this community is dominated exclusively by Giant Goldenrod. Rare occurrences of Spotted Joe-Pye-Weed, Common Milkweed and Narrow-leaved Meadowsweet are possible.

The ground layer covers between 25-60% of this vegetation type. Species, in order of dominance, include Field Horsetail, Sedge spp. and Sensitive Fern. Also present in variable abundance are Pointed-leaved Tick Trefoil , Marsh Fern, Basil (*Clinopodium vulgare*) and Riverbank Grape (which spans across several layers).

Willow Mineral Deciduous Thicket Swamp Ecosite (SWTM3)

These thicket swamps are located on mineral soils and are dominated by willow shrub species.

Pussy Willow Mineral Deciduous Thicket Swamp Type (SWTM3-5)

This vegetation community is present only as a complex within a larger Common Reed Graminoid Mineral Meadow Marsh (polygon 1191). Mineral soils are dominated by Pussy Willow (Salix discolor). On the ground layer, Sedge spp. and Canada Blue-joint are typically found.

Mineral Deciduous Thicket Swamp Ecosite (SWTM5)

This Ecosite is characterized by mineral soils that experience wet moisture regimes and are dominated by specific shrub species.

Buttonbush Mineral Deciduous Thicket Swamp Type (SWTM5-1)

This community is found on mineral soils that experience abundant shallow water in the early spring that usually dries out as the summer progresses. It is most often found in long narrow depressions in the park. This community is often associated with Common Reed and Broad-leaved Cattail shallow and meadow marshes.

Vegetation is dominated by Buttonbush shrubs. The total shrub cover is always greater than 25% and much greater in most communities. Other shrubs may include Silky Dogwood and Pussy Willow. Occasional trees may be present, such as Silver Maple, Swamp Maple, Green Ash and Yellow Birch. The understory layer is composed of Broad-leaved Cattail, Spotted Joe-Pye-Weed and Common Reed.

In the ground layer, a mixture of forb and graminoid species is present. These include Canada Blue-joint, Spotted Jewelweed, Swamp Dock (*Rumex verticillatus*), Stinging Nettle, Swamp Thistle (*Cirsium muticum*), False Nettle (*Boehmeria cylindrica*), Bearded Sedge (*Carex comosa*), Marsh Fern, Tufted Loosestrife, Bittersweet Nightshade, Sensitive Fern and Southern Water-plantain.

Winterberry Mineral Deciduous Thicket Swamp Type (SWTM5-6)

This thicket swamp type is characterized by mineral soils that experience variable flooding. It is not a significant vegetation type in Rondeau and is found only in one location (polygon 858) as a complex within a *Green Ash Mineral Deciduous Swamp.*

The dominant vegetation is Common Winterberry. Associated species include Spotted Jewelweed, Sedge spp., Giant Goldenrod, Southern Water-plantain and Dotted Smartweed.

Spicebush Mineral Deciduous Thicket Swamp Type (SWTM5-9)

This vegetation community is present between ridges in the Rondeau forest. It is represented as a complex in polygons 1145 and 1176, but is also found as the prevailing type in polygon 1177. Mineral soils are generally moist, due to the ridge/slough pattern of the peninsula. It is very shrub-rich with a thin canopy.

The canopy (10-25%) is mainly represented by Green Ash with some Tuliptree. The sub-canopy (10-25%) is composed of young Green Ash. In the understory (>60%), Spicebush dominates, with some Blue Beech also present. The ground layer (60%) contains, in order of highest abundance, Field Horsetail, Spotted Jewelweed, Sedge spp. and Mayapple.

Organic Deciduous Thicket Swamp Ecosite (SWTO5)

This Ecosite is characterized by organic soils that experience wet moisture regimes and are dominated by specific shrub species.

Buttonbush Organic Deciduous Thicket Swamp Type (SWTO5-1)

Organic soils experience a longer period of flooding than the Buttonbush Mineral Deciduous Thicket Swamp. Vegetation is dominated by Buttonbush in the canopy. Silky Dogwood and, in lesser numbers, Common Winterberry are also present. The understory is dominated by Canada Blue-joint with various sedge species.

5.3.2 Marsh Class (MA)

Rondeau Provincial Park protects a large marsh community on its western side. The marsh is characterized by less than 25% tree cover and is dominated by emergent hydrophytic macrophytes. Flooding regimes are variable and water depth does not exceed two meters. Two main categories of marsh are found in Rondeau - shallow marsh and meadow marsh, each with a characteristic diversity of dominant plant species. As a result of the ridge and slough pattern of the park, larger tracts of lower lying marsh are interrupted by higher narrow ridges, often dominated by shrub species and mixed forbs and even forested areas.

Meadow Marsh Series (MAM)

The Meadow Marsh series of community types is characterized by species that are less tolerant of prolonged flooding. Flooding does occur in these sites, but is seasonal. Soils flood in the spring and are moist to dry by summer. The Meadow Marsh represents the transition zone between wetland and terrestrial systems.

Graminoid Mineral Meadow Marsh Ecosite (MAMM1)

Grasses and sedges dominate the Vegetation Types in this Ecosite. The substrate is composed of mineral soils. These sites can be found throughout the Rondeau Marsh on the west side of the park, as well as in openings throughout the forest.

Canada Blue-joint Graminoid Mineral Meadow Marsh Type (MAMM1-1)

Seasonal inundation of mineral soils with shallow water which typically dries out by mid to late summer characterizes this Vegetation Type. It is often present as a complex within a larger Vegetation Type and is usually located on slightly elevated narrow ridges within wetter sites, and may represent a transitional zone from dry ridges to wet depressions. This community is very common in Rondeau.

The canopy is dominated by Canada Blue-joint, which covers greater than 60% of the area of this vegetation community. False Nettle is the most abundant species in the sub-canopy, followed by Stinging Nettle and then Sedge spp.. There is between 25-60% cover in the sub-canopy. At the ground level (coverage of 25-60%), Spotted Jewelweed is found in greater quantities than Marsh Bellflower (*Campanula aparinoides*).

Additional associated species include Swamp Milkweed (*Asclepias incarnata* ssp. *incarnata*), Spotted Joe-Pye-Weed, False Nettle, Giant Goldenrod, Marsh Fern, Common Reed, Blue Vervain, Wild Mint (*Mentha arvensis* ssp. *borealis*), Water Sedge (*Carex aquatilis*), Marsh Hedge-nettle (*Stachys palustris*), Swamp Dock, Southern Blue-flag Iris, Common Arrowhead (*Sagittaria latifolia*), White Grass (*Leersia virginica*) (in the wetter depressions), Common Milkweed, Three-way Sedge (*Dulichium arundinaceum*) and Broad-leaved Cattail.

Due to the topographic pattern of ridges and sloughs in the park, species associations become variable. Occasional shrubs are also represented in this vegetation community and include Buttonbush, Common Elderberry, Gray Dogwood and Black Raspberry.

Cattail Graminoid Mineral Meadow Marsh Type (MAMM1-2)

Standing water is rare in this community. Mineral soils are generally dry for most of the year. Broad-leaved Cattail and Narrow-leaved Cattail (*Typha angustifolia*) are the dominant species found in this community, and cover greater than 60% of the site. The understory is Canada Blue-joint (predominant) and Spotted Jewelweed. Other species present include Water Smartweed, Common Reed, Marsh Fern, Stinging Nettle, False Nettle, Soft-stem Bulrush (*Schoenoplectus tabemaemontani*), Sedge spp., Giant Goldenrod, Wild Basil (*Clinopodium vulgare*), Swamp Thistle, Swamp Milkweed, Southern Blue-flag Iris, Bittersweet Nightshade and Tufted Loosestrife.

Reed Canary Grass Graminoid Mineral Meadow Marsh Type (MAMM1-3)

Often found as a complex within a larger community, this Vegetation Type is seasonally inundated with water but typically dries out by mid to late summer. It is characterized by mineral soils and the dominant species is Reed Canary Grass.

Associated with Reed Canary Grass are Common Reed, Giant Goldenrod, Spotted Jewelweed, Indian Hemp, False Nettle, Canada Thistle, Riverbank Grape and Buttonbush (on the ridges).

Narrow-leaved Sedge Graminoid Mineral Meadow Marsh Type (MAMM1-9)

This vegetation community is limited to only one polygon (319), where it is found as a complex within a larger Spike-rush Organic Shallow Marsh. Mineral soils are seasonally inundated and typically dry out during the summer months.

Water Sedge, Tussock Sedge (*Carex stricta*) and Woolly Sedge are the dominant sedge species that compose most of the vegetation present in this type. Often associate species are also found, such as Spotted Joe-Pye-Weed, Stinging Nettle, Giant Goldenrod, False Nettle, Marsh Fern, Spotted Jewelweed, Water Smartweed, Swamp Thistle, Bearded Sedge, Marsh Bellflower and Reed Canary Grass.

Common Reed Graminoid Mineral Meadow Marsh Type (MAMM1-12)

Mineral soils are seasonally flooded and dry out during the summer. This community is quite widespread on the west side of the park where long, narrow bands can be found running for hundreds of meters along specific moisture gradients. Some of the sloughs in the central section of the park have become dense homogeneous stands of this type, as well. It often merges into the surrounding communities, creating some overlapping of Vegetation Types. It is present as both the dominant Vegetation Type and as a complex

within other larger communities. This Vegetation Type is expanding within the park and is taking over other native community types. Some recent control actions have been initiated, however, and as a result, the actual coverage of this community is dynamic, both expanding and contracting depending on location and management.

This community is dominated by Common Reed which often grows up to 3.5 m tall, and is present in very dense stands. Other species that can be found in these communities in varying frequencies include Canada Blue-joint, Hardstem Bulrush (*Schoenoplectus acutus*), Tufted Loosestrife, Swamp Thistle, Stinging Nettle, Marsh Fern, Water Smartweed, Spotted Jewelweed, Swamp Loosestrife (*Decodon verticillatus*), Bittersweet Nightshade, Broad-leaved Cattail, sedge spp., Giant Goldenrod, Common Arrowhead, Marsh Hedge-nettle, False Nettle, Swamp Candles (*Lysimachia terrestris*), Buttonbush, Sandbar Willow, Silky Dogwood and Spicebush.

Rush Graminoid Mineral Meadow Marsh Type (MAMM1-13)

This vegetation type can be divided into two main types within the park. Both types are characterized by mineral soils that are inundated with standing water in the spring and dry out by mid to late summer; however, associated species are significantly different among the two types. They are often drier than surrounding communities but soils do remain saturated for the majority of the year.

Type A is restricted to the west side of the park, found only on the east side of the Marsh Trail. The most abundant species is Canadian Rush (*Juncus canadensis*) and associates include Boneset (*Eupatorium perfoliatum*), Giant Goldenrod, Swamp Milkweed, Bulrush spp. (*Scirpus* spp.), Canada Thistle, Bebb's Sedge (*Carex bebbii*) and Three-way Sedge.

Type B is restricted to low interdunal depressions found adjacent to the open beach on the Lake Erie (east) side of the peninsula. Soils are slightly drier. Here, Baltic Rush (*Juncus balticus*) dominates. Other species include Silverweed, Common Strawberry (*Fragaria virginiana*), White Clover, Common Milkweed, Meadow Goat's-beard (*Tragopogon pratensis* ssp. *pratensis*) and Marsh Fern.

Rice Cut-grass Graminoid Mineral Meadow Marsh Type (MAMM1-14)

Mineral soils are seasonally flooded, drying out by mid summer. This community is usually semi-shaded for part of the day. Species are dominated by Rice Cut-grass

(*Leersia oryzoides*) but may also include Mad-dog Skullcap (*Scutellaria lateriflora*) and Hop Sedge.

Bulrush Graminoid Mineral Meadow Marsh Type (MAMM1-15)

As with the other mineral meadow marshes, this vegetation community is typified by mineral soils that are flooded for part of the year and dry out during the summer months.

Vegetation is dominated by Hardstem Bulrush. Also present are False Nettle, Marsh Fern, Swamp Milkweed, Ovate Spike-rush (*Eleocharis ovata*), Common Arrowhead, Fraser's St. John's-wort (*Triadenum fraseri*), Canada Blue-joint, Water Smartweed, Bebb's Sedge and Stinging Nettle.

Mixed Graminoid Graminoid Mineral Meadow Marsh Type (MAMM1-16)

This vegetation community is characterized by mineral soils that experience seasonal inundation of standing water and dry out in the mid-summer months.

Various graminoid species make up the majority of the vegetation in these sites, but no one species dominates. A combination of Canada Blue-joint, broad and narrow-leaved sedge spp., rush spp. (*Juncus* spp.) and cattail are present in these communities.

Broad-leaved Sedge Graminoid Mineral Meadow Marsh Type (MAMM1-17)

This community is only found in two polygons (1032, 1046) where it is represented as a complex in the larger community. It is seasonally inundated with shallow water, drying out by mid to late summer. The mineral soils of this vegetation type are dominated by Bearded Sedge. Other species found in this community include Canada Blue-joint, Spotted Jewelweed, False Nettle, Marsh Bellflower, Reed Canary Grass, Giant Bur-reed (*Sparganium eurycarpum*), Water Smartweed and Broad-leaved Cattail.

Forb Mineral Marsh Ecosite (MAMM2)

A diversity of broad-leaved forb species dominates the Vegetation Types in this Ecosite. The substrate is composed of mineral soils. These sites can be found throughout the Rondeau marsh on the west side of the park, as well as in openings throughout the forest.

Jewelweed Forb Mineral Meadow Marsh Type (MAMM2-1)

Mineral soils are seasonally flooded, drying up by mid to late summer. Spotted

Jewelweed and Pale Jewelweed (*Impatiens pallida*) are the dominant vegetation species and compose the canopy of greater than 60 % cover in this wetland community. Associated species in the sub-canopy, with a cover of less than 60%, include Sensitive Fern, Rice Cut-grass, Panicled Aster (*Aster lanceolatum*), Reed Canary Grass, Wood Nettle and Stinging Nettle.

Mixed Forb Mineral Meadow Marsh Type (MAMM2-4)

Covering large areas in the Rondeau marsh, this community often includes several low ridges alternating with shallow depressions. Mineral soils are seasonally inundated with shallow water and typically dry out by mid to late summer.

There is generally a high diversity of species found in this community and typically, no one species is dominant. Often present are Marsh Hedge-nettle, Canada Blue-joint, Indian Hemp, False Nettle, Swamp Milkweed, Stinging Nettle, Spotted Jewelweed, Water Smartweed, Swamp Thistle, Canada Thistle, Blue Vervain, Spotted Joe-Pye-Weed, Giant Goldenrod, Canada Goldenrod, Swamp Loosestrife, Climbing False Buckwheat (*Fallopia scandens*), Broad-leaved Cattail, Marsh Bellflower, Reed Canary Grass, Southern Blue-flag Iris, Fraser's St. John's-wort and Canada Anemone. Shrub species, which are most often located on low ridges, are also present and include Buttonbush, Swamp Rose (*Rosa palustris*), Riverbank Grape and Black Raspberry.

Mixed Mineral Meadow Marsh Ecosite (MAMM3)

A diversity of forb species mixed with graminoid species dominates the Vegetation Types in this Ecosite. The substrate is composed of mineral soils. These sites can be found throughout the Rondeau marsh on the west side of the park, as well as in openings throughout the forest.

Mixed Mineral Meadow Marsh Type (MAMM3-1)

Seasonally inundated with shallow water, mineral soils typically dry out by mid to late summer. Vegetation includes a combination of Canada Blue-joint and a variety of forb species. Canada Blue-joint is co-dominant with species such as Giant Goldenrod, False Nettle, Spotted Joe-Pye-Weed, Fraser's St. John's-wort, Indian Hemp, Blue Vervain, Marsh Hedge-nettle, Water Smartweed, Stinging Nettle, Swamp Milkweed, Spotted Jewelweed, Common Reed, Hedge Bindweed (*Calystegia sepium*), Bearded Sedge, Swamp Loosestrife, Hooded Skullcap (*Scutellaria galericulata*), Wild Mint, Marsh Bellflower, Bittersweet Nightshade, Common Arrowhead, Ovate Spike-rush and

Hardstem Bulrush. Occasionally, shrubs such as Buttonbush, Riverbank Grape and Silky Dogwood are found on higher ridges in these communities.

Graminoid Organic Meadow Marsh Ecosite (MAMO1)

Grasses and sedges dominate the Vegetation Types in this Ecosite. The substrate is composed of organic soils. These sites can be found in low disturbance areas of the Rondeau marsh on the west side of the park.

Canada Blue-joint Graminoid Organic Meadow Marsh Type (MAMO1-1)

Organic soils are seasonally inundated with shallow water and dry out during the summer months. This community represents rare pockets within the Rondeau marsh.

Vegetation in the canopy layer is dominated by Canada Blue-joint, and includes Bearded Sedge and Rush spp. with decreasing abundance. Other species present include Ovate Spike-rush, Spotted Jewelweed, Spotted Joe-Pye-Weed, Common Reed and, rarely, Buttonbush.

Cattail Graminoid Organic Meadow Marsh Type (MAMO1-2)

Soils are organic and seasonally flooded during the spring, drying out by mid to late summer. Broad-leaved Cattail is the dominant species in the full canopy by far. Associated species may also include Swamp Thistle, Swamp Milkweed, Marsh Fern, Bittersweet Nightshade, Spotted Jewelweed, Sedge spp. and Canada Blue-joint. Occasional Buttonbush may be found on slightly elevated ridges.

Rice Cut-grass Graminoid Organic Meadow Marsh Type (MAMO1-4)

This vegetation community features organic soils that are seasonally inundated with shallow water that dries up by mid to late summer. Rice Cut-grass dominates this vegetation type. Species found in lesser frequencies include Dotted Smartweed, Common Arrowhead, False Nettle, Swamp Milkweed, Canada Blue-joint, Ovate Spike-rush and Hooded Skullcap.

Bulrush Graminoid Organic Meadow Marsh Type (MAMO1-21)

Organic soils flood during the spring time and dry out during the summer months. Hardstem Bulrush is the most abundant species of this community, sometimes associated with high quantities of Soft-stem Bulrush (*Schoenoplectus tabernaemontani*). Other species often found in this community are Canada Goldenrod,

Marsh Fern, Bittersweet Nightshade, sedge spp., Common Arrowhead, Canada Blue-joint, Spotted Joe-Pye-Weed and Stinging Nettle.

Common Reed Graminoid Organic Meadow Marsh Type (MAMO1-20)

This vegetation type is found only as a complex within a *Buttonbush Organic Thicket Swamp* (polygon 414) where it is represented by a homogeneous stand of Common Reed. The organic soils are seasonally inundated, typically drying out by mid to late summer.

Forb Organic Meadow Marsh Ecosite (MAMO2)

Jewelweed Forb Organic Meadow Marsh Type (MAMO2-1)

These sites can be found in low disturbance areas of the Rondeau marsh on the west side of the park. The organic soils flood in early spring and often dry by mid to late summer. The dominant species in this community is Spotted Jewelweed. Associated species include Canada Thistle, Sensitive Fern and Bittersweet Nightshade.

Shallow Marsh Series (MAS)

Vegetation Types categorized in the Shallow Marsh Series include vegetation species that are fairly tolerant of prolonged flooding.

Graminoid Mineral Shallow Marsh Ecosite (MASM1)

Mineral soils (sand, gravel) dominated by grasses and sedges. Some shallow water is present often drying up in the summer. This is the dominant Ecosite in the Rondeau Marsh.

Cattail Mineral Shallow Marsh Type (MASM1-1)

This is the dominant community type on the west side of the Marsh Trail. Some shallow water is present, a significant percentage of which often dries up by late summer.

The canopy is composed of Broad-leaved Cattail or Narrow-leaved Cattail. Associate vegetation in the sub-canopy includes Giant Goldenrod, Southern Blue-flag Iris, Swamp Loosestrife, Bittersweet Nightshade, Canada Blue-joint, and Common Boneset. Understory vegetation of these areas of the marsh includes Wild Basil, Common Ragweed (*Ambrosia artemesiifolia*), Marsh Fern, Sedge spp., Fringed Loosestrife, Smartweed spp. (*Persicaria* spp.), Southern Water-plantain, Common Arrowhead, Sensitive Fern and Spotted Jewelweed. Occasional Buttonbush are also found in the elevated areas.

Bulrush Mineral Shallow Marsh Type (MASM1-2)

This vegetation type is found in areas with moist mineral soils such as sloughs in the western forested region and in the marsh. A low diversity of plant species exists, sometimes found in homogeneous stands. Hardstem Bulrush is the main component of the canopy, occasionally with Tufted Loosestrife in low abundance, as well as Rice Cut-grass.

Broad-leaved Sedge Mineral Shallow Marsh Type (MASM1-5)

Standing in shallow water in early spring and drying up by late summer, but mineral soils are saturated all year. Often present as a slough between two ridges of forest. Surrounding forest may prevent light from penetrating to the water's surface.

The canopy includes less than ten percent tree canopy closure of Silver Maple and Green Ash. The sub-canopy (<10% closure) consists of shrub species such as Buttonbush and Gray Dogwood. The understory is mainly covered with Bearded Sedge, then Canada Blue-joint and, to a lesser extent, Hardstem Bulrush and Broad-leaved Cattail. Overall, there is greater than 60% cover in the understory. The ground layer is dominated by 40% cover of Marsh Fern, Sensitive Fern and Spotted Jewelweed.

Wild Rice Mineral Shallow Marsh Type (MASM1-6)

This Vegetation Type is characterized by standing shallow water in the early spring and drying up by late summer. Soils remain saturated during the entire year. This vegetation type is found in many of the channels that weave through the cattail marshes on the east side of Rondeau Bay. The dominant species is Southern Wild Rice (*Zizania aquatica*).

These communities seem to be fairly cyclical, being abundant in one season and quite sparse in another. With the lowering of the Lake Erie water level, these sites are becoming exposed mud over most of the year.

Bur-reed Mineral Shallow Marsh Type (MASM1-8)

This community is generally found in small patches and only as an inclusion (polygons 295, 457, 578c and 587) in a larger community type within the Rondeau Marsh. Giant Bur-reed dominates, with associated species such as Common Arrowhead, Ovate Spike-rush, Lesser Duckweed and various other Sedge species.

Canada Blue-joint Graminoid Mineral Shallow Marsh Type (MASM1-9)

Shallow water is present in this vegetation type during the spring and early summer, but may dry up and turn into a Meadow Marsh later in the season. Canada Blue-joint is dominant in mineral soils, but edge species are common associates.

Rice Cut-grass Mineral Shallow Marsh Type (MASM1-10)

Mineral soils are dominated by Rice Cut-grass. Shallow water is present for most of the year, occasionally drying up late in the summer. Associate species may include sedge spp. and Common Arrowhead.

Spike-rush Mineral Shallow Marsh Type (MASM 1-11)

This vegetation type is characterized by some shallow water in the spring and early summer, with the mineral soils remaining saturated well into the fall.

The community is dominated by Ovate Spike-rush but includes a great variety of associated species. The understory is composed of Common Arrowhead, Smartweed spp., Hooded Skullcap, Climbing False Buckwheat, Tufted Loosestrife, Common Hop Sedge and Swamp Loosestrife. In the canopy, Canada Blue-joint, Fraser's St. John's-wort, False Nettle, Swamp Milkweed, Common Reed, bulrush spp., Marsh Bellflower, Spotted Joe-Pye-Weed, Broad-leaved Cattail, Spotted Jewelweed, Marsh Hedge-nettle, Stinging Nettle and Blue Vervain are all present in varying rates of occurrence.

Common Reed Mineral Shallow Marsh Type (MASM 1-12)

This community is found mostly along the shoreline of Rondeau Bay. It is similar to Common Reed Graminoid Mineral Meadow Marsh with respect to dominant vegetation and mineral soils except that standing water is present for longer periods during the year. Shallow water is present in the spring and early summer, often drying up in late summer leaving mineral soils exposed but saturated.

Common Reed is the most abundant plant species by far and forms the canopy within this vegetation type. Associate species in the sub-canopy include Canada Blue-joint, Nodding Beggarticks (*Bidens cernua*), Buttonbush, Southern Blue-flag Iris, and Spotted Jewelweed. Marsh Fern, Bittersweet Nightshade, smartweed spp. and other sedge spp. compose the understory.

Reed Canary Grass Mineral Shallow Marsh Type (MASM 1-14)

Mineral soils are dominated by Reed Canary Grass. Shallow standing water is present in spring and early summer and may dry up by late summer.

Graminoid Organic Shallow Marsh Ecosite (MASO1)

Organic soils are dominated by grasses and sedges. Some shallow water is present, often drying up in the summer. This Ecosite includes areas of Rondeau Marsh on the west side of the park.

Cattail Organic Shallow Marsh Type (MASO1-1)

This vegetation type is characterized by organic soils and the presence of standing water in the spring, which usually dries up by late summer. The canopy contains greater than 60% cover and is composed predominantly of Broad-leaved Cattail, however, Common Reed may also be present. In the sub-canopy, there are, in order of abundance, Giant Bur-reed, Common Hop Sedge and Boneset. Spotted Jewelweed, Common Arrowhead and False Nettle are all found in the understory, which has between 25-60% total cover. Frog's Bit (*Hydrocharis morsus-ranae*) covers less than 25% of the ground layer.

Bulrush Organic Shallow Marsh Type (MASO1-2)

Shallow water is present for most of the year. Some stands are in permanent shallow water in Rondeau Bay. Organic soils produce a variety of plant species dominated by Hardstem Bulrush. Occasionally, Hardstem Bulrush forms homogeneous stands, but it is more often associated with an understory assemblage of species. In these assemblages, Hardstem Bulrush forms the canopy (>60%). Dominant species in the sub-canopy (<60%) include, in order of abundance, Bebb's Sedge, Bearded Sedge and Canada Blue-joint. The understory includes Ovate Spike-rush, which is more abundant than Common Arrowhead. The sparse ground layer contains rare occurrences of Dotted Smartweed. Other associated species include Water Smartweed, False Nettle, Fraser's St. John's-wort, Three-way Sedge, White Grass, Common Reed, Swamp Loosestrife, Swamp Milkweed, Canada Blue-joint, goldenrod species, Broad-leaved Cattail, Swamp Dock, Stinging Nettle and Spotted Joe-Pye-Weed. In places where elevated ridges are present, there may be small clusters of intermixed Buttonbush and Silky Dogwood.

Narrow-leaved Sedge Organic Shallow Marsh Type (MASO1-5)

This vegetation type exists in organic soils in which shallow water is present for most of the year. The canopy (<25% closure) is dominated by Buttonbush. In the sub-canopy, Water Sedge is the dominant species, but also included are Ovate Spike-rush, White Grass, Bulrush species, Bearded Sedge and Tufted Loosestrife. Coverage in the sub-canopy exceeds 60%.

Broad-leaved Sedge Organic Shallow Marsh Type (MASO1-6)

This vegetation community exists in organic soils in which shallow water is present for most of the year. Bearded Sedge is the most common species, but is usually not found in homogeneous mats as it is mixed with various graminoid and forb species. Common associates include Canada Blue-joint, Spotted Jewelweed, Common Reed, Broad-leaved Cattail, Buttonbush, Silky Dogwood, False Nettle, Softstem Bulrush and Spotted Joe-Pye-Weed.

Spike-rush Organic Shallow Marsh Type (MASO1-8)

This vegetation type is typified by organic soils which are inundated with shallow water for most of the year, but may dry up by late summer. Soils do remain saturated all year long.

The vegetation in this community is low in stature, generally not exceeding 0.5 m in height. Occasionally, taller species may be found only around the periphery of the community. Ovate Spike-rush and White grass are the two most abundant species. Associated with these are Bebb's Sedge, Common Hop Sedge, Hooded Skullcap, Dotted Smartweed, Floating-leaf Pondweed (Potamogeton natans), Common Arrowhead, Giant Bur-reed, Three-way Sedge, Marsh Bellflower, Swamp Loosestrife, Fraser's St. John's-wort, Tufted Loosestrife, Broad-leaved Cattail and Swamp Milkweed.

Bur-reed Organic Shallow Marsh Type (MASO1-9)

Shallow water is present in this vegetation type most of the year. Soils are saturated and organic. In some areas that are not covered in shallow water, the ground is covered in a dense moist layer of moss.

Vegetation in the canopy is predominantly Giant-Bur-reed which exceeds 60% cover. Also present in the canopy is Swamp Milkweed, Swamp Loosestrife, Swamp Dock and Broad-leaved Cattail, although frequency of these species is much lower than Giant

Bur-reed. In the sub-canopy, Water Sedge is more abundant than Yellow Pond-lily, which in turn is more abundant than Fragrant Water-lily and Hardstem Bulrush. The understory includes White Grass in greater abundance than Common Arrowhead. Some Giant Bur-reed is also present in the understory layer. Forming the ground layer is Ovate Spike-rush, pondweed spp. (Potamogeton spp.) and an infrequent presence of Frog's Bit.

Rice Cut-grass Organic Shallow Marsh Type (MASO1-10)

Organic soils are dominated by virtually homogeneous stands of Rice Cut-grass. Shallow water is present for most of the year, occasionally drying up late in the summer. Soils remain saturated throughout the year. Associate species may include sedge spp. and Common Arrowhead.

Common Reed Organic Shallow Marsh Type (MASO1-20)

Organic soils are inundated with shallow water for most of the year, possibly drying by late summer, soils remain saturated. This vegetation type is characterized by very dense, virtually homogeneous stands of Common Reed, but can be found with an associated understory matrix. This understory may include Broad-leaved Cattail, Canada Blue-joint, sedge spp., Spotted Jewelweed, Buttonbush, Tufted Loosestrife, Common Arrowhead, Swamp Loosestrife, Yellow Pond-lily, Slender Stinging Nettle, Swamp Thistle, Giant Goldenrod and Silky Dogwood.

Mixed Graminoid Graminoid Organic Shallow Marsh Type (MASO1-21)

This community is similar to the Bulrush Organic Shallow Marsh Type, but with a mix of bulrush, cattail, sedges, Swamp Loosestrife, Ovate Spike-rush and grasses in the canopy with Yellow Pond-lily and Fragrant Water-lily in the sub-canopy. Approx 50% of the community is open water.

5.4 Community Descriptions - Aquatic Systems

Rondeau Bay is a relatively large, shallow bay, with the majority of it being less than 3 meters deep. Where the water depths in the bay range between 1 and 2 metres, there are some large extensive stands of Eurasian Water-milfoil (*Myriophyllum spicatum*). These large stands provide suitable habitat for the growth of many native species of aquatic plants which are intermixing with this introduced species. This area provides habitat for many aquatic invertebrates and various fish species. In many of the more

sheltered inlets, where wave action is limited, there are also some fine examples of submergent aquatic communities along with a few floating-leaved plant communities.

Areas of the bay with submerged aquatic systems (Submersed Shallow Aquatic Series [SAS] below) could not be mapped by aerial photo interpretation. As such, they are mapped in the Open Water Series (OAW), but are complexed together.

5.4.1 Open Aquatic Class (OA)

Open Water Series (OAW)

No aquatic vegetation is present in areas classified within the Open Water Series, however these areas are often complexed with the *Submerged Shallow Aquatic Ecosite* communities. Where vegetation is absent, water depth is the controlling factor. In Rondeau Bay, the substrate generally consists of mineral soil, sometimes with a thin covering of organic material.

Communities in this series have not been classified below the series level due to the absence of vegetation.

Pond Ecosite (OAWPO)

Pond (OAWPO)

Represented by a single polygon (1181c) which is an anthropogenic feature in the north-eastern part of the park adjacent to the Pony Barn. This pond was likely dug as a watering hole for the horses that were at one time kept for trail rides in the park. It is associated with an upland *Fresh - Moist Oak - Hardwood Deciduous Forest*. More recently, after a number of dry seasons, a significant flush of ash seedlings has become established, however the pond is always inundated in the spring.

Lacustrine Ecosite (OAWLA)

Lake (OAWLA)

This community is represented by Rondeau Bay and Lake Erie within the park boundary.

Shallow Marsh Pond Ecosite (OAOPO)

Shallow Marsh Pond Type (OAOPO)

This community is represented by a single open aquatic community (polygon 336e)

found within Shallow Marsh communities where there is no significant vegetation. It differs from OAWPO in that it is found within (or complexed with) Shallow Marsh communities and may develop significant wetland vegetation in low-water years.

5.4.2 Shallow Water Class (SA)

Water depths in areas classified within the Shallow Water Class are variable, but usually less than 2 m. Vegetation consists of emergent, floating or submerged vascular plant species. In some areas where the water level is between 0.5 and 1 m, there are homogeneous communities of algal species.

Emergent aquatic communities are generally restricted to sheltered bays, next to the Broad-leaved and Narrow-leaved Cattail marshes found along the east side of the bay. Here, the wave action is less severe, and these species are less likely to be uprooted by the energy of waves.

Submerged Shallow Aquatic Series (SAS)

Communities classified as Submerged Shallow Aquatic Series have water depths less than 2 m and the dominant vegetation species are submerged below the water's surface. Communities in this series are found in the deeper water areas of the marsh and Rondeau Bay. Since they cannot be seen from an aerial photograph, they have not been mapped. These communities also change in distribution from year to year depending on water levels and summer weather.

Submerged Shallow Aquatic Ecosite (SAS1)

Pondweed Submerged Shallow Aquatic Type (SAS1-1)

These communities are characterized by various water depths (0.5 to 2 m), both on mineral and organic substrates. Dominant vegetation includes Clasping-leaved Pondweed (*Potamogeton perfoliatus*) and Sago Pondweed (*Potamogeton pectinatus*). Vegetation forms sparse to dense patches that do not reach the water's surface.

Stonewort Submerged Shallow Aquatic Type (SAS1-3)

This community is characterized by shallow water less than 1 m deep and sand substrates. Dominant vegetation is Stonewort species (*Chara* spp.). Usually, one species dominates the site, with no other associated species in the immediate area.

Water Milfoil Submerged Shallow Aquatic Type (SAS1-4)

Communities are generally found in deeper water, 1 to 2 m deep. There are some very large extensive stands found at the north end of the Bay. The dominant vegetation is Eurasian Water-milfoil. Other common species include Clasping-leaved Pondweed, Water Celery (*Vallisnera americana*) and Sago Pondweed.

The Eurasian Water-milfoil reaches the water surface and produces large floating mats of vegetation that are visible from the shoreline.

Naiad Submerged Shallow Aquatic Type (SAS 1-9)

These communities are usually found in the more sheltered inlets along the edge of Broad-leaved Cattail Marshes. The dominant species of vegetation is Southern Naiad (*Najas guadalupensis*), although Clasping-leaved Pondweed is often present, as well. Southern Naiad forms sparse to dense patches that do not reach the water's surface.

Floating-leaved Shallow Aquatic Series (SAF)

Communities classified in the Floating-leaved Shallow Aquatic series have water depths less than 2 m and the dominant vegetation is floating on the water's surface.

Floating-leaved Shallow Aquatic Ecosite (SAF1)

Water Lily – Bullhead Lily Mixed Shallow Aquatic Type (SAF1-1)

This community is found predominantly in sheltered bays or inlets where wave action is limited. Substrates are mineral or organic soils. The dominant vegetation is Bullhead Pond-lily (*Nuphar variegatum*). These communities usually consist of small patches that are approximately 5 m across and are generally found along the edge of the cattail marshes.

Chapter 6: Life Science Features - Flora

A total of 916 species of vascular plants has been recorded in the park. The list provided in Appendix 2 has been modified and updated from Woodliffe (2002), with the addition of new species to the list, NHIC S-ranks and SARO list status. Additional species were added to the list based on the work of David Bradley (unpublished data), Michael Oldham (Oldham 2005, unpublished data), Savanta (2009) and new species recorded by park staff.

6.1 Plant Species at Risk

Of the 916 species listed for the park, 72 (7.9%) are provincially significant as denoted by NHIC S-ranks of S1, S2 or S3 (Appendix 1). Specifically, 10 species are listed as S1, 28 as S2/S2? and 34 species as S3/S3?. Fourteen of these are also listed as Endangered, Threatened or Special Concern on the SARO list (Table 13). A brief discussion on each of the SARO listed species with respect to current status and any monitoring activities is provided.

Table 13. Plant species at risk recorded at Rondeau Provincial Park

Common Name	Scientific Name	S-Rank/SARO
Bent Spike-rush	*Eleocharis geniculata*	S1 END
Nodding Pogonia	*Triphora trianthophora*	S1 END
Red Mulberry	*Morus rubra*	S2 END
American Ginseng	*Panax quinquefolius*	S2 END
Flowering Dogwood	*Cornus florida*	S2? END
Butternut	*Juglans cinerea*	S3? END
American Water-willow	*Justicia americana*	S1 THR
Goldenseal	*Hydrastis canadensis*	S2 THR
Willowleaf Aster	*Symphyotrichum praealtum*	S2 THR
Common Hoptree	*Ptelea trifoliata var. trifoliata*	S3 THR
Swamp Rose Mallow	*Hibiscus moscheutos ssp. moscheutos*	S3 SC
Broad Beech Fern	*Phegopteris hexagonoptera*	S3 SC
Shumard's Oak	*Quercus shumardii*	S3 SC
Riddell's Goldenrod	*Solidago riddellii*	S3 SC

Bent Spike-rush S1 END. This species is represented by a 1934 specimen (R.F. Cain; DAO, TRT) from the park. Despite considerable searching, it has not been seen since (NHIC 2011).

Nodding Pogonia S1 END. Nodding Pogonia is restricted to two locations in Ontario - Rondeau and a small woodlot in Essex County (Government of Canada 2011). Native populations exist within the park, but it is believed that some introductions have also been made. It has been documented from a total of four locations in Rondeau, with one primary one. Due to the potential for collection, no detailed information on the location of these populations is provided.

Formal monitoring plots were developed by P. Allen Woodliffe in 1986 and monitored in most years since that time (Woodliffe 2009). This species flowers for only a day per year and is very difficult to find. It can also remain dormant underground for many years, appearing to have declined. However, monitoring has shown that the flowering population has varied dramatically with extreme ranges of as low as seven stems to as many as 1357 (Woodliffe 2009).

One of the threats for this species within the park has been the expansion of Japanese Barberry (Woodliffe 2009). In an attempt to reduce the competition from barberry, a spray program was conducted in the spring of 2010 in the general area of the main Nodding Pogonia population. Success of this program needs to be evaluated.

Red Mulberry S2 END. This species has been well documented in Rondeau and an up-to-date inventory is available. All but one of the trees are located along park roads or trails (Figure 27), bringing into question whether they are actually native to the park or were planted at some point in time. Due to their location adjacent to the road, care must be taken during road maintenance and brushing operations to ensure that damage to the trees does not occur. Eventually, some pruning may be required to prevent overhead branches from impacting large vehicles on the road.

Red Mulberry is considered Endangered due in part to its tendency to hybridize with the more common (and invasive) White Mulberry. Studies have shown that hybridization results in a loss of the Red Mulberry genes and favours the White Mulberry genes, which is due in part to the relative frequency of both parents (Burgess *et al*. 2005). Since White Mulberry is a common invasive in the park, the likelihood of pure Red Mulberry seedlings will remain very low until White Mulberry can be significantly reduced in numbers.

Red Mulberry is also known to suffer from twig blight, twig dieback, cankers and root rot. Health assessments were done at the four main populations, including Rondeau. The Rondeau trees were some of the healthier ones assessed (PCA 2007).

American Ginseng S2 END. American Ginseng is present within the park and has been confirmed recently. Due to the threat of collection for this species, no further discussion is provided here. Further information may be obtained from the Zone Ecologist.

Flowering Dogwood S2? END. Flowering Dogwood is listed on the park checklist, and was present historically, although no records exists within the NHIC data base. Apparently, this species was collected by R.D. Ussher (former park naturalist) in 1965, and two to three trees were present south of the Visitor Centre along Harrison Trail. The trees persisted into the 1970s, but were likely lost through a combination of deer browsing and ice storms (P.A. Woodliffe, pers. comm.).

Butternut S3? END. Butternut is a rare but regular species in the Rondeau forest at very low densities and is scattered throughout the deciduous forests. No recent inventory work has been conducted and the status of Butternut Canker (*Sirococcus clavigignenti-juglandacearum*) has not been evaluated in the park.

American Water-willow S1 THR. American Water-willow was recorded from the park in 1984 when approximately 30 plants were observed in a slough in the south-east corner of park. Location details available in the NHIC database are not sufficient to determine the exact location and the species has not been seen since, despite some focussed searches (NHIC 2011).

Goldenseal S2 THR. Goldenseal is present within the park and has been confirmed recently. Due to the threat of collection for this species, no further discussion is provided here. Further information may be obtained from the Zone Ecologist.

Willowleaf Aster S2 THR. This species was recorded in the park in 1956 by W.J. Cody, but no confirmed observations have been made since (NHIC 2011).

Common Hoptree S3 THR. This species is associated with beach dune communities in Rondeau, particularly the *Little Bluestem - Switchgrass - Beachgrass Open Graminoid Sand Dune Type* but as a result of succession, it is now found in some shrub and treed sand dune communities (*Cottonwood Treed Sand Dune Type and Willow Shrub Sand Dune Type*). There are also a few stems in what is now *Fresh - Moist Oak Carolinian*

Deciduous Forest Type, but right at the edge of that community and Common Hoptree likely established when the area was more open.

It is found as a naturally occurring tree in the park, but has also been planted to some extent by park staff in an effort to bolster the population which was perceived to be declining. To assess the population within the park, an inventory was conducted in 2004 which found a total of 138 trees in the park, of which 38 were considered natural and 92 which were assessed as planted (Figure 27) (Dobbyn 2005b). Prior to ongoing deer control in the park, Common Hoptrees were likely heavily browsed which may have resulted in a decline. Off-lease activities to clear dune vegetation may have also reduced numbers. Currently, the population appears to be stable, but an updated inventory could be conducted. If such an updated inventory is conducted, standardized health indicators should be taken.

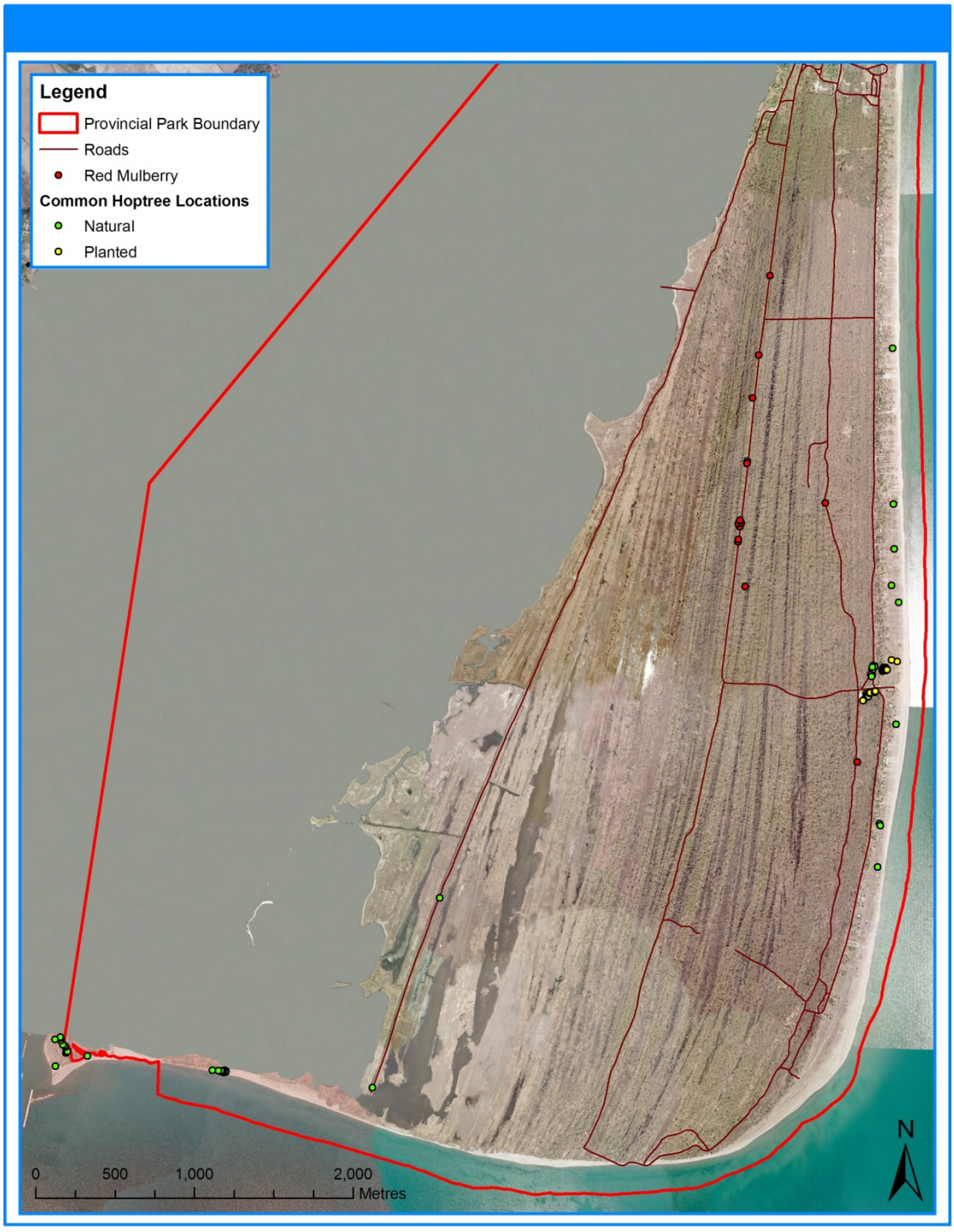

Figure 27. Locations of Common Hoptree and Red Mulberry in Rondeau

Swamp Rose Mallow S3 SC. Swamp Rose Mallow is a regular species in the Rondeau marsh, particularly along the western edge of the marsh bordering Rondeau Bay. A detailed inventory of plants has not been made recently, but an estimated 50-100 patches would be found in the park (S. Dobbyn pers. obs.).

Broad Beech Fern S3 SC. Broad Beech Fern is known from one general location within the park along Spicebush Trail, and has been known from the same general area back as far as 1936. More recent counts have documented thousands of stems along a 25 m portion of the trail (NHIC 2011).

Shumard's Oak S3 SC. This species is listed on the park checklist but no record or element occurrence exists within the NHIC data base. No further details are available.

Riddell's Goldenrod S3 SC. This species was recorded from the park in 1892, and was last observed in 1948. Despite a number of searches, this species has not been re-located since 1948 (NHIC 2011).

6.2 Other Significant Plant Species

There are many other significant plant species documented within the park, with a total of 72 species ranked between S1 and S3, most of which will not be discussed here in detail. However, a few of these do deserve some discussion.

Pumpkin Ash, (*Fraxinus profunda*) S2?. Pumpkin Ash is a fairly recent addition to the Ontario plant list, and Rondeau was one of the locations from which the species was originally recorded in Ontario (Waldron *et al.* 1996). At Rondeau, it is found mixed throughout some of the Green Ash Mineral Deciduous Swamp and Silver Maple Mineral Deciduous Swamp types. It can be difficult to identify during much of the year, but can be readily identified by its very large keys in the fall. This species is at risk due to the invasion of Emerald Ash Borer (*Agrilus planipennis*) into southwestern Ontario. Since only Blue Ash (*Fraxinus quadrangulata*) appears to have any resistance to Emerald Ash Borer, it is likely that all or a significant portion of the Pumpkin Ash population in Rondeau is at risk.

Putty-root (*Aplectrum hyemale*) S2. This species has been recorded in five general locations within the park and has been monitored intermittently since the 1970's (Woodliffe 2010). This species will be assessed by COSEWIC in the next few years,

and thus, a 2009 updated inventory was conducted by Nigel Finney, Allen Woodliffe and Sandy Dobbyn. A total of 146 plants was observed in three of the five historical locations within the park.

Eastern Prickly Pear Cactus (*Opuntia humifusa*) S1 End. Eastern Prickly Pear Cactus is listed on the SARO list as Endangered, but the designation is specific to the population at Fish Point Provincial Nature Reserve on Pelee Island. Cactus within Rondeau is believed to be introduced, likely from the Fish Point population. Genetic analysis had been initiated but has not yet been completed to confirm whether the Rondeau plants are from Fish Point. If they are, it may be appropriate to repatriate the plants from Rondeau to Fish Point due to the declining population at that location. An inventory of cactus at Rondeau was conducted in May 2005 (S. Dobbyn, unpublished data), when 22 plants in 18 locations were found. Additional plants have been noted since that time, indicating either reproduction or further introductions. There is some suspicion that additional plants have been introduced within the same area in recent years (S. Dobbyn, pers. obs).

Green Milkweed (*Asclepias virdiflora*) S2. Green Milkweed is found growing in the open dune areas of the park, associated with big bluestem and Indian grass. This species has been monitored sporadically. Areas where it has been found include the campground and the dunes across from the Visitor Centre (Table 14).

Table 14. Locations of Green Milkweed in Rondeau Provincial Park

Location	Number of Plants	UTM
Campground, Site 138	2	430452 4685785
Campground Site 183	5	430455 4685770
Campground Pine St. close to main road	5	430457 4685761
Campground Site 139 (near oak tree)	5	430451 4685752
Campground , between Cedar St. and fence line	11	430462 4685735
Campground, near Cedar St. sign	2	430515 4685713
Campground, 10 m north of main road extension to Lakeshore	1	
Fence line to Beech St.	5	430508 4685762
Visitor Centre, north of beach parking lot	5	

6.3 Alien and Invasive Plant Species

Of the 916 plant species found in the park, 224 (24.5%) are considered non-native to Ontario (alien) and a further four species are native to Ontario but not to the park itself. This is slightly higher than the percentage of alien to native species known provincially (OMNR 2006c), which may be the result of Rondeau's location in the extreme southwestern portion of the province.

Alien species are plants, animals and micro-organisms that have been accidentally or deliberately introduced into areas beyond their normal range. Invasive species are defined as harmful alien species whose introduction or spread threatens the environment, the economy or society, including human health. Not all alien species express invasive tendencies, nor are equally as aggressive.

Although alien species can be found throughout the park, there is a concentration in the eastern and northern portions of the park where most of the development has occurred. A recent inventory of invasive species along the eastern portion of the park was conducted by Savanta (2009). Their study focussed on the areas from Lakeshore Road east to the lake, but it also examined trail sides along Harrison, Black Oak and Tuliptree Trails. The study documented 105 alien species in the area between Lakeshore Road

and the open beach. Savanta then used the U.S. Invasive Species Impact Rank (I-Rank) data base to assign ranks to each of the species found so that they could be ranked in their order of “invasiveness”. According to this ranking, the top twenty invasive species found during their study were:

Tree-of-heaven *Ailanthus altissima*
Garlic Mustard *Alliaria petiolata*
Japanese Barberry *Berberis thunbergii*
Cheatgrass *Bromus tectorum*
Canada Thistle *Cirsium arvense*
Quack Grass *Elymus repens*
Cypress Spurge *Euphorbia cyparissias*
Creeping Charlie *Glechoma hederacea*
Dame's-rocket *Hesperis matronalis*
Common St. John's-wort *Hypericum perforatum*
Tartarian Honeysuckle *Lonicera tatarica*
Black Medick *Medicago lupulina*
White Sweet Clover *Melilotus alba*
White Mulberry *Morus alba*
Canada Bluegrass *Poa compressa*
Kentucky Bluegrass *Poa pratensis*
European White Poplar *Populus alba*
Black Locust *Robinia pseudo-acacia*
Multiflora Rose *Rosa multiflora*
Bouncing Bet *Saponaria officinalis*
Alsike Clover *Trifolium hybridum* ssp. *elegans*
Periwnkle *Vinca minor*

This list has many similar species as listed in the Rondeau Vegetation Management Plan (OMNR 2001, Table 1 page 34), although the list in the Vegetation Management Plan includes a number of species that, albeit alien, were not necessarily expressing invasive tendencies within the park.

A number of the species listed above have been of concern for some time and have had some management actions initiated to try to control them. These include Tree-of-heaven, Japanese Barberry, Tartarian Honeysuckle, White Sweet-clover, White Mulberry, European White Poplar and Black Locust. In the winter of 2010, a control program was undertaken to remove non-native tree species from the eastern dune community in the park. Work was done when the ground was frozen, and all non-native

trees that could be identified accurately were removed in an area from the most southerly cottage to the north boundary. A control program for Japanese Barberry was also conducted in the vicinity of Nodding Pogonia populations (see section 6.1).

Meloche conducted a study on Tree-of-heaven in the park and evaluated various control options, including various herbicide treatments and the use of prescribed burning. She concluded that Tree-of-heaven was best controlled by a combination of Easy-ject and cut and stump treatments (Meloche and Murphy 2002).

A survey to map the distribution and abundance of Japanese Barberry was conducted in the fall of 2011. The results of the survey will be used to investigate the influence of environmental and anthropogenic factors on the introduction and spread of the plant in the park, and to provide baseline data for evaluating control options.

The most recent invasive species to be discovered in the park is Jetbead which has only recently started to be found outside of cultivation in southwestern Ontario (M. Oldham, pers. comm.).

Chapter 7: Life Science Features - Fauna

7.1 Mammals

Thirty-six species of mammals have been documented in Rondeau Provincial Park, of which 30 are or may still be found within the park during all or part of the year (Appendix 3, Dobbyn 2005c). The species that are most often seen include Gray Squirrel (*Sciurus carolinensis*), Eastern Cottontail (*Sylvilagus floridanus*), Eastern Chipmunk (*Tamius striatus*), White-tailed Deer, Raccoon (*Procyon lotor*), Virginia Opossum and Mink (*Mustella vison*). Several other species are common within the park but are rarely seen due to their secretive and/or nocturnal behaviour. These include the shrews, bats, small rodents (mice and voles), Southern Flying Squirrel (*Glaucomys volans*), Coyote and weasels.

7.1.1 Recent Mammal Research and Inventories

Some mammals are large and conspicuous and their general status can be derived by the number of casual observations obtained for each. Other mammals such as mice, voles, shrews and bats, however, can be very difficult to observe due to their small size,

secretive nature, or nocturnal habits. These species require more intensive sampling, including such methods as live trapping or mist netting.

In 2002, an intensive small mammal trapping study was conducted in the park (Dobbyn and Pasma 2003). Effort consisted of a total of 2520 trap nights at 21 sites throughout the park. A total of 172 captures of seven species (plus two sub-species) was obtained, including all of the expected small rodents and shrews except for the Masked Shrew (*Sorex cinereus*). The most common species detected during the study were White-footed Mouse (*Peromyscus leucopus*) and Northern Short-tailed Shrew (*Blarina brevicauda*).

There have been no formalized bat surveys; however, mist netting and surveys with bat detectors have been conducted regularly since 2000 during interpretive programs and casual sampling. These surveys were responsible for detecting Eastern Pipistrelle (*Perimyotis subflavus*) and confirming Little Brown Bat (*Myotis lucifugus*) in the park and confirming the status of the other species.

7.1.2 Uncommon Mammals of Rondeau

Two species of Rondeau's mammal fauna are at the extreme edge of their Ontario range in the park and despite being common elsewhere in the province, are regionally rare here.

The Star-nosed Mole (*Condylura cristata*) is an unexpected resident of the park. Records from the Atlas of the Mammals of Ontario (Dobbyn 1994) and Peterson (1966) indicate that Rondeau represents a southwest range extension for this species in Ontario. The closest record submitted to the Atlas was for a single specimen found approximately 40 km north of the park. Stewart (1982) indicates that the species is relatively common in Elgin County, but not found west of Kent County.

Although there were no records for Rondeau submitted to the Atlas, species observation cards indicate that Star-nosed Moles were found within the park on at least three occasions between 1958 and 1981 (Park Files). A more recent record was provided to the park in the form of a photograph of a road-killed individual in 2004.

The Eastern Pipistrelle is a southern species found throughout the eastern United States north to the Great Lakes basin and St. Lawrence River (van Zyll de Jong 1985, Dobbyn 1994). In Ontario, it is most often found between Kingston and Renfrew, with a

handful of records from the Guelph, Hamilton and Long Point areas. West of Long Point, the only published record is for Point Pelee in 1992 (Dobbyn 1994). The absence of this species from southwestern Ontario may be due to a lack of suitable hibernacula (Kurta 1995) and the difficulty in surveying for it. A single Eastern Pipistrelle was captured in a mist net at Rondeau during the summer of 2003 (S. Dobbyn, unpublished data).

7.1.3 Historical, Incidental and Introduced Mammals of Rondeau

Of the six species that are no longer found in the park, one was lost as a result of changing habitat conditions and two were lost as a result of a provincial range reduction or extirpation. Woodchucks (*Marmota monax*) were once relatively common in the park (OMNR 1972), but have not been seen since the early 1970's (P.A. Woodliffe, pers. comm.). Higher water levels in the early 1970's likely made the park unsuitable for burrowing. Woodchucks. They are also not particularly common in the intensively cropped farmlands of southern Chatham-Kent (Dobbyn 1994), and thus, recolonization is not very likely.

Beavers (*Castor canadensis*) were common in southwestern Ontario at the time of European settlement but harvest, combined with loss of forest and aquatic habitat to agriculture, resulted in population declines throughout this area. Eventually, Beavers were lost from Essex County and Chatham-Kent, including Rondeau (Peterson 1966, Dobbyn 1994). Beavers likely disappeared from the park more than a century ago, as there are no records on file.

The eastern race of Wapiti or Elk (*Cervus canadensis*) was common throughout southern Ontario at the time of European arrival, but declined due to excessive hunting and habitat loss. The eastern race became extinct in the late 1800s. Wapiti that have been introduced to areas of central Ontario are from the western race (*Cervus elaphus manitobensis*) (Peterson 1966, Dobbyn 1994, OMNR 2010b).

The other three species that are no longer found in the park are exceptional records of species not normally expected here and include a failed introduction, a transient species and one species that is at the extreme edge of its Ontario range and out of typical habitat.

Marten (*Martes americana*) was introduced to the park in 1958, but disappeared by 1960 (OMNR 1972). In Ontario, Marten is not typically found south of the Canadian Shield (Dobbyn 1994).

At least one Grey Fox has been seen in the park (R. D. Usher, notes in park files), but it is unlikely that it was resident here. Grey Foxes in Ontario are considered to be transitory and nomadic, and most individuals likely originate from the U.S. (Peterson 1966). The only location in the province where there is a permanent population with breeding records is Pelee Island (Judge and Haviernick 2002).

The Red Squirrel (*Tamiasciurus hudsonicus*) is common throughout most of the province in coniferous or mixedwood habitats, but it is generally absent from areas of southwestern Ontario where pine and spruce are rare or absent (Dobbyn 1994). In 1960, one Red Squirrel was observed near the Visitor Centre in the early summer, with another sighting in the late summer (Park Files). Since there are no other records for this species in the park, the origin of the single animal is questionable. It is possible that this squirrel was inadvertently transported to the park in a camper or other vehicle.

7.1.4 Mammals Not Found in Rondeau

There are four species of mammal (two bats and two shrews) that have not been recorded in the Rondeau area, but that are shown as potential species for the park in range maps published by a number of authorities (i.e., Peterson 1966, Banfield 1974, van Zyll de Jong 1983, 1985). Although their range maps illustrate these species ranging throughout southwestern Ontario, the authors did not include any specific records from as far west as Rondeau. Since the Atlas of the Mammals of Ontario (Dobbyn 1994) does not show any records for these species west of Middlesex County, we may conclude that the previously published ranges were speculative. These species may, however, be considered as potentially being found in the park and should be looked for during future surveys.

The two shrews include the Pygmy Shrew (*Sorex hoyi*) and the Smoky Shrew (*Sorex fumeus*). Both of these species are shown to range throughout southwestern Ontario by van Zyll de Jong (1983), but actual documented records in Peterson (1966) and Dobbyn (1994) show that the most westerly records are from Coldstream and London, respectively.

Both Peterson (1966) and van Zyll de Jong (1985) show the Eastern Small-footed Bat (*Myotis leibii*) to be found here, but the closest published record is of an individual from Mount Brydges (just west of London). This species is most common in eastern Ontario and may not range far from suitable hibernacula. It is also considered to be uncommon in Ontario (S2S3), and as such, it may simply have been overlooked in this area (van Zyll de Jong 1985).

The Northern Long-eared bat (*Myotis septentrionalis*) is also shown by some authors to range here, but the only records from west of Elgin County are from Peterson (1966) in Essex County. Interestingly, those records were not on file at the Royal Ontario Museum (where Peterson was curator) during the Mammal Atlas. This species is closely associated with forested habitats (van Zyll de Jong 1985) and thus, could be overlooked.

7.1.5 Mammal Species at Risk

One species of mammal that is listed on the SARO list, Gray Fox (S1 THR), has been detected in the park, but it is not resident in the park and the record likely represents a wandering individual (see 7.1.3). The Southern Flying Squirrel was, until recently, listed as Special Concern, but it has been removed from the list based on more recent surveys that show its range to be much more widespread in Ontario than previously thought. Southern Flying Squirrels are quite abundant in the park (S. Dobbyn pers. obs).

Two bat species found in Rondeau (Eastern Pipistrelle and Little Brown Bat) were listed by COSEWIC as Endangered in February 2012 due to the threat of White-nosed Syndrome which is caused by the fungus *Geomyces destructans* (COSEWIC 2012c). COSSARO reviewed these species as well, but results of that review are not yet available. Both of these are expected to be ranked Endangered by COSSARO.

The Eastern Pipistrelle is currently listed by the NHIC as S3? It has the most limited distribution of all bats in the province and is most often found in the southeastern part of the province. Only one record of this species has been obtained in the park, but targeted surveys have been limited, and further surveys for all bat species are warranted.

7.2 Birds

Rondeau is well known as one of the most significant locations in the province for bird migration (Cheskey and Wilson 2001) however it is also a very significant location for breeding species. To date, 354 species of birds have been documented within the Rondeau Provincial Park checklist area (Woodliffe 2009b), of which there is breeding evidence for 147 species (Appendix 4). The checklist area corresponds with the Christmas Bird Count circle which includes a significant amount of area outside of the park proper, including some habitats that are much different than those found within the park (such as the Blenheim Sewage Lagoons). As such, some species on the checklist have not have been recorded in the park. An attempt has been made to note any species that have likely not been detected in the park proper, as denoted by (NP) in Appendix 4. As well, birds that have no known evidence of breeding in the park proper (but do have breeding evidence in the checklist area) are denoted by (NB). This brings the total number of birds known to have occurred in the park to 343, with 137 of those having breeding evidence in the park.

Thirty-two species of birds on the Rondeau checklist are considered species at risk and are listed on the *Species at Risk in Ontario List* (OMNR 2012). Of these, ten are Endangered, nine are Threatened, thirteen are Special Concern, and one each is Extirpated and Extinct (see section 7.2.5 and Appendix 4).

As a major bird migration stop-over, Rondeau receives a great deal of visitation by bird watchers from all over Ontario and the world in general. As a result, Rondeau has benefited significantly from visitors reporting species that are uncommon or new to the park, and many of these records have contributed to the park species list. Any records of rare species new to the park that are on their review list, have been reviewed by the Ontario Bird Records Committee prior to being included on the checklist.

Our knowledge of bird distribution and populations has benefited from the efforts of a number of monitoring programs, several of which are discussed in the following sections. Although a complete summary of all findings has not been provided here, the information is available and is being used to assist in long-term monitoring of various species.

7.2.1 Bird Monitoring Results – Forest Bird Monitoring Program

Forest Bird Monitoring Plots have been monitored irregularly since 1991. Between 1991 and 2005, monitoring was conducted in eight different years. Some routes were also monitored in 2009, but since not all sites were surveyed, data from that year have not been included.

A total of 111 species of birds has been documented by the FBMP, however the program averages approximately 1900 individuals of 64 different species per year (Figure 28). The most common species detected include Yellow Warbler (*Setophaga petechia*), Common Grackle (*Quiscalus quiscula*), Red-winged Blackbird (*Agelaius phoeniceus*), Eastern Wood-pewee (*Contopus virens*), Baltimore Oriole (*Icterus galbula*), American Robin (*Turdus migratorius*), House Wren (*Troglodytes aedon*), Mourning Dove (*Zenaida macroura*), Brown-headed Cowbird (*Molothurs ater*), Great Crested Flycatcher (*Myiarchus crinitus*), Song Sparrow (*Melospiza melodia*), Yellow-billed Cuckoo (*Coccyzus americanus*), Northern Cardinal (*Cardinalis cardinalis*), American Redstart (*Setophaga ruticilla*) and Red-eyed Vireo (*Vireo olivaceus*).

The FBMP focuses on birds that utilize forested habitats during the breeding season. However, significant overlap occurs with some more typically open habitats (particularly wetland) in Rondeau, due to the rapid change between communities in the east-west direction. As a result, species such as Red-winged Blackbird, Song Sparrow and Common Yellowthroat (*Geothlypis trichas*) are more regularly recorded in Rondeau than may otherwise be recorded by the FBMP.

A full statistical analysis of the FBMP data for Rondeau has not been completed, but it is possible to detect some rough trends and make some observations, particularly for more common species. For example, despite the concerns that West Nile Virus could have a significant impact on members of the families Paridae and Corvidae (chickadees, crows, jays), a look at trends over time (Figure 29) shows that both Black-capped Chickadee (*Poecile atricapillus*) and Blue Jay (*Cyanocitta cristata*) are, in fact showing a slight increase in numbers over time within the park. Species at Risk are also monitored, although many species are detected at numbers too low to detect actual trends. Despite that, Chimney Swift (*Chaetura pelagica*) (THR) and Red-headed Woodpecker (SC) are both detected fairly regularly by the FBMP, and neither has shown a decline between 1991 and 2005 within the park. In fact, Chimney Swift detections have increased slightly (Figure 29). Prothonotary Warbler (END) is also

detected by the program and does show a decline based on detections within the FBMP, however, much more intensive monitoring of the entire park has occurred since 1998 by the recovery team and there are much better data documenting the declining trends of Prothonotary Warbler in the park (section 7.2.4).

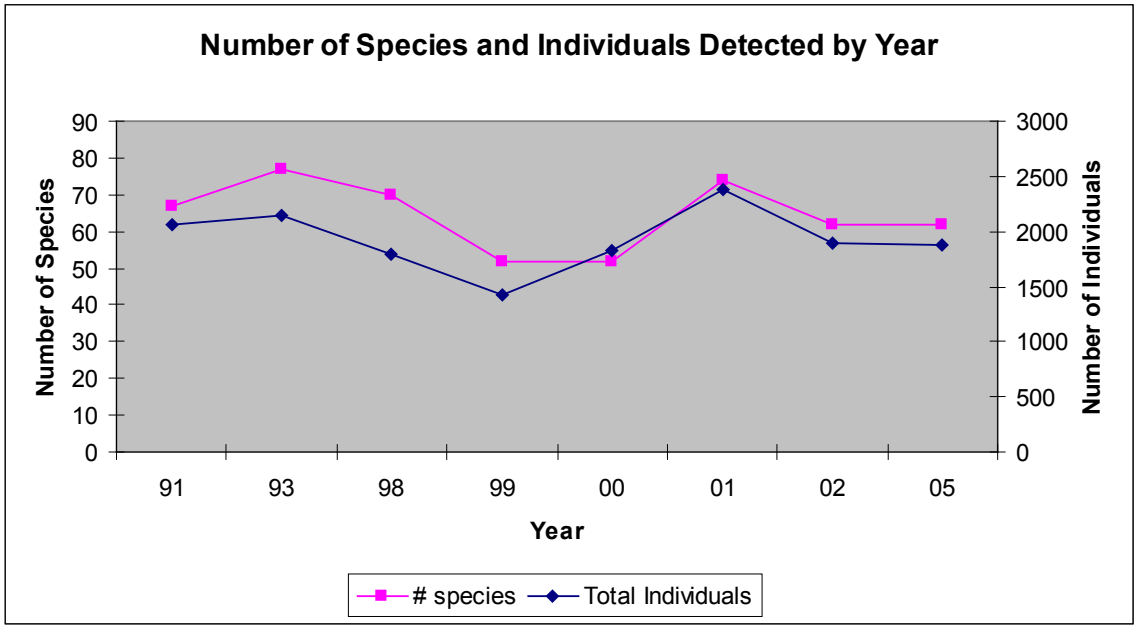

Figure 28. Number of bird species and individuals detected per year of the FBMP program

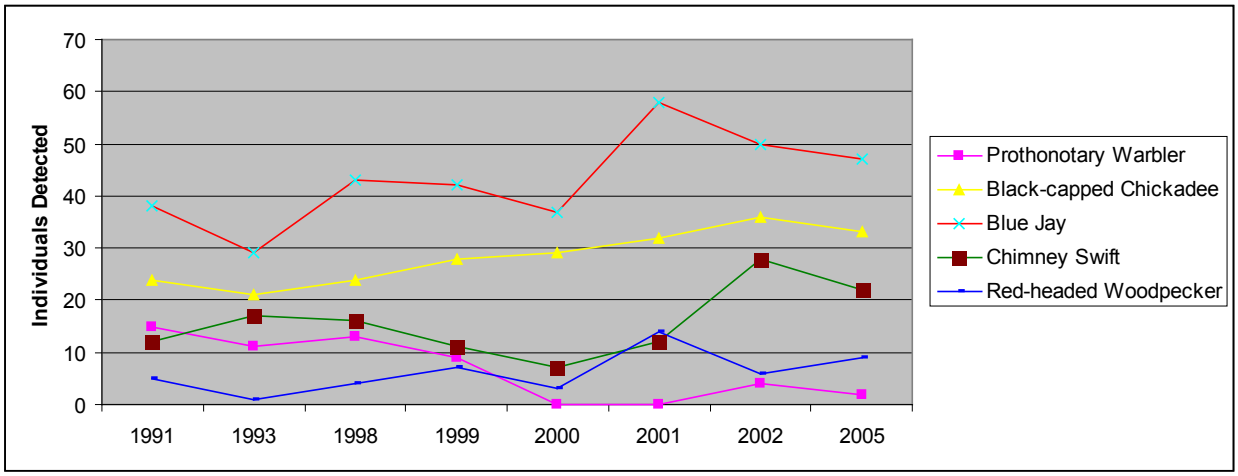

Figure 29. Trends in birds of concern

Monitoring data can also be used to determine if trends in various species are occurring based on changes in the overall forest community. For example, Figure 30 shows that there was a significant dip in a number of interior forest species (e.g., Eastern Wood-Pewee, Great Crested Flycatcher, Red-eyed Vireo among others) in 1999 following the 1998 wind storm, followed by an initial recovery and subsequent second decline.

These data can also be used to try to follow trends in bird species as a result of impacts on the forest by overgrazing White-tailed Deer. For example, data on low- and ground-nesting species (Wood Thrush, Gray Catbird (*Dumetella carolinensis*) and Eastern Towhee (*Pipilo erythrophthalmus*)) could be used to detect changes in nesting activity at and near ground level based on recovery of the understory after more than a decade of deer control. Figure 30 shows that there has been some increase in these three species since approximately 1999 or 2000. Similarly, we can look at canopy-nesting forest interior species such as Eastern Wood-Pewee, Red-eyed Vireo and Great Crested Flycatcher to determine trends in this guild. Figure 30 suggests that there has been some decline in these species, which would support other observations that there has been an ongoing loss of canopy trees due to long-term (decades) suppression of regeneration by deer. Although an initial look at the FBMP may show some of these trends, a full analysis of the data would be required to determine the statistical significance of these apparent trends.

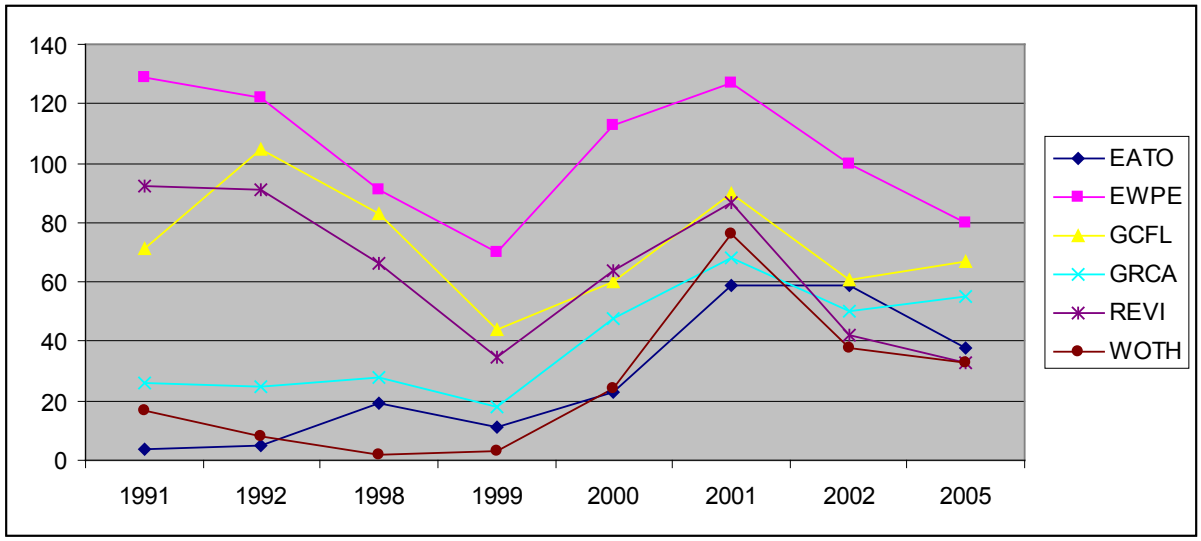

Figure 30. Trends in some common species

7.2.2 Bird Monitoring Results – Marsh Bird Monitoring Program

The Marsh Bird Monitoring Program (MMP), coordinated by Bird Studies Canada, has been conducted in the park for many years by volunteers solicited by BSC. Since the project is not coordinated by the park, data must be obtained from BSC. To date, data for the years 2003-2005 and 2009 have been obtained. In 2005, BSC was contracted by the Lake Erie Management Unit to conduct more intensive surveys in Rondeau and to prepare a report on findings (Timmermans *et al*. 2005).

A total of 111 bird species has been reported by the MMP in all years (although 31 have been detected only once), with 41 species detected in the 2005 survey. As with the FBMP, there is some overlap in target habitats. The MMP is designed to sample wetland bird species, but there is often overlap with upland species. The top 24 species detected by the program include:

Red-Winged Blackbird (*Agelaius phoeniceus*)
Yellow Warbler (*Setophaga petechia*)
Common Yellowthroat (*Geothlypis trichas*)
Song Sparrow (*Melospiza melodia*)
Swamp Sparrow (*Melospiza georgiana*)
Marsh Wren (*Cistothorus palustris*)
Tree Swallow (*Tachycineta bicolor*)
Mallard (*Anas platyrhynchos*)
Willow Flycatcher (*Empidonax traillii*)
Wood Duck (Aix *sponsa*)
Black Tern (*Chlidonias niger*)
Barn Swallow (*Hirundo rustica*)
American Bittern (*Botaurus lentiginosus*)
Purple Martin (*Progne subis*)
Eastern Kingbird (*Tyrannus tyrannus*)
Sora (*Porzana carolina*)
Great Blue Heron (*Ardea herodias*)
Bank Swallow (*Riparia ripara*)
Double-crested Cormorant (*Phalacrocorax auritus*)
Canada Goose (*Branta canadensis*)
Ring-billed Gull (*Larus delawarensis*)

Killdeer (*Charadrius vociferus*)
Virginia Rail (*Rallus limicola*)
Mourning Dove (*Zenaida macroura*)

Of note is the fact that several of the focal marsh species of the MMP are detected fairly frequently including American Bittern, Virginia Rail and Sora. As well, despite not being among the top 24 species, some of the other focal marsh species were also detected including Pied-billed Grebe, Common Moorhen, King Rail and Least Bittern. The only focal species not detected were American Coot and Black Rail.

Timmermans *et al*. (2005) noted a number of interesting trends at Rondeau. First, the abundance of focal marsh bird species was lower west of Marsh Trail than east of it. They attributed this to the fact that habitats west of the trail are more exposed to the scouring effects of the bay, and tend to have a higher proportion of cattail monoculture and lower heterogeneity of marsh habitats. On the east side of Marsh Trail, where grasses and sedges are more predominant, species such as Virginia Rail, Sora, Common Yellowthroat and Swamp Sparrow were more prevalent. They also found a north-south gradient in bird distribution. The northern areas of the marsh had higher proportions of habitat with grasses and sedges, with less cattail and open water, which favoured species such as Sora, Virginia Rail, Common Yellowthroat, Swamp Sparrow and Sedge Wren (*Cistothorus platensis*). In southern zones, where water was deeper, open water patches larger and cattail more dominant, species such as Pied-billed Grebe, Marsh Wren, American Bittern and Black Tern were more prevalent.

Bird Studies Canada has been working to develop Indices of Biotic Integrity (IBI) using marsh-dependent bird and anuran community attribute responses to relative measures of landscape level disturbances (including land use). Using MMP data from Rondeau across years with varying high and low Great Lakes water level regimes, they have tentatively placed Rondeau in the ‘fair’ to ‘good’ category. Work on this is not complete, but may prove the value of long-term MMP surveys (Crewe and Timmermans 2005).

For a complete summary of results from this project, see Timmermans *et al*. (2005).

7.2.3 Bird Monitoring Results – Ontario Breeding Bird Atlas

The Ontario Breeding Bird Atlas (OBBA) documented species occurrence by 10X10 km grid squares. Rondeau sits at the junction of four such squares (17MG27, 17MG28,

17MG37 and 17MG38). As such, there are areas outside of the park that are included in a data summary for the OBBA (similar to the park checklist). Species that are almost certainly not park breeders have been identified.

The OBBA identified a total of 147 species in the four squares with possible, probable or confirmed breeding evidence, but at least three of these would not have been documented from within the park. Of the remaining 144 species, 94 had Confirmed breeding evidence, while 28 had Probable and 22 had Possible breeding evidence. The atlas shows that even today, in the significantly altered landscape of southwestern Ontario, Rondeau still supports a high number of bird species. One of the Rondeau squares (17MG28) had a total of 138 species with at least Possible breeding status. In the first breeding bird atlas, this square had the highest number of species in the province (146) with at least Possible breeding evidence.

The atlas can also illustrate how Rondeau is a bit of an island in the severely degraded landscape of southwestern Ontario. For example, Rondeau is one of the most southwesterly breeding locations for a number of species that require quality forest habitat. These include species such as Black-throated Green Warbler (*Setophaga virens*), Blackburnian Warbler (*Setophaga fusca*) Pine Warbler (*Setophaga pinus*), Black-and-white Warbler (*Mniotilta varia*) and Northern Waterthrush (*Seiurus noveboracensis*).

7.2.4 Prothonotary Warbler Recovery Efforts

The Prothonotary Warbler is listed as Endangered on the *Species at Risk in Ontario* list and by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (McCracken 1984, COSEWIC 2007, OMNR 2012). It is generally restricted to coastal areas of Lakes Erie and Ontario from Hamilton to Windsor. Although never very common in Ontario, its numbers have declined significantly in the last two decades (COSEWIC 2007).

Rondeau has always been a stronghold for the Prothonotary Warbler in Canada, and qualitative estimates placed the population at approximately 100 pairs in the 1930's (McCracken 1984). Although this estimate was likely a broad extrapolation based on the amount of suitable habitat, Nickel (1969, cited in COSEWIC 2007) considered the Prothonotary Warbler to be one of the more numerous species in forested sections of

the park in the 1950s. By 1981, however, the population estimate was 20-25 pairs, and by 1997, only ten breeding pairs were detected.

Beginning in 1998, the Prothonotary Warbler Recovery Team initiated a nest box program throughout the historic range of the species in Ontario in an attempt to bolster the population by providing predator-proof nesting opportunities (McCracken and Dobbyn 1997). The Prothonotary Warbler is one of only two cavity nesting warblers in North America, and cavities chosen by it tend to be located over standing water in swamp forests or buttonbush swamps (Petit 1999). At Rondeau, the initial program consisted of 40 nest boxes placed in the highest quality sloughs throughout the park. Eventually, the number of nest boxes topped 60 (McCracken and Somple 2008). Combined with the nest box program was an intensive monitoring program which focussed on nest box monitoring and searching for birds nesting in natural cavity situations.

The nest box program resulted in an almost immediate increase in the number of nesting pairs in Ontario, and showed a marked increase in successful nesting. By 2000, the population had risen to 20 breeding pairs and the number of males continued to rise until 2002 (McCracken and Somple 2008). By 2002, a persistent drought (which started in 2000) meant that water levels in coastal wetlands were drying up by mid-June. This resulted in a province-wide drop in the number of returning birds. Another compounding issue at Rondeau was an increase in House Wren populations which likely resulted from a combination of the 1998 windstorm (Larson and Waldron 2000) and a population bolstering effect from a large number of House Wren boxes in the park's cottage community (Dobbyn and McCracken 2005). By 2008, the entire Canadian population was down to six breeding pairs, with recovery of the population in question (Figure 31). Throughout this population rise and fall, Rondeau's population continued to be significant, with generally half of the Canadian population being found in the park each year (COSEWIC 2007, McCracken and Somple 2008).

House Wrens interfere with Prothonotary Warbler nesting by competing directly for nesting cavities (natural and nest boxes), but also through nest and egg destruction. Competition for cavities comes in the form of cavities being used for breeding by House Wrens, and also boxes that they use as dummy nests; filling them to capacity with small sticks and rendering them useless for other birds. In an attempt to reduce the impact of House Wrens, a number of box modifications have been tested to see if House Wrens

could be dissuaded from using them. As well, nest boxes have been plugged by late June if they were not being used by Prothonotary Warblers. To date, none of these efforts has resulted in a decrease in House Wren impacts on Prothonotary Warblers, and the future for Prothonotary Warbler in the park is in question.

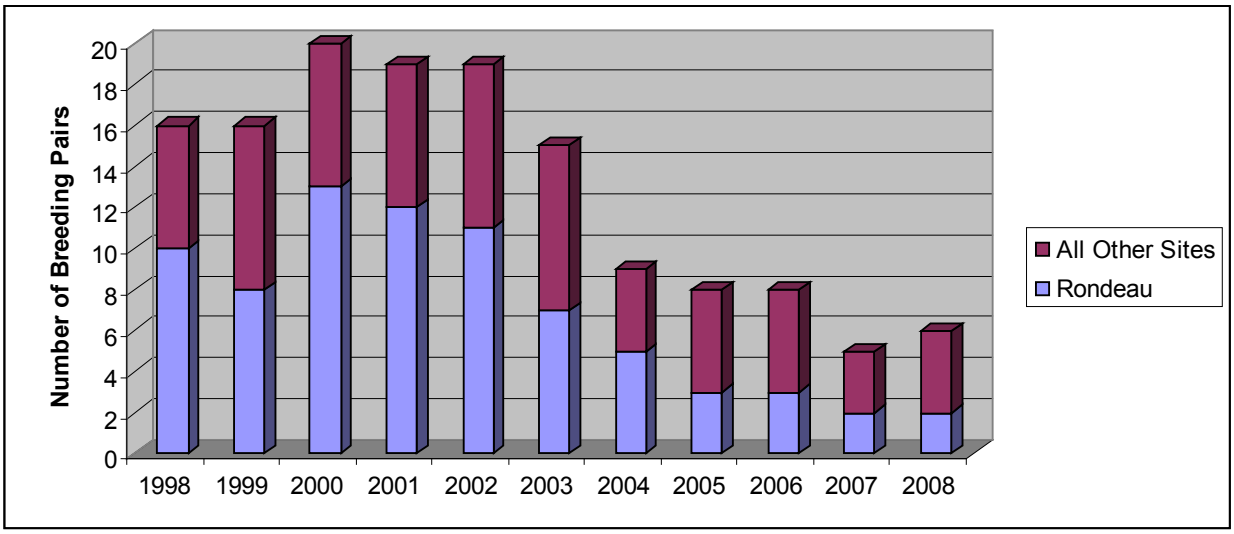

Figure 31. Number of breeding pairs of Prothonotary Warblers at Rondeau and all other Canadian sites.

7.2.5 Bird Species at Risk

A total of thirty-two birds on the Rondeau checklist are considered to be species at risk on the SARO list (OMNR 2012). Some of these species are non-breeders in the park and are on the checklist due to their presence as migrants or vagrants. A short discussion of each is provided here. Two species are of historical occurrence in the park; Passenger Pigeon (extinct) and Eskimo Curlew (extirpated).

Acadian Flycatcher END. Acadian Flycatchers were more abundant in Rondeau prior to the 1998 windstorm, and were absent for several years afterward. They have recently resumed breeding in the park, with up to two territorial males being detected in a single year in 2009. This species is easily detected during FBMP surveys.

Bald Eagle (Haliaeetus leucocephalus) SC. Bald Eagles are regular breeders within Rondeau, with one active nest in the park in most years back at least to 1982 (Alair

2009). Nest success was somewhat inconsistent in the 1980's and early 1990's, but in the last ten years, nest success has generally been two fledged young (Alair 2009). Park staff monitor the eagle nest each summer and provide data to the southern Ontario monitoring program coordinated by Bird Studies Canada.

Barn Owl (Tyto alba) END. Barn Owls have been noted within the park and there are breeding records from near-by mainland areas, but no breeding evidence has been noted in the park. This species may have been a breeding species in the park historically, when more savannah was present.

Barn Swallow THR. Barn Swallows are common breeders within the park, generally nesting in or on various park buildings and cottages. They are also one of the top 24 species monitored by the Marsh Bird Monitoring Program in the marsh (section 7.2.2).

Black Tern SC. Rondeau is home to a breeding colony of Black Terns, located to the west of Marsh Trail. No direct monitoring of the colony is done to determine the number of nests, but birds are detected during MMP surveys.

Bobolink (Dolichonyx oryzivorus) THR. Bobolinks are occasional breeders in the Rondeau bird checklist area, but they are likely associated with hay fields on the mainland rather than on the point itself. It is likely, however, that they do breed in small numbers in meadow marshes within Rondeau's marsh community. They are also regular migrants in the park.

Cerulean Warbler THR. Cerulean Warblers did breed in the park prior to the 1998 windstorm, but no breeding pairs have been detected in almost ten years. The second breeding bird atlas confirmed that three of the four squares at Rondeau did not have any breeding evidence between 2001-2005, while all four squares in the 1981-85 time period had breeding evidence, with two of the squares having confirmed breeding (Cadman *et al*. 2007). This species is a high canopy nester and it is these mature trees that are the slowest to recover from the wind storm; the impact of decades of overgrazing by White-tailed Deer also has had adverse effects on regeneration of these tree species.

Chimney Swift THR. Chimney Swifts are listed as breeders within the park and it is very likely that they do, however, confirming breeding in natural settings (hollow trees) is difficult. COSEWIC (2007b) states that Chimney Swifts have almost entirely converted

to anthropogenic nesting structures such as chimneys, due to the decline in natural cavities which they characterize as large diameter (>50 cm) hollow American Beech. Within Rondeau, Chimney Swifts are regularly encountered during FBMP surveys, particularly in areas with an abundance of old, large American Beech. There is also an absence of larger chimney structures anywhere in the vicinity of the park, increasing the likelihood that swifts are using natural roosting and nesting habitat within the park.

Common Nighthawk (Chordeiles minor) SC. Common Nighthawks are noted within the park, but not on a regular basis. This may be due in part to their crepuscular/nocturnal habits. It is also very difficult to confirm breeding, and both bird atlases list the species as a probable breeder only (Cadman *et al*. 1987, 2007).

Canada Warbler (Wilsonia canadensis) SC. Canada Warbler is a regular migrant in the park, and has been noted in the park in the early portion of the breeding season. It has not, however, been confirmed as a breeding species in the park and may only be represented by late migrants. It was noted in both atlas periods as a possible/probable breeder (Cadman *et al*. 1987, 2007).

Golden-winged Warbler (Vermivora chrysoptera) SC. This species is noted as a breeding species in the park, but it is not likely a regular breeder. It was noted as a possible breeder during the first atlas but not during the second atlas (Cadman *et al*. 1987, 2007).

Eastern Meadowlark (Sturnella magna) THR. As with Bobolink, Eastern Meadowlarks are occasional breeders in the Rondeau bird checklist area, but would generally be found associated with hay fields on the mainland. The potential for them to breed within dry meadows within the extensive marsh exists, however, and should not be ruled out. They are also regular migrants in the park.

Henslow's Sparrow (Ammodramus henslowii) END. Henslow's Sparrow is a rare migrant in the park and has, on occasion, lingered for two or three days, but it has never established a territory, nor has a pair been seen together. Some marginally suitable habitat exists within the park, however, this species is an area-sensitive species (Ribic *et al*. 2009), preferring grasslands in excess of 30 ha and likely in excess of 100 ha. Most of the larger savannah blocks in Rondeau have too many trees to be suitable and the more open blocks are well under 30 ha in size. Some habitat may exist in wet

meadow communities, but to date, no birds have been detected there, although targeted surveys have not been conducted in these areas.

Hooded Warbler (Wilsonia citrina) SC. Hooded Warblers are regular migrants in the park and have been observed and/or heard in the early portion of the breeding season , but no evidence beyond possible breeding has been noted. This species takes advantage of openings in the forest once they begin to be occupied by dense, low vegetation. These types of conditions are becoming more common in the park now that recovery of the understory is occurring. It is fairly likely that Hooded Warblers will be confirmed as breeders in the park in the near future. Hooded Warblers may be removed from the SARO list in the near future due to substantial range and population increases throughout the southern part of the province. COSEWIC downlisted Hooded Warbler to *Not at Risk* in May 2012 (COSEWIC 2012).

King Rail END. King Rails are occasional breeders in Rondeau's marsh complex, and were detected incidentally by Bird Studies Canada staff in 2005, but not during the formal MMP surveys (Timmermans *et al*. 2005). The species was also recorded as a probable breeder (bird on territory) during both the initial and recent breeding bird atlases (Cadman *et al*. 1987, 2007).

Least Bittern THR. Least Bitterns are regular breeders in Rondeau's extensive marsh complex. No formal monitoring is done for this species by park staff, but the Marsh Bird Monitoring Program coordinated by BSC specifically targets this species. The 2005 work by Bird Studies Canada documented five territorial males (Timmermans *et al*. 2005).

Louisiana Waterthrush (Seiurus motacilla) SC. Louisiana Waterthrush is a sporadic breeder in the park, but no quantitative information is available to provide an estimate of the number of times it has occurred. It was noted as a possible breeder in two squares during the first breeding bird atlas, but not during the second atlas (Cadman *et al*. 1987, 2007). It has been detected only once by the FBMP.

Northern Bobwhite (Colinus virginianus) END. Northern Bobwhite likely would have been a breeding resident of Rondeau prior to the range-wide decline of the species which resulted from the dramatic loss of prairie habitat in southwestern Ontario (COSEWIC 2003). As recently as the 1981-85 Breeding Bird Atlas (Cadman *et al*.

1987), there was evidence of Northern Bobwhite in or around the park. The more recent atlas (2001-2005) (Cadman *et al*. 2007) shows no local records for the species.

Piping Plover (Charadrius melodus) END. Piping Plover was an historic breeder in Rondeau prior to the range-wide decline of the species. Recent recovery efforts have resulted in an increase in the Great Lakes population, and breeding plovers have been documented in up to three Ontario locations in the last four years. A single bird showed up on Rondeau's South Beach on May 17, 2004, but no other bird joined it, and the bird was gone within a few days. The potential for Piping Plover to return to Rondeau as a breeding bird is very high, and possibly inevitable.

Prothonotary Warbler END. Prothonotary Warblers are regular, but declining, breeders in the park. For a full discussion on this species see section 7.2.4.

Red-headed Woodpecker SC. Red-headed Woodpeckers are regular breeders in Rondeau, and are documented through the FBMP which shows a stable to potentially increasing population in the park (Figure 29). It should be noted, however, that due to the limited number of detections (0-12 per year), it is unlikely that this result would be statistically significant.

Short-eared Owl (Asio flammeus) SC. Short-eared Owls are typically found as winter residents in the Rondeau Marsh, and no evidence of breeding has been noted.

Whip-poor-will (Caprimulgus vociferus) THR. Whip-poor-wills are resident breeders in Rondeau. As in other areas of the province, they appear to be in declining in the park, but no formal monitoring efforts have been initiated to document the decline. Being nocturnal, this species is not detected during other bird monitoring programs.

Yellow-breasted Chat (Icteria virens) SC. Yellow-breasted Chat formerly was a regular migrant in the park and has been recorded breeding on several occasions, but not recently. Breeding was confirmed during the first breeding bird atlas, but only possible breeding evidence was obtained in the second atlas (Cadman *et al*. 1987, 2007). It is possible that succession has made the habitat within the park less suitable for this species.

The remaining species at risk on the Rondeau bird list are represented only as migrants or vagrants, either because they do not breed in southwestern Ontario, or because the appropriate breeding habitat does not occur within the park. These include Horned

Grebe (*Podiceps auritus*) (SC), American White Pelican (*Pelecanus erythrorhynchos*) (THR), Golden Eagle (*Aquila chrysaetos*) (END), Peregrine Falcon (*Falco peregrinus*) (THR), Yellow Rail (*Coturnicops noveboracensis*) (SC), Olive-sided Flycatcher (*Contopus coooperi*) (SC), Kirtland's Warbler (*Setophaga kirtlandii*) (END), and Loggerhead Shrike (*Lanius ludovicianus*) (END).

7.3 Herpetofauna

Rondeau hosts a wealth of herpetofauna with a total of 31 species being recorded in the park (Appendix 5). Herpetofauna have been studied extensively within the park with two formal inventory reports prepared by Campbell (1971) and Gillingwater (2001). Rondeau was also well studied as part of the Ontario Herpetofaunal Survey (Oldham and Weller 2000).

7.3.1 Herpetofauna Species at Risk

Of the 31 species of herpetofauna detected within the park, thirteen are provincially tracked species (S2 or S3) and listed as species at risk on the *Species at Risk in Ontario List* (OMNR 2012). Of these, four are listed as Endangered, five as Threatened and four as Special Concern (Table 15). Species of particular note in the park, due to their limited distribution in Southwestern Ontario, include Fowler's Toad, Eastern Musk Turtle, Spiny Softshell and Common Five-lined Skink.

Table 15. Species at risk herpetofauna in Rondeau Provincial Park

Common Name	Scientific Name	S-Rank	SARO
Fowler's Toad	*Anaxyrus fowleri*	S2	END
Snapping Turtle	*Chelydra serpentina*	S3	SC
Eastern Musk Turtle	*Sternotherus odoratus*	S3	THR
Northern Map Turtle	*Graptemys geographica*	S3	SC
Blanding's Turtle	*Emydoidea blandingi*	S3	THR
Spiny Softshell	*Apalone spinifera*	S3	THR
Spotted Turtle	*Clemmys guttata*	S3	END
Common Five-lined Skink (Carolinian)	*Plestiodon fasciatus*	S2	END
Milksnake	*Lampropeltis triangulum*	S3	SC
Butler's Gartersnake	*Thamnophis butleri*	S2	THR
Eastern Ribbonsnake	*T. sauritus*	S3	SC
Eastern Hog-nosed Snake	*Heterodon platirhinos*	S3	THR
Eastern Foxsnake (Carolinian)	*Pantherophis gloydi*	S2	END

Fowler's Toad. Fowler's Toads are only found within three general locations in Ontario, with Rondeau being the most westerly population (COSEWIC 2010). Fowler's Toads have been monitored within the park annually since 2004 (Dobbyn 2005a, S. Dobbyn, unpublished data). Toads have been found along almost the entire east and southern coast lines of the park (Figure 32). Population sizes have been documented but have significant natural variation from year to year (COSEWIC 2010) making it impossible to determine an average annual population or to determine overall trends within the park. In four years of monitoring, the estimated population ranged from 195 ± 64 (S.E.) to 1401 ± 107 (S. Dobbyn, unpublished data). Within the park, toads are threatened by ongoing erosion of the south beach, recreational use of the beach and destruction of dune habitat adjacent to cottage leaseholds.

Figure 32. Cumulative locations of Fowler's Toads in Rondeau 2004-2008

Eastern Musk Turtle. Eastern Musk Turtles were never common in the park, but occasional records were noted in the 1970's. No other records had been noted since around 1980, despite an extensive amount of field work conducted on turtles since 2000. In 2009, however, a researcher documented an individual on the west side of Rondeau Bay while conducting field work on Spotted Gar (*Lepisosteus oculatus*) (W.

Glass, pers. comm.). This record provides evidence that they may still be found in low numbers within the park proper, and may suggest that targeted searches should be conducted.

Spiny Softshell. Spiny Softshells are quite common within Rondeau Bay and the population here constitutes one of the four key populations in Ontario (COSEWIC 2002). A significant amount of work has been done on softshells in the park and Rondeau Bay, including mark/recapture and radio telemetry studies (Dobbyn and Smith 2005), genetic investigations (Davy 2009) and nesting ecology studies (Gillingwater 2001, Bolton 2007, Bolton *et al*. 2008). The radio telemetry studies found that softshells have a seasonal shift in habitat utilization. In the spring, they utilize the marsh and sheltered bays along the western portion of the marsh. They then begin to move into deeper water and move throughout the bay by early summer. Females move to Rondeau's south beach for nesting in June and July, after which they become associated with the extensive weed beds in the middle of Rondeau Bay, remaining in the weed beds for weeks at a time. By late fall, they all appear to move to one general location within the bay to hibernate in deep water with a sand bottom (Dobbyn and Smith 2005). This means that the entire bay is essential to softshells and threats such as boating, mechanical weed removal and herbicide use within the bay could be threats to the species.

Common Five-lined Skink. Five-lined skinks are found throughout much of the park, including the beach-dune community, oak savannah and dry ridges within the marsh. They are even found throughout the forested areas of the park anywhere that there is a canopy gap enabling sun to reach the forest floor. Skinks are also known to use buildings and other anthropogenic structures regularly for shelter and for basking.

There has not been a targeted survey for skinks in the park, but they are regularly encountered under coverboards set up for salamanders (S. Dobbyn, unpublished data). Work conducted in Rondeau on the genetic structure of Ontario skink populations (Howes 2006, COSEWIC 2007c) suggested that the Rondeau population likely ranges from 259-329 individuals. Based on informal monitoring through the coverboard survey and general observations, however, this estimate appears to be low. This population estimate may have been based largely on the dune and savannah habitats and may not have considered the park as a whole. A targeted inventory should be conducted within the park to develop a more realistic population estimate.

7.3.2 Salamander Coverboard Monitoring

Salamander data collection began in 2003 and was conducted intensively for three years. Since that time, monitoring has continued, but at a lower intensity. The coverboard program detected all three salamanders known to occur in Rondeau, with Blue-spotted Salamander (*Ambystoma laterale*) being detected at very high rates, followed by lower rates of detection for Eastern Red-backed Salamander (*Plethodon cinereus*) and Eastern Newt (red eft form) (*Notophthalmus viridescens viridescens*) (Table 16). The salamander boards were also detecting a number of other herpetofauna and even mammals. Other species detected included Common Five-lined Skink, Eastern Gartersnake (*Thamnophis sirtalis sirtalis*), DeKay's Brownsnake (*Storeria dekayi*), American Toad (*Anaxyrus americanus*), Tetraploid Gray Treefrog (*Hyla versicolor*), Northern Leopard Frog (*Lithobates pipiens*), Spring Peeper (*Pseudacris crucifer*), Wood Frog (*Lithobates sylvaticus*), Long-tailed shrew (*Sorex spp*.) and Northern Short-tailed Shrew. Many of these species were detected in low numbers, but Common Five-lined Skink is likely detected in numbers sufficient for long-term monitoring.

Table 16. Number of salamanders and Common Five-lined Skinks detected in 2004

Coverboard Structure	Blue-spotted Salamander	Eastern Newt	Eastern Red-backed Salamander	Common Five-lined Skink
Thick	64	3	8	73
Thin	1709	32	56	47
Under	1451	4	100	13
Total	3224	39	164	133

A full analysis of the coverboard data has not yet been completed. Habitat data were also collected for all salamander coverboards and routes. A full analysis of salamander detection rates and the effect of various habitat criteria will be conducted. However, it is possible to draw some preliminary conclusions at this time, based on a subset of the data.

Salamanders did not use all areas of the coverboard structure equally. The three salamander species utilized the thin spaces between the coverboards and the area beneath the cover board between the ground and the bottom board. They appeared to avoid the thicker spaces between the two boards. Skinks, however, appeared to use the thick areas more often than the thin areas and much more often than the area under the entire coverboard structure (Table 16). Other species utilized the areas differently as well, with the smaller snakes often using the thin spaces, and the larger snakes and anurans utilizing the thick areas more often.

In 2003, cover boards were checked every two-four weeks from May to the end of October. It was noted that salamander detections were higher in the fall than in the spring, as was originally anticipated. To investigate the pattern of salamander detections across the entire active season, a very intensive monitoring effort was conducted in 2004, where coverboards were checked every week to ten days from April to the end of September. Use of the coverboards by salamanders was lowest in the spring and increased throughout the summer, with a peak in early September, followed by a slight decrease in use prior to the discontinuation of monitoring (Figure 33). This would suggest that given limited human resources to conduct salamander monitoring, focussing on August through early October would be the most productive time to monitor the coverboards.

One of the purposes of initiating the salamander coverboard study was to assess whether the amount of canopy closure and soil moisture affected the distribution of salamanders in the park. Table 17 summarizes the proportion of captures for each species across the four initial salamander monitoring routes.

From this summary, it is apparent that Blue-spotted Salamanders were most abundant on routes 99 and 106, followed by route 96, and were uncommon on route 94. Conversely, Eastern Red-backed Salamanders had an almost reverse trend with the highest proportion of all individuals detected on route 94, followed by route 96, and were uncommon on routes 99 and 106. Similarly, Eastern Newts and Common Five-lined Skinks were most abundant on route 94, although they varied in the next most preferred route.

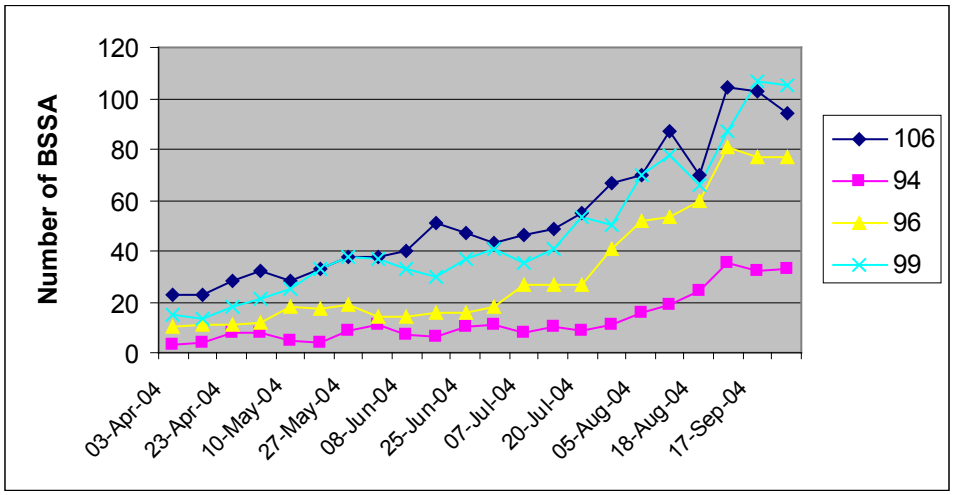

Figure 33. Number of Blue-spotted Salamanders detected in coverboards by date

Table 17. Proportion of detections by species and route

Route	Blue-spotted Salamander	Eastern Red-backed Salamander	Eastern Newt	Common Five-lined Skink
94	8.8%	61.6%	46.2%	43.6%
96	21.9%	26.2%	7.7%	3.8%
99	32.8%	9.8%	28.2%	21.8%
106	36.6%	2.4%	17.9%	30.8%

Although the habitat data have not been analysed, route 94 is known to have the lowest canopy closure and the driest, warmest conditions due to the extensive blowdown from the 1998 windstorm. Comparatively, the other sites have a higher percentage of closed canopy and moister conditions. Site 96, has the most dense canopy and the water table is at or just below the surface for much of the year. This would explain why Common Five-lined Skinks are almost absent from route 96 (as skinks prefer drier conditions) but does raise the question why Eastern Red-backed Salamanders have the second highest abundance on that route.

7.3.3 Ambystoma Complex Assessment

In 2004, as part of the salamander coverboard monitoring project, the question arose as to whether the Blue-spotted Salamanders in the park were pure *Ambystoma laterale* or whether there were individuals of the *Ambystoma polyploid* complex. Members of the genus *Ambystoma* can hybridize, but rather than resulting in normal diploid offspring, the hybrid offspring are polyploids - generally triploid, i.e., having three sets of chromosomes rather than the normal two sets (Bogart and Lichts 1986, Bogart and Cook 1991). Most of the triploid offspring are females with two sets of the maternal genes and one set of the paternal genes. During subsequent reproduction, the female gametes are often not reduced and remain triploid. Sperm from the male is normally not incorporated into the zygote, but serves only to initiate development of the egg, thus perpetuating the triploid condition. On occasion, the male sperm is incorporated and the resulting offspring are tetraploid. If sperm is incorporated during subsequent reproduction by these individuals, then there can even be pentaploid offspring, but this is extremely rare (Bogart and Lichts 1986, Bogart and Cook 1991). The various polyploids cannot be identified visually, and generally, cannot even be reliably separated from the pure diploids (*A*. *laterale* or *jeffersonianum*). Since the polyploid condition will persist through an indefinite number of generations, the presence of genes from two parent species in a triploid individual at a site does not necessarily indicate the presence of the pure strains of both species in that geographic area because colonization of the site may have occurred after initial hybridization.

To assess the genetics of the Blue-spotted Salamanders in the park, a total of 80 tail tips were harvested from Blue-spotted Salamanders and sent to Dr. Jim Bogart at the University of Guelph. The results indicate that all salamanders at Rondeau are either pure *Ambystoma laterale* or a polyploid of *Ambystoma* dominated by *laterale* genes (LLJ, LLLJ) (J. Bogart, unpublished data). No Jefferson's Salamanders (*Ambystoma jeffersonianum*) or Jefferson's dominated polyploids were documented in the park, indicating that Jefferson's Salamander is likely absent from the park and local area.

7.3.4 Results of Amphibian Monitoring by the Marsh Monitoring Program

Bird Studies Canada's Marsh Monitoring Program surveys amphibians (primarily anurans) as well as birds (Timmermans *et al*. 2005, Marsh Monitoring Program, unpublished data). Amphibians were monitored in the park from 1995-2002, and again in the focussed 2005 inventory (Timmermans *et al*. 2005). Since its inception, the

program has detected all of the anuran species on the park checklist. The most frequently detected species (and the species with the highest average calling code) was Spring Peeper, followed in order by Northern Leopard Frog (*Lithobates pipiens*), American Toad, Bullfrog (*Lithobates catesbeianus*), Tetraploid Gray Treefrog, Green Frog (*Lithobates clamitans*), Western Chorus Frog (*Pseudacris triseriata*), Fowler's Toad and Wood Frog. Wood Frog, in particular, was detected only a few times across all of the years, however this may be an artefact of survey timing. Few of the earliest spring surveys were conducted prior to mid April.

The focussed 2005 inventory (with an expanded number of stations) detected all of the anuran species on the checklist other than Fowler's Toad. American Toad and Spring Peeper were the most commonly recorded species, based on calling intensity, across all three sampling periods, although all species attained the highest call intensity class in at least one of the survey periods, with the exception of Western Chorus Frog. Western Chorus Frog was detected only infrequently (Timmermans *et al*. 2005).

In contrast to the marsh bird results, there was no significant difference in the north-south gradient of the marsh and all but two species were detected in both the northern and southern sections of the marsh. Of the remaining two species, Wood Frog was only detected in the south zone while Bullfrog was detected only in the north. There was, however, a west-east effect on species diversity with more species detected in the east than in the west. The authors attributed this to the increase in wetland habitat diversity towards the eastern portion of the marsh, combined with the increased effects of wind and waves on the habitats west of Marsh Trail.

7.4 Fishes

A total of 81 species of fishes have been documented from Rondeau Bay and the Rondeau marshes (Appendix 6). A number of fish surveys had been conducted in the past by the Royal Ontario Museum (Ramshaw and Holm 1996), which formed the basis for the fish checklist. A number of recent surveys have also been conducted (Reid *et al*. 2005, Edwards *et al*. 2006, MacDougal 2008) and some seining work has been conducted by Ontario Parks staff. Work conducted by the Department of Fisheries and Oceans (DFO) found that 74% of total catch was composed of five species, including Pumpkinseed, Spottail Shiner, Bluegill, Yellow Perch and Emerald Shiner.

7.4.1 Fish Species at Risk

Of the 81 species, 13 are listed as provincially significant (S1-S3) and 10 are listed as species at risk on the SARO list (3 endangered, 5 threatened and 2 special concern) (Table 18). One additional species is now listed as extirpated (Blue Walleye).

Table 18. Species at risk fishes of Rondeau

Common Name	Scientific Name	S-Rank	COSEWIC/SARO
Silver Lamprey	*Ichthyomyzon unicuspis*	S3	
Lake Sturgeon	*Acipenser fulvescens*	S3	THR/THR
Spotted Gar	*Lepisosteus oculatus*	S1	THR/THR
American Eel	*Anguilla rostrata*	S1?	THR/END
Silver Chub	*Macrhybopsis storeriana*	S2	END/SC
Pugnose Shiner	*Notropis anogenus*	S2	END/END
Lake Chubsucker	*Erimyzon sucetta*	S2	END/THR
Black Redhorse	*Moxostoma duquesnei*	S2	THR/THR
Greater Redhorse	*M. valenciennesi*	S3	
Warmouth	*Lepomis gulosus*	S1	SC/SC
Longear Sunfish	*L. megalotis*	S3	
Eastern Sand Darter	*Ammocrypta pellucida*	S2	THR/END
Channel Darter	*Percina copelandi*	S2	THR/THR

Recent survey work by the Department of Fisheries and Oceans in 2004-5 (Edwards *et al.* 2006) confirmed Warmouth in Rondeau Bay which had not been seen for many years. Further records were also obtained for Warmouth by a researcher during Spotted Gar work (W. Glass, unpublished data).

Additional field work by the Lake Erie Management Unit confirmed the presence of Lake Chubsucker (Gilbert *et al*. 2008, MacDougal 2008). Seining work as part of the Natural Heritage Education Program in the park resulted in the confirmation of Eastern Sand Darter in 2005 adjacent to the pier (Rondeau park files, unpublished data).

Despite some intensive sampling for Channel Darter in the fall of 2005, this species was not confirmed as still being extant in the park (Reid *et al*. 2005). Surveys were conducted at three sites along Rondeau's east beach in what was considered suitable habitat.

A radio telemetry and mark/recapture study of Spotted Gar in Rondeau Bay has been conducted by William Glass, however a report on the study is not yet available. A significant number of gar has been captured and tracked, however, and a significant amount of data on other fish species has also been obtained (W. Glass, unpublished data).

7.5 Insects

The insect fauna of Rondeau has been relatively well studied in recent years, with the largest effort having been spearheaded by the University of Guelph insect lab (Marshall and Paiero 2011). Park staff and local naturalists also have documented some groups of insects quite well, including butterflies (and skippers) and the dragonflies and damselflies.

7.5.1 Lepidoptera

Park staff have coordinated the annual butterfly count in the park since 1999. The count averages 42 species and 35390 individual butterflies and skippers, with a total of 61 species documented for the count. The top ten species (by number of individuals) counted during the eleven years are Cabbage White (*Pieris rapae*), European Skipper (*Thymelicus lineola*), Red Admiral (*Vanessa atalanta*), Monarch (*Danaus plexippus*), Orange Sulphur (*Colias eurytheme*), Little Wood-Satyr (*Megisto cymela*), Summer Azure (*Celastrina neglecta*), Clouded Sulphur (*Colias philodice*), Common Wood-Nymph (*Cercyonis pegala*) and Eastern Tiger Swallowtail (*Papilio glaucus*).

Since the butterfly count occurs at approximately the same time every year, not all of the park's species of butterflies and skippers have been documented during the count. However, butterflies are relatively well documented in the park, and the park list currently sits at 78 species (Appendix 7). Provincially tracked species in the park include:

Mottled Duskywing (*Erynnis martialis*) S2
Common Sootywing (*Pholisora catullus*) S3

Mulberry Wing (*Poanes massosoit*) S3
Dion Skipper (*Euphyes conspicua*) S3
Black Dash (*Euphyes conspicua*) S3
Giant Swallowtail (*Papilio cresphontes*) S3
Purplish Copper (*Lycaena helloides*) S3
Hickory Hairstreak (*Satyrium caryaevorum*) S3
Tawny Emperor (*Asterocampa clyton*) S2S3

Being located in the south, Rondeau also has a number of species on the checklist that are not permanent residents, but move north into Ontario later in the season. In particular, Horace's Duskywing (*Erynnis horatius*), Fiery Skipper (*Hylephila phyleus*), Cloudless Sulphur (*Phoebis sennae*) and Pipevine Swallowtail (*Battus philenor*) are not found much north of the north shores of Lakes Erie and Ontario (Layberry *et al*. 1998). Rondeau also has the first photographic evidence of Gulf Fritillary (*Agraulis vanillae*) in Ontario, which was documented by Allen Woodliffe on June 10, 2010. The only other Ontario record for this species is from the Ojibway Prairie complex, but without a photograph or voucher.

Rondeau also has a list of 371 moth species (Appendix 7). This list has been derived from specimens in the park collection and recent observations by David Bree and Dave Beadle, both of whom were employed at the Visitor Centre. Many of the moths have not yet been assigned S-ranks. Perhaps the most significant species of moth in the park is the Tulip-tree Silk Moth (*Callosamia angulifera*), recorded in 1965. This species has only been recorded at Rondeau and in the Walsingham/Turkey Point regions.

7.5.2 Odonata

Twenty-nine species of dragonflies and damselflies have been recorded in the park (Appendix 7). Of these, seven are provincially tracked species. Table 19 details the species and last observation date.

Table 19. Provincially tracked odonata of Rondeau

Scientific Name	Common Name	S-Rank	Last Observation
Epiaeshna heros	Swamp Darner	S2S3	1998
Nasiaeschna pentacantha	Cyrano Darner	S3	Historic - 1922
Arigomphus furcifer	Lilypad Clubtail	S3	Historic 1922
Gomphus vastus	Cobra Clubtail	S1	2003
Sympetrum corruptum	Variegated Meadowhawk	S3	Historic
Libellula semifasciata	Painted Skimmer	S2	2004
Libellula vibrans	Great Blue Skimmer	S1	1993

Despite having 29 species of Odonata on the park checklist, there has not been any intensive inventory work for this group. Further work on this group is warranted.

7.5.3 Other Insect Lists for Rondeau

A list of savannah-dwelling bee species in the park was obtained through survey work by York University. As part of an undergraduate thesis, Lily Mac sampled bee species in two different-sized savannah plots that had experienced recent burning. A total of 42 species was detected, of which 30 represent additions to the University of Guelph list (below) (Mac and Bazely 2003).

The University of Guelph Insect Collection (Marshall and Paiero 2011) lists 1728 taxa for Rondeau that have specimens in the university collection. This list is based entirely on specimens collected by members of the Guelph lab. A significant number of the species collected by the lab at Rondeau represent the first, or one of the first, records for Canada (e.g., Paiero and Buck 2004, Paiero and Marshall 2003, Marshall *et al*. 2005, 2005b).

The Guelph lab also noted that Rondeau has significant representation in species that specialize in dune, prairie/savannah, and Carolinian communities; including species that are found in only a few locations in the province (Marshall *et al*. 2005b). Examples include *Bruchomorpha dorsalis, Cryphula trimaculata, Ischnodemus falicus, Neohecalus*

cf. *magnificus, Graminella oquaka, Chlorotettix fallax, Polyamia caperata, Cicindela hirticollis* and *Anoplius brevihirta*.

One of the species that the Guelph lab detected at Rondeau which was relatively new to Ontario, with only a few known sites, was *Cerceris fumipennis*, a crabronid wasp that stocks its nest almost exclusively with adult Buprestidae. A small nesting colony was located in the group camp site location south of Bennett Road. By intercepting *C. fumipennis* as they returned to the nest, the prey could be "robbed" from the wasp by gently knocking it to the ground. This resulted in discovery of three new buprestid species for Canada, along with the documentation of nine additional species for the park (Marshal *et al*. 2005). This was seen as an opportunity to use *C. fumipennis* to assist in the early detection of Emerald Ash Borer since the wasp appeared to be a better "surveyor" of local buprestid species. Since that discovery, a great deal of work has been conducted using *C. fumipennis* for detecting Emerald Ash Borer in Ontario and in several U.S. states (Careless 2009, Careless *et al*. 2009).

Although Emerald Ash Borer had not been detected in the park at the time that *C. fumipennis* was being used to search for it, evidence of this drastically invasive species has since been observed in the park campground in the form of galleries and crown dieback in two ash trees (S. Dobbyn, pers. obs).

Due to the significant size of the Guelph checklist, it has not been included in the report, but can be found on-line at the University of Guelph Insect Collection. It should be noted that the University collection is not comprehensive for all groups of insects found in the park. In particular, the Guelph lab did not focus on Lepidoptera nor Odonata, although a few of both were collected. The list of insects provided in Appendix 7 represents all Lepidoptera and Odonata detected by all sources, some of which may also be found on the University of Guelph checklist. It is also anticipated that further work by the Guelph lab will continue to expand the park checklist.

7.6 Freshwater Mussels

Rondeau Bay historically housed a rich assemblage of freshwater mussel species. However, since the establishment of dressenid mussels (*Dreissena* spp.) (Zebra and Quagga mussels), very few unionid mussels appear to remain, which is consistent with most of the lower Great Lakes (Schloesser and Nalepa 1994, Zanatta *et al*. 2002, COSEWIC 2004, 2007d, Bouvier and Morris 2011). In total, the park has records for 22

unionid mussel species (Appendix 8), including 13 species that are now considered provincially significant, 7 of which are listed as species at risk on the SARO list (Table 20).

Table 20. Provincially tracked and species at risk mussels of Rondeau

Family	Genus	Common Name	S-Rank	COSEWIC/ SARO
Unionidae	*Epioblasma triquetra*	Snuffbox	S1	END/END
Unionidae	*Fusconaia flava*	Wabash Pigtoe	S2S3	
Unionidae	*Ligumia nasuta*	Eastern Pondmussel	S1	END/END
Unionidae	*Ligumia recta*	Black Sandshell	S3	
Unionidae	*Obliquaria reflexa*	Threehorn Wartyback	S1	
Unionidae	*Pleurobema sintoxia*	Round Pigtoe	S1	END/END
Unionidae	*Potamilus alatus*	Pink Heelsplitter	S3	
Unionidae	*Ptychobranchus fasciolaris*	Kidneyshell	S1	END/END
Unionidae	*Quadrula pustulosa*	Pimpleback	S3	
Unionidae	*Quadrula quadrula*	Mapleleaf Mussel	S2	THR/THR
Unionidae	*Truncilla donaciformis*	Fawnsfoot	S2	END/END
Unionidae	*Truncilla truncata*	Deertoe	S3	
Unionidae	*Villosa iris*	Rainbow Mussel	S2S3	END/THR

Two recent surveys of freshwater mussels have been conducted in Rondeau Bay. In 2001, Zanatta and Woolnough conducted a survey at six sites in the bay (2 person hours per site) (COSEWIC 2004, 2007d). In total, they found evidence of 17 unionid mussel species, however only one live individual was found, a Three-ridge (*Amblema plicata*). They also noted one fresh shell of the Threehorn Wartyback. The report pointed to extensive numbers of Zebra Mussels as the likely cause.

In 2008, Gilbert conducted transects across the bay. Along the transect quadrats were placed on the bottom and the substrate searched for mussels. She did not detect any live unionids but did locate the fresh shell of a Giant Floater (*Pyganodon grandis*) (Gilbert 2008).

Chapter 8: Site Evaluation and Summary of Significance

8.1 Representation

8.1.1 GapTool Summary

GapTool identifies 26 Landform/Vegetation (LV) types within the park, of which 23 are considered critical in Ecodistrict 7E-1 (Table 21). Unfortunately, the base mapping used for GapTool is too coarse and/or inaccurate to delineate some community types within Rondeau.

The first issue is that the geological layer used in the analysis (Surficial geology for Southern Ontario available through the Ministry of Northern Development and Mines, MNR Provincial Geomatics Service Centre) (Davis 2006) has most of the park classified as “unclassified”. Thus the landform/vegetation associations derived are for an unclassified type and has resulted in a large number of critical associations with unclassified landform.

The second component of the analysis, the vegetation layer, is derived from Land Cover 28 LANDSAT imagery from the early 1990’s. This layer breaks vegetation into only 28 classes (Davis 2006) and is quite coarse. For example, a very large section of the park (986 ha) was identified as “Swamp” (Table 21). This area of the park is mixed with upland ridges of Deciduous Forest with Swamp forest types occurring within the depressions between the ridges. As such, a much larger area of the park is identified as Swamp than is actually present, while the amount of Deciduous Forest has been significantly under-estimated. The ELC mapping for the park identifies only 251 ha of swamp (compared to 986 by GapTool outputs), and 515 ha of Deciduous Forest (compared to 21 ha by GapTool) (see Chapter 5 and Section 8.1.2). Other community types have less significant discrepancies when compared to the ELC mapping, but the representation achievements could be updated using the ELC data. Using the ELC to improve the GapTool outputs could result in an increase in Ecodistrict representation in

the Open Sand Barren and Dune, Treed Sand Barren and Dune and Tallgrass Savannah communities (and potentially others), except that we would not be able to make comparisons with the rest of the Ecodistrict.

Despite these issues, it is apparent that Rondeau contributes significantly to Ecodistrict 7E-1 representation targets. If we consider only those LV types with a classified landform (not including anthropogenic types), then twelve of the fifteen LV types have critical representation at Rondeau. Three of these types are represented within the Ecodistrict only in Rondeau, including Open Shoreline, Open Sand Barren and Dune, and Treed Sand Barren and Dune communities (all on Fine Lacustrine and Glaciolacustrine soils). A further three have all of their protected area representation within Rondeau including Marsh (on Fine Lacustrine and Glaciolacustrine soils) and Tallgrass Savannah and Tallgrass Woodland (on Coarse Lacustrine and Glaciolacustrine soils).

8.1.2 ELC Summary

A better representation of vegetation communities in the park is available from the Ecological Land Classification mapping conducted as part of this inventory. A total of 102 Vegetation Types in 48 Ecosites has been identified in the park (see Chapter 5 and fold out maps).

Of the 102 Vegetation Types identified at Rondeau, nineteen have been identified as being provincially significant (S1-S3) and a further three communities are ranked as S3S4, indicating potential provincial significance (see Section 8.5.1).

Table 21. Landform Vegetation Representation summary for Rondeau Provincial Park from GapTool

Landform Description	Vegetation Description	Ecodistrict Total Ha	Protected Areas Ha	Required Ecodistrict	Min +	P4483 Ha	PA-P4483 Ha	Critical?
Fine Lacustrine & Glaciolacustrine	Open Shoreline	0.76	0.76	0.77	Y	0.76	0.00	Y
Fine Lacustrine & Glaciolacustrine	Open Sand Barren and Dune	0.25	0.25	0.25	Y	0.25	0.00	Y
Fine Lacustrine & Glaciolacustrine	Treed Sand Barren and Dune	1.82	1.82	1.82	Y	1.82	0.00	Y
Fine Lacustrine & Glaciolacustrine	Swamp	3,446.82	30.31	50.00	N	0.70	29.61	Y
Fine Lacustrine & Glaciolacustrine	Marsh	882.11	123.03	50.00	Y	123.03	0.00	Y
Coarse Lacustrine & Glaciolacustrine	Open Shoreline	30.24	26.80	30.24	N	3.10	23.69	Y
Coarse Lacustrine & Glaciolacustrine	Open Sand Barren and Dune	60.28	57.10	50.00	Y	46.33	10.78	Y
Coarse Lacustrine & Glaciolacustrine	Treed Sand Barren and Dune	8.10	7.38	8.10	N	0.74	6.64	Y
Coarse Lacustrine & Glaciolacustrine	Tallgrass Savannah	143.75	9.09	50.00	N	9.09	0.00	Y
Coarse Lacustrine & Glaciolacustrine	Tallgrass Woodland	78.68	22.45	50.00	N	22.45	0.00	Y
Coarse Lacustrine & Glaciolacustrine	Forest	152.19	2.81	50.00	N	1.87	0.94	Y
Coarse Lacustrine & Glaciolacustrine	Coniferous Forest	1.93	0.54	1.94	N	0.54	0.00	Y
Coarse Lacustrine & Glaciolacustrine	Deciduous Forest	2,178.85	240.30	50.00	Y	20.72	219.58	N
Coarse Lacustrine & Glaciolacustrine	Built-Up Area Pervious	1,562.60	25.45	50.00	N	25.45	0.00	Y
Coarse Lacustrine & Glaciolacustrine	Swamp	1,948.90	392.38	50.00	Y	280.21	112.16	N
Coarse Lacustrine & Glaciolacustrine	Marsh	582.39	104.35	50.00	Y	19.89	84.46	N
Unclassified	Forest	0.11	0.09	0.11	N	0.09	0.00	Y
Unclassified	Deciduous Forest	0.20	0.16	0.20	N	0.16	0.00	Y
Unclassified	Built-Up Area Pervious	0.67	0.11	0.68	N	0.11	0.00	Y
Unclassified	Swamp	708.03	705.46	50.00	Y	705.46	0.00	Y
Unclassified	Marsh	478.87	346.03	50.00	Y	346.03	0.00	Y
Unclassified	Open Shoreline	26.23	26.23	26.24	Y	26.23	0.00	Y
Unclassified	Open Sand Barren and Dune	14.67	13.61	14.67	N	13.50	0.11	Y
Unclassified	Treed Sand Barren and Dune	3.37	3.24	3.38	N	3.13	0.11	Y
Unclassified	Tallgrass Savannah	12.22	12.22	12.22	Y	12.22	0.00	Y
Unclassified	Tallgrass Woodland	49.66	49.66	49.66	Y	49.66	0.00	Y

8.2 Condition

8.2.1 Direct Anthropogenic Disturbances

Rondeau is a natural environment class provincial park with associated infrastructure (roads, buildings), campgrounds and day use areas, as well as 286 active cottage leaseholds. These activities directly impact upon approximately 99 of the 858 ha (11.5%) of the terrestrial portion of the park, and have an indirect impact on the park as a whole. Section 3.3 provides a summary of historic and current anthropogenic activities that have impacted upon the park's natural communities, including fire suppression, logging and clearing, planting of non-native species and grazing of farm animals. Most of these activities occurred in the past, but some (introduction of non-native species) continue to be a concern today.

Park infrastructure is largely restricted to the north end, with only the visitor centre as a major (park-related) development in the southern portion of the park. Relocation of the visitor center would allow for restoration of the existing site and a potential elimination of one of the southerly running roads in the park, thus reducing fragmentation and

associated road mortality. Cottage infrastructure along Lakeshore Road, however, continues to occupy and impact upon provincially significant habitats and maintains the requirement to maintain the second paved access road along the eastern side of the park. Impacts from cottage lot use occur on the lots themselves, and on adjacent dune and beach communities through clearing of dune vegetation and use of boats, trailers and other recreational equipment. Current policy indicates that cottage leases expire in 2017, which would then allow for ecological restoration of these communities.

Road mortality is of concern within the park, particularly for herpetofauna. Seasonal road closures of Rondeau Park Road south of Spicebush Trail has reduced but certainly not eliminated impacts. A study of road mortality within the park was conducted by Farmer (2007), who found that road mortality is related to speed limits and recommended reduced speed limits and aggressive enforcement.

Waterfowl hunting in the marsh has been occurring for many decades. The waterfowl hunting itself is certainly sustainable on a waterfowl population basis, but impacts to vegetation communities and some aquatic fauna may be significant. Most of these impacts come from the use of boats within the interior portion of the marsh. Boat motors impact upon vegetation due to the low water levels often found within the marsh, and can have a direct impact on animals, particularly turtles.

8.2.2 Indirect Anthropogenic Aspects Impacting Condition

Invasive alien species are having a negative impact on native communities and species (including species at risk). Of the 916 plant species in the park, 225 (25%) are non-native and some of these have invasive tendencies. Common Reed, in particular, is a significant threat to the park's wetland communities, although some control efforts have been implemented in recent years. A more detailed plan for control of Common Reed should be considered. A number of other invasive species (including but Japanese Barberry, White Mulberry, Black Locust, Tree-of-heaven and European White Poplar) are also impacting upon natural values. A complete discussion on non-native and invasive species is provided in section 6.3.

Populations of White-tailed Deer have been reduced to a much more sustainable level in recent years, but the impacts of more than two decades of uncontrolled population growth are still evident and recovery will take many more years. Ongoing efforts at controlling deer numbers are crucial to the long-term health of the park. A complete

discussion on the history and management of White-tailed Deer in the park is provided in section 3.1.

8.2.3 Condition Ranking

Despite the level of anthropogenic disturbance and associated impacts on the park's natural values, Rondeau remains the largest protected area in Ecodistrict 7E-1 and is in the best overall condition of the protected areas in this Ecodistrict. Assigning an appropriate condition ranking for the park as a whole depends on whether we consider the condition of the park in isolation, or within the context of the Ecodistrict. Rondeau is located within the most intensively agricultural area of the province where there is almost no native vegetation cover remaining, except within protected areas. Within this context, Rondeau (as a whole) would be considered as being in Good to Excellent condition. Considering the number of ongoing issues within the park that are impacting upon condition (see above), however, an overall ranking of Fair to Good may be more appropriate.

Some areas of the park would rank higher than this if we looked at them in isolation. For example, parts of the marsh, South Beach and the forested areas west of Rondeau Park Road, receive fewer anthropogenic impacts and are in better overall condition.

8.3 Diversity

8.3.1 Landscape Diversity

Rondeau has a very high landscape diversity due to the nature of how the park was formed, and the resulting ridge and slough topography. As discussed in Section 8.1.1, the GapTool output is not ideal for describing the actual LV associations found within the park, due to the limitations of the input data layers. An on-the-ground assessment of the LV associations has not been conducted, as a detailed Ecological Land Classification was conducted instead. Results of that investigation found 102 unique vegetation types in 48 Ecosites (Chapter 5). For a park the size of Rondeau, this is a significantly high number of community types.

8.3.2 Species Diversity

Rondeau is located in the most species-rich part of the province and consequently has a very high level of species diversity. Several of the taxa have also been very well

studied in the park, providing larger than average species lists due, in part, to the amount of inventory work that has been done. This is particularly true of the insects which have been extensively surveyed by the University of Guelph Insect lab (section 7.5.3). Table 22 provides a summary of the numbers of species recorded in the park for each taxon. For a complete summary of the species recorded in the park, see Chapters 6-7 and Appendices 2-8.

Table 22. Summary of species by taxon recorded in Rondeau Provincial Park

Taxon	Number of Species	Section in Report
Vascular Plants	916	6.1
Mammals	36	7.1
Birds	343 (137 breeding)	7.2
Herpetofauna	31	7.3
Fishes	81	7.4
Insects (generally)	1728	7.5
Lepidoptera (specifically)	449	7.5.1
Odonata (specifically)	29	7.5.2
Freshwater Mussels	25	7.6

8.4 Ecological Functions

Rondeau is something of an island in an otherwise agriculture-dominated landscape. The majority of Chatham-Kent has been cleared for agriculture, with only approximately four percent natural cover remaining (Rondeau Watershed Coalition 2004, Stewardship Kent 2004). As a result, very little connectivity to other natural areas exists, and the surrounding agricultural landscape is most likely a functional barrier to many species.

The agricultural landscape also impacts upon Rondeau Bay and, to an extent, Rondeau's marsh communities, through inputs from agricultural runoff including pesticides and fertilizers (Gilbert *et al*. 2008). Despite these significant pressures, Rondeau does contribute to a number of ecological functions.

Hydrological Functions. Rondeau has no running water in the forms of streams or rivers. Hydrological functions are well represented, however, in the form of the extensive wetlands found within the park. This includes coastal wetland communities that are open to Rondeau Bay, and interior marsh communities and sloughs (swamp forests) that are isolated from the fish communities of Rondeau Bay and Lake Erie. Although the marsh communities on the west side of the bay (outside the park) have been impacted somewhat significantly from agricultural inputs, the marshes on the east side of the bay (in the park) are in fairly good health (Gilbert *et al*. 2008).

Size, Shape and Connectivity. Connectivity with other natural areas is very limited or even non-existent. The park itself, however, is relatively intact with only minimal internal fragmentation. It has significant interior forest and wetland habitats. Fragmentation has occurred along the eastern shoreline where leaseholds have functionally isolated the beach and beach-dune communities from the remainder of the park. Lakeshore Road, meant to service these leaseholds, further contributes to this.

The park boundary is quite appropriate from the terrestrial and wetland aspects in that the entire peninsula has been contained. The portion of the park within Rondeau Bay, however, is not ecologically appropriate in that the boundary extends down the middle of the bay and therefore, offers little protection for the entire open water portion of the bay. Historically, the entire bay was included in the park boundary but the boundary was amended in 1984.

The regulated area of the park is 3452 ha making it the largest regulated park in Ecoregion 7E. A portion of this area, however, is represented by the open waters of Rondeau Bay and Lake Erie. The terrestrial and wetland portions of the park total about 1633 ha, which is still extremely large for this Ecoregion.

Natural Disturbances. Natural disturbance from wind and ice storms has been extensive over the years (see Section 3.3.5). A number of significant storms has created abundant areas of blowdown in the park, creating openings throughout. Although generally considered as a positive aspect of natural disturbance, there have been some negative impacts to species like Prothonotary Warbler and Cerulean Warbler, and an increase in some invasive species such as Japanese Barberry and possibly Common Reed within forest openings.

Fluctuating lake levels have resulted in a fluctuating water levels within the sloughs. This has been observed both on a seasonal scale and across years as long-term lake levels increase or decrease. These fluctuations result in occasional flooding within the forested sloughs and subsequent tree dieback which provides habitat for a number of cavity-dwelling birds and mammals.

Limiting Components of Habitat. Rondeau provides some of the only winter deer yard habitat in the county. Yarding does not occur every year, however, and is based on winter severity. In years with higher than average snow cover, there is a significant immigration to the park.

Rondeau provides habitat for some colonial nesting bird species. Small colonies of both Black Tern and Forester's Tern occur annually in the marsh. Recently, Double-crested Cormorants have begun to nest on one of the small islands in the bay, both on the ground and in low shrubby vegetation.

The Rondeau Marsh provides some of the best fish spawning areas on this portion of the Lake Erie shoreline.

Other Ecological Functions. Most of the Rondeau forest is in a natural state, with normal nutrient cycling processes functioning without disturbance. A significant amount of downed woody debris has resulted from numerous wind and ice storm events and the salvage of trees has occurred only where trees have fallen over roads or onto cottage lots or day use/camping areas. Earthworms are beginning to have a negative impact within the park, but a moderate leaf layer is still present.

8.5 Special Features

8.5.1 Rare Vegetation Communities

Of the 102 vegetation communities identified in the ELC (Chapter 5 and fold out maps), 12 are provincially significant, including 12 S1 community types (Table 23). A significant portion of the rare community types found in Rondeau are beach/dune and tallgrass communities, illustrating the importance of the park for protection of tallgrass communities and supporting the ongoing restoration of a number of degraded communities that were previously, and could be restored to, tallgrass.

For a complete description of these rare communities, see Chapter 5.

Table 23. Provincially significant community types in Rondeau Provincial Park

Vegetation Type	Veg Code	S-Rank
Sea Rocket Sand Open Shoreline Type	SHOM1-2	S2S3
Little Bluestem - Switchgrass - Beachgrass Open Graminoid Sand Dune Type	SBOD1-1	S2
Cottonwood Treed Sand Dune Type	SBTD1-1	S1
Dry Big Bluestem Graminoid Tallgrass Prairie Type	MEGM1-2	S1
Dry Indian Grass Tallgrass Prairie Type	MEGM1-3	S1
Dry Mixed Graminoid Tallgrass Prairie Type	MEGM1-4	S1
Dry Black Oak - Pine Tallgrass Savannah Type	SVMM1-2	S1
Fresh - Moist Big Bluestem Deciduous Savannah Type	SVDM2-20	S1
Dry - Fresh Black Oak Tallgrass Savannah Type	SVDM3-23	S1
Fresh - Moist Black Oak Deciduous Savannah Type	SVDM4-20	S1
Dry White Pine - Oak Tallgrass Mixed Woodland Type	WOMM1-1	S1
Dry Black Oak - White Oak Tallgrass Woodland Type	WODM1-1	S1
Dry Black Oak Woodland Type	WODM3-2	S1
Fresh - Moist Oak Tallgrass Woodland Type	WODM6-1	S1
Dry - Fresh Black Oak Deciduous Forest Type	FODM1-3	S3
Fresh - Moist Black Walnut Lowland Deciduous Forest Type	FODM7-4	S2S3
Silky Dogwood Mineral Deciduous Thicket Swamp Type	SWTM2-2	S3S4
Gray Dogwood Mineral Deciduous Thicket Swamp Type	SWTM2-3	S3S4
Buttonbush Mineral Deciduous Thicket Swamp Type	SWTM5-1	S3
Winterberry Mineral Deciduous Thicket Swamp Type	SWTM5-6	S3S4
Spicebush Mineral Deciduous Thicket Swamp Type	SWTM5-9	S3
Buttonbush Organic Deciduous Thicket Swamp Type	SWTO5-1	S3

8.5.2 Rare Species

Rondeau supports one of the largest concentrations of rare species and species at risk within a protected area in Ontario. A total of 132 provincially significant species are or have been recorded from the park. As well, a total of 78 species is listed on the *Species at Risk in Ontario* list, including 50 Threatened and Endangered species (Table 24). At least two more species found in the park are expected to be listed as Endangered on the SARO list in the near future – Little Brown Bat and Eastern Pipistrelle.

Some species are also listed by COSEWIC, but classifications are generally the same, with a few minor exceptions. COSEWIC rankings are provided in the appendices for species under federal jurisdiction.

For a complete list of all species including rare species and species at risk, see Chapters 6-7 and Appendices 2-8.

Table 24. Species at Risk and provincially significant species of Rondeau Provincial Park

Taxon	(SARO) SC	(SARO) THR	(SARO) END	(Prov Sig) S1/S1-S2	(Prov Sig) S2/S2-S3	(Prov Sig) S3/S3-S4	S-rank Total	SARO Total
Vascular Plants	4	4	6	10	28	34	72	14
Mammals		1		1		1	2	1
Birds	13	9	10	1	1	1	3	32
Herpetofauna	4	5	4		4	9	13	13
Fish	2	5	3	3	6	4	13	10
Lepidoptera	1				2	7	9	1
Odonata				2	2	3	7	
Freshwater Mussels		2	5	5	4	4	13	7
Total	*24*	*26*	*28*	*21*	*47*	*63*	*132*	*78*

8.5.3 Specialized Habitats and Recognized Areas

Rondeau contains a number of specialized habitats that are important to park fauna. These include:

- The Rondeau wetland communities, and particularly the marsh and shallow water aquatic communities within the marsh, provide significant fish spawning areas for many fish species, including several species at risk.
- Bald Eagles have been nesting in the park sporadically since the 1980's, and annually for at least ten to fifteen years. See section 7.2.5
- The slough (swamp) forests of Rondeau provide habitat for the Endangered Prothonotary Warbler. Rondeau has long been one of the strongholds for this species in Canada, and was an integral part of the recovery program. Common Reed is degrading some of the western sloughs, but most of the interior swamp forests are still suitable. See section 7.2.4 for a full discussion on the Prothonotary Warbler in Rondeau.
- Rondeau has been recognized as an Important Bird Area for a number of congregatory and resident breeding species (Cheskey and Wilson 2001). See section 1.2.3 for a more detailed discussion of the IBA status, including the species for which it was designated.
- Both Rondeau Bay and the Rondeau peninsula are recognised as provincially significant areas (Klinkenberg 1985, Riley *et al.* 1997).
- The Rondeau marsh community is designated as Provincially Significant Wetland, and the complex of Rondeau Bay marshes (in and out of the park) is the largest wetland complex on the Canadian shoreline of Lake Erie (Environment Canada and Ontario Ministry of Natural Resources 2003).

8.6 Provincial, Regional or Local Significance

Rondeau Provincial Park ranks as a provincially significant site based on the assessment provided in chapter 8.0. Rondeau protects a number of L/V associations that are found in the Ecodistrict only within the park, and some other L/V associations would also represent the best examples in the Ecodistrict. The condition of the park is also generally Fair to Good to Excellent depending on the vegetation community. Rondeau also protects a very high level of both species and community diversity, including a very high number of species at risk. The park provides a number of

significant ecological functions. The site was also assessed as having national significance for its Carolinian forests and associated wetland habitats (Klinkenberg 1985).

Literature Cited

Allen, G.M. 1988. A Life Science Inventory and Evaluation of Sinclair's Bush, Kent County, Ontario: An ANSI, Parts I and II. OMNR, Southwestern Region, Chatham District, Chatham. OFER 8812. Part 1, 6 pp. Part 2, vi + 59 pp. + map.

Allen, G.M., P.F.J. Eagles and S.D. Price (eds.). 1990. Conserving Carolinian Canada: Conservation Biology in the Deciduous Forest Region. University of Waterloo Press, Waterloo, Ontario. 346 pp.

Allair, J.R. 2009. Southern Ontario Bald Eagle Monitoring Project, 2009 Report. Unpublished report by Bird Studies Canada to the Ontario Ministry of Natural Resources and the Canadian Wildlife Service. 14 pages.

Ashley, E. P. 1990. Morphological Variability in White-tailed Deer from Four Southern Ontario Sites. M.Sc. Thesis, Trent University, Peterborough, Ontario. 47 pp.

Ashley, E.P., G.B. McCullough and J.T. Robinson. 1998. Morphological responses of white-tailed deer to a severe population reduction. Canadian Journal of Zoology, 76:1-5.

Bakowsky, W. 1995. The impact of deer grazing on the vegetation of Pinery Provincial Park. Natural Heritage Information Centre, Ontario Ministry of Natural Resources. 78 pp.

Banfield, A.W.F. 1974. The Mammals of Canada. University of Toronto Press, Toronto. 438 pp.

Bartlett, C.O. 1955. Starvation of Deer on Navy Island. Technical Bulletin, Ontario Department of Lands and Forests.18 pp.

Bartlett, C.O. 1958a. A Study of Some Deer and Forest Relationships in Rondeau Provincial Park. Wildlife Study-Technical Bulletin, Department of Lands and Forest.

Bartlett, C.O. 1958b. Some Aspects of the Deer Herd in Southwestern Ontario. Department of Lands and Forests. 8 pp.

Bazely, D.R., L.W. Carr, S. Koh, J. Carnie, A. Greenberg, L. Isaac, N. Falkenberg, A. Hunt, C. Sykes, T.J. Carleton, D.R. Voigt and S.M. Carleton. 1996. Interactions Between Deer and Vegetation in Southern Ontario: Monitoring and Restoration of Overgrazed Plant Communities in Pinery and Rondeau Provincial Parks: Report 2 Covering the 1995 and 1996 Field Seasons. Report to the Southern Region Science and Technology Transfer Unit (STTU), Ontario Ministry of Natural Resources. 85 pp.

Bernatas, S. 2007. Aerial Infrared Deer Count of Rondeau and Pinery Provincial Parks. Report to Ontario Parks, Southwest Zone. 8 pp.

Bogart, J.P. and W.J. Cook. 1991. 1991 Ambystoma Survey on the Niagara Escarpment. Prepared for the Niagara Escarpment Branch of the Ontario Heritage Fund. 49 pp.

Bogart, J.P. and L.E. Lichts. 1986. Reproduction and the origin of polyploids in hybrid salamanders of the genus *Ambystoma*. Genome 28(4):605-617.

Bolton, R. 2007. Effects of Anthropogenic Disturbance, Nest-site Selection, and Dipteran Infestation on Spiny Softshells (*Apalone spinifera*). MSc. Thesis, University of Guelph, Guelph, ON.93 pp.

Bolton, R.M., S.A. Marshall and R.J. Brooks. 2008. Opportunistic exploitation of turtle eggs by *Tripanurga importuna* (Walker) (Diptera: Sarcophagidae). Canadian Journal of Zoology, 86:151-60.

Bouvier, L.D. and T.J. Morris. 2011. Information in support of a recovery potential assessment of Eastern Pondmussel (*Ligumia nasuta*), Fawnsfoot (*Truncilla donaciformis*), Mapleleaf (*Quadrula quadrula*), and Rainbow (*Villosa iris*) in Canada. DFO Can. Sci. Advis. Sec. Res. Doc. 2010/120. vi + 51 p.

Bowles, J.M. and M.E. Gartshore. 1992. Monitoring the Response of Vegetation and Breeding Bird Communities to a Reduction in Deer Browsing at Rondeau Park: Baseline Survey - 1991. Long Point Bird Observatory and the Ontario Ministry of Natural Resources. 92 pp.

Bradfield, G.E. 1972. Trend Seeking and Cluster Recognition in Natural Communities. M.Sc. Thesis, University of Western Ontario, London, Ontario.146 p.

Brown, D.M., G.A. McKay and L.J. Chapman. 1968. The Climate of Southern Ontario. Climatological Studies, Number 5. Meteorological Branch, Canadian Department of Transport, Toronto, Ontario. 50 pp.

Burger, D. 1993. Revised Site Regions of Ontario: Forest Research Report 129. Ontario Forest Research Institute, Sault Ste. Marie. 25 pp.

Burgess, K.S., M. Morgan, L. Deverno and B.C. Husband. 2005. Asymmetrical introgression between two Morus species (*M. alba*, *M. rubra*) that differ in abundance. Molecular Ecology (2005) 14: 3471-3483.

Cadman, M.D., P.F.J. Eagles and F.M. Helleiner (eds.). 1987. Atlas of the Breeding Birds of Ontario. Federation of Ontario Naturalists and Long Point Bird Observatory. University of Waterloo Press, Waterloo, Ontario. 617 pp.

Cadman, M. D., H. J. Dewar, and D. A. Welsh. 1998. The Ontario Forest Bird Monitoring Program (1987-1997): Goals, Methods and Species Trends Observed. Can. Wildl. Serv. Tech. Rep. 325. 26 pp.

Cadman, M.D., D.A. Sutherland, G.G. Beck, D. Lepage and A.R. Couturier (eds.). 2007. Atlas of the Breeding Birds of Ontario, 2001-2005. Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources and Ontario Nature, Toronto, xxii + 706 pp.

Cairns, M. 2011. White-tailed Deer Count Surveys Using Helicopters in Ontario Parks Southwest Zone. January 2011. Ontario Parks Southwest Zone, London. 14 pp.

Campbell, C.A. 1971. Herpetology of Rondeau Provincial Park. Ontario Department of Lands and Forests, Provincial Parks Branch, Toronto. 16 pp. + map.

Careless, P.D. 2009. Biosurveillance: utilizing the beetle hunting wasps (*Cerceris fumipennis*, Hymenoptera: Cabronidae) to detect infestations of emerald ash borers (*Agrilus planipennis*, Coleoptera: Buprestidae). University of Guelph. Dept. of Environmental Biology). Masters Thesis, x, 149 p.

Careless, P.D., S.A. Marshall, B.D. Gill, E. Appleton, R. Favrin and T. Kimoto. 2009. *Cerceris fumipennis* – A Bioserveillance Tool for Emerald Ash Borer. Canadian Food Inspection Agency, Ottawa, Ontario.

Carman, R.S. 1928. Survey of Forest Conditions of Rondeau Provincial Park. Ontario Department of Lands and Forests, Toronto, Ontario. 76 pp.

Chapman, L.J. and D.F. Putnam. 1984. The Physiography of Southern Ontario. 3rd Edition. Ontario Geological Survey. 270 pp.

Cheskey, E.D. and W.G. Wilson. 2001. Greater Rondeau Important Bird Area Conservation Plan. Canadian Nature Federation, Bird Studies Canada, Federation of Ontario Naturalists. 64 pp.

Chopra, S. 2002. Assessing the Impact of an Exploding White-tailed Deer Population on Woody Browse Following Population Control. Biology 4000.80, Department of Biology, York University, Toronto, Ontario. 44pp.

Coakley, J.P. 1989. The origin and evolution of a complex cuspate foreland: Pointe Aux Pins, Lake Erie, Ontario. Geographie Physique et Quaternaire 43(1): 65-79.

COSEWIC. 2002. COSEWIC assessment and update status report on the spiny softshell turtle *Apalone spinifera* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 17 pp.

COSEWIC. 2003. COSEWIC assessment and update status report on the Northern Bobwhite *Colinus virginianus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 20 pp.

COSEWIC. 2004. COSEWIC assessment and status report on the round pigtoe *Pleurobema sintoxia* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 33 pp.

COSEWIC. 2007. COSEWIC assessment and update status report on the Prothonotary Warbler *Protonotaria citrea* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. Vii + 31 pp.

COSEWIC. 2007b. COSEWIC assessment and status report on the Chimney Swift *Chaetura pelagica* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. Vii + 49 pp.

COSEWIC. 2007c. COSEWIC assessment and update status report on the Five-lined Skink *Eumeces fasciatus* (Carolinian population and Great Lakes/St. Lawrence population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. Vii + 50 pp.

COSEWIC. 2007d. COSEWIC assessment and status report on the Eastern Pondmussel *Ligumia nasuta* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. Vii + 34 pp.

COSEWIC. 2010. COSEWIC assessment and status report on the Fowler's Toad *Anaxyrus fowleri* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 58 pp.

COSEWIC. 2012. COSEWIC Wildlife Assessments (detailed version) May 2012. Committee on the Status of Endangered Wildlife in Canada. Ottawa. (http://www.cosewic.gc.ca/rpts/Detailed_Species_Assessments_e.pdf).

COSEWIC 2012b. Definitions and Abbreviations Approved by COSEWIC in November 2011. Committee on the Status of Endangered Wildlife in Canada. Ottawa. (http://www.cosewic.gc.ca/eng/sct2/sct2_6_e.cfm).

COSEWIC. 2012c. Wildlife Species Search. Committee on the Status of Endangered Wildlife in Canada. Ottawa. (http://www.cosewic.gc.ca/eng/sct1/SearchResult_e.cfm).

Crewe, T.L. and S.T.A. Timmermans. 2005. Assessing Biological Integrity of Great Lakes Coastal Wetlands using Bird and Amphibian Communities. Technical report to Great Lakes Commission for project # Wetland3-EPA-01. 88 pp.

Crins, W.J. 2002. Ecozones, Ecoregions and Ecodistricts of Ontario. Queens Printer for Ontario.

Crins, W.J. and W.C. Uhlig. 2000. Ecoregions of Ontario: Modifications to Angus Hills' Site Regions and Districts Revisions and Rationale. Queens Printer for Ontario. 7 pp.

Crins, W.J., P.A. Gray, P.W.C. Uhlig and M.C. Wester. 2009. The Ecosystems of Ontario, Part 1: Ecozones and Ecoregions. Ontario Ministry of Natural Resources, Peterborough Ontario, Inventory, Monitoring and Assessment, SIB TER IMA TR-01, 77 pp.

Crysler and Lathem, Ltd. 1973. Rondeau Provincial Park Shoreline Erosion Study - Phase 1. Willowdale, Ontario.

Crysler and Lathem, Ltd. 1974. Rondeau Provincial Park Shoreline Erosion Study - Phase 2. Willowdale, Ontario.

Crysler and Lathem, Ltd. 1975. Rondeau Provincial Park Shoreline Erosion Study - Phase 3. Willowdale, Ontario.

Dai, T.S., D.G. Stevens, and D.W. Smith. 1975. Vegetation Assessment of Rondeau Provincial Park. Four Seasons Ecological Consultants Limited for W.E. Coates and Associates Ltd, Guelph, Ontario. 24 pp.

Davis, R.G. 2006. GapTool users guide. Ontario Ministry of Natural Resources, Peterborough, Ontario. 52 pp + app.

Davy, C. 2009. Summary of work conducted in 2009 under MNR Wildlife Scientific Collector's Authorization #1049600 and ON Parks research authorization. 5 pp.

Dennis, M. 1996. The Response of *Arisaema tryphyllum* to Grazing by White-tailed Deer in Southern Ontario. Department of Biology, York University, Toronto, Ontario. 38 pp.

Dobbyn, J.S. 1994. Atlas of the Mammals of Ontario. Federation of Ontario Naturalists, Don Mills, Ontario. 120 pp.

Dobbyn, S. 2005. A Preliminary Assessment of the Fowler's Toad (*Bufo fowleri*) Population in Rondeau Provincial Park. *in* G. Nelson, T. Nuts, M. Beverdige and B. Dempster *eds*. Proceedings of the Parks Research Forum of Ontario (PRFO) and Carolinian Canada (CCC) Annual General Meeting May 5-7, 2005, University of Guelph.

Dobbyn, S. 2005b. An Inventory of the Common Hoptree (*Ptelea trifoliata*) in Rondeau Provincial Park. Ontario Parks, Morpeth. 7 pp.

Dobbyn, S. 2005c. Checklist of Mammals of Rondeau Provincial Park. 2 pp.

Dobbyn, S. 2006. Rondeau Forest Bird Monitoring Routes Directions for Locating. Unpublished report, Ontario Parks Southwest Zone. 4 pp.

Dobbyn, S. 2007. Deer Count Surveys Using Helicopters in Southwest Zone Ontario Parks December 2007.

Summary of Results and Recommendations. Ontario Parks, London. 8 pp.

Dobbyn, S. 2009. Deer Count Surveys Using Helicopters in Southwest Zone Ontario Parks January 2009. Ontario Parks Southwest Zone, London. 10 pp.

Dobbyn, S. 2010. Deer Count Surveys Using Helicopters in Southwest Zone Ontario Parks Winter 2009-10. Ontario Parks Southwest Zone, London. 13 pp.

Dobbyn, S. and T. Marchand. 2007. An Assessment of Spotted Turtle Home Range, Habitat Use and Population Size in Rondeau Provincial Park. Preliminary Report to Funders on Activities in 2005/2006 Field Seasons. Ontario Parks. 20 pp.

Dobbyn, S. and J. McCracken. 2005. The Causes and Effects of Interspecific Competition by House Wrens (*Troglodytes aedon*) on the Recovery of Prothonotary Warbler (*Protonotaria citrea*) Population in Rondeau Provincial Park. Pp. 347-59 *in* G. Nelson, T. Nudds, M. Beveridge, B. Dempster, L Lefter and E. Zaje *Eds*., Protected Areas and Species and Ecosystems at Risk: Research and Planning Challenges. Proceedings of the Parks Research Forum of Ontario (PRFO) and Carolinian Canada Coalition (CCC) Annual General Meeting May 5-7, 2005.

Dobbyn, S. and L. Pasma. 2002. Open Grown Oak Study: Rondeau Provincial Park. Internal report, Ontario Parks, Morpeth.

Dobbyn, S. and L. Pasma. 2003. A Pilot Small Mammal Trapping Study in Rondeau Provincial Park. Ontario Parks, Morpeth, ON. 16 pp.

Dobbyn, S. and D. Smith. 2005. Eastern Spiny Softshell Turtle Radio Telemetry Study in Rondeau Bay. Internal report, Rondeau Provincial Park, Morpeth. 18 pp.

Ecological Services for Planning. 1975. Report on the Sensitivity and Use Capability of the Faunal and Soil Resources of Rondeau Park. Ontario Ministry of Natural Resources.

Ecoregions Working Group. 1989. Ecoclimatic Regions of Canada, First Approximation. Ecological Land Classification Series No. 23, Sustainable Development Branch, Canadian Wildlife Service, Environment Canada, Ottawa, Ontario. 118 pp.

Edwards, A., J. Barnucz, and N.E. Mandrak. 2006. Fish assemblage surveys of Rondeau Bay, Ontario: 2004 and 2005. Can. Manuscr. Rpt. Fish. Aquat. Sci. 2773: v + 43 pp.

Ellingwood, M.R. and S.L. Caturano. 1988. An Evaluation of Deer Management Options. New England Chapter of the Wildlife Society and the Northeast Deer Technical Committee.

Engel, A.M. 1996. Response of *Viola pubescens* to deer grazing in a Carolinian forest: is there selection for grazing tolerant genotypes? Undergrad. Hon. Thesis. York University, Toronto, Ontario. 48 pp.

Environment Canada. 2004. Canadian Climate Normals 1971-2000 for Ridgetown Ontario. http://www.climate.weatheroffice.ec.gc.ca/climate_normals

Environment Canada and Ontario Ministry of Natural Resources. 2003. The Ontario Great Lakes Coastal Wetland Atlas: A Summary of Information (1983-1997).

Farmer, R.G. 2007. Factors Associated with Vertebrate Roadkill in Southern Ontario Parks. Graduate thesis, University of Guelph, Guelph, ON. 149 pp.

Faull, J.H. 1907. Notes on Rondeau Park. Ontario Science Bulletin, 4:99-104.

Firanski, C. 2003. Monitoring Changes in a Deer Disturbed Carolinian Forest: A Multiscale Approach. MSc. Thesis, York University, Toronto, Ontario.148 pp.

Flowerdew, J.R. and S.A. Ellwood. 2001. Impacts of woodland deer on small mammal ecology. Forestry, 74(3):277-287.

Fox, W.S. and J.H. Soper. 1952. The distribution of some trees and shrubs of the Carolinian zone of Southern Ontario: Part 1, Trans. Of the Royal Can. Inst. XXIX(II):65-84.

Fox, W.S. and J.H. Soper. 1953. The distribution of some trees and shrubs of the Carolinian zone of Southern Ontario: Part 2, Trans. Of the Royal Can. Inst. XXX(I):3-22.

Fox, W.S. and J.H. Soper. 1954. The distribution of some trees and shrubs of the Carolinian zone of Southern Ontario: Part 3, Trans. Of the Royal Can. Inst. XXX(II):99-130.

Franklin, F. and D. Mercker. 2009. Tree Growth Characteristics. University of Tennessee Extension Note W227.

Fuller, R.J. 2001. Responses of woodland birds to increasing numbers of deer: a review of evidence and mechanisms. Forestry, 74(3):289-298.

Fuller, R.J. and R.M.A. Gill. 2001. Ecological impacts of increasing numbers of deer in British woodlands. Forestry, 74(3):193-199.

Gardiner, I. 1895. Rondeau Provincial Park, Report of Ranger. Report to Commissioner of Crown Lands for the Year 1894. Rondeau Provincial Museum Historical Notes. Ontario Department of Lands and Forests. 8 pp.

Gardiner, I. 1913. Report of Superintendent, Rondeau Provincial Park. Report to the Minister of Lands and Forests and Mines for the Year 1912. Rondeau Provincial Museum Historical Notes. Ontario Department of Lands and Forests. 8 pp.

Gartshore, M.E. 1994. Monitoring the response of breeding bird communities to a reduction in deer browsing at Rondeau Provincial Park: baseline survey - 1993. Unpublished report by Long Point Bird Observatory for the Ontario Ministry of Natural Resources. 46 pp.

Gilbert, J. 2008. Summary Report on Freshwater Mussel Sampling in Rondeau Bay and Long Point Bay, Lake Erie, Ontario. Report by the Ontario Ministry of Natural Resources.

Gilbert, J.M., G. Dunn and B. Locke. 2008. Ecological Assessment of Rondeau Bay. Ontario Ministry of Natural Resources, Lake Erie Management Unit, Technical Report.

Gill, R.M.A. and V. Beardall. 2001. The impact of deer on woodlands: the effects of browsing and seed dispersal on vegetation structure and composition. Forestry, 74(3):209-218.

Gillingwater, S.D. 2001. A Selective Herpetofaunal Survey Inventory and Biological Research Study of Rondeau Provincial Park. Upper Thames River Conservation Authority.

Gionfriddo, J.P., N.B. Gates, A.J. DeNicola, K.A. Fagerstone and L.A. Miller. 2008. Field test of gonacon immunocontraceptive vaccine in free-ranging female fallow deer. Pp 235-239 *in* Proc. 23rd Vertebr. Pest Conf. (R.M. Timm and M.B. Madon, Eds.). University of California.

Government of Canada. 2011. Species at Risk Public Registry, species profile for Nodding Pogonia. http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=224 accessed March 31, 2011.

Haggith, Edward George. 1981. *Carpinus caroliniana* Walt. In the Forest of Rondeau: Scratching the Surface. University of Toronto, Department of Forestry, Toronto, Ontario. 39 pp.

Haggith, Edward George. 1982. An Assessment of the Composition and Structure of a Segment of the Rondeau Forest. M.A. Thesis, University of Toronto, Department of Forestry, Toronto, Ontario. 168 pp.

Hills, G.A. 1959. A Ready Reference to the Description of the Land of Ontario and its Productivity. Ontario Department of Lands and Forests, Division of Research, Maple, Ontario. 142 pp.

Hills, G.A. 1961, reprinted 1966. The Ecological Basis for Land-use Planning. Ontario Department of Lands and Forests, Research Branch, Research Report 46. 204 pp.

Howes, B. 2006. Genetic and Ecological Analysis of a Species Range. Phd Thesis, Queen's University, Kingston, ON.

Hynes, K.E., S. Koh, S.M. McLachlan, M. Timiska, and D.R. Bazely. 2002. Shedding Light on the Problem of Deer Overgrazing in Carolinian Forests. Proceedings of SAMPAA IV, Waterloo University, 2000.

J.E. Hanna and Associates Inc. 1984. A Management Strategy for the Restoration of Aquatic Vegetation in Rondeau Bay, Lake Erie. Southwestern Region, Ontario Ministry of the Environment.

Jalava, J.V., J.L. Riley, D.G. Cuddy and W.J. Crins. 1997. Natural Heritage Resources of Ontario: Revised Site Districts in Ecological Site Regions 6E and 7E, Part I: Rationale and Methodology. Natural Heritage Information Centre, Ministry of Natural Resources, Peterborough, Ontario. XXX pp. + map.

Johnson, M., B. Tegler and S. Dobbyn. 2003. Monitoring the Effects of Prescribed Burns in Oak Savannah and Woodlands: Field Methods. Revised September 2003. 32 pp.

Judge, K.A., Haviernick, M. 2002. Update COSEWIC status report on the grey fox *Urocyon cinereoargenteus* in Canada, *in* COSEWIC assessment and update status report on the grey fox *Urocyon cinereoargenteus* interior in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-32 pp.

Kenny, M. 1974. Report on the Forest of Rondeau Provincial Park. Ontario Ministry of Natural Resources, Chatham District. 19 pp.

Killan, G. 1993. Protected Places: a History of Ontario's Provincial Parks System. Ministry of Natural Resources Book Number 4763. Dundern Press Limited, Toronto, Ontario. 426 pp.

Kirby, K.J. 2001. The impact of deer on the ground flora of British broadleaved woodland. Forestry, 74(3):219-229.

Klinkenberg, R. 1985. Life Science Areas of Natural and Scientific Interest in Site District 7-1: A Review and Assessment of Significant Natural Areas. Parks and Recreational Areas Section, Ontario Ministry of Natural resources, Southwestern Region, London, Ontario. Viii + 82 pp. + folded map, illus.

Koh, S. 1991a. Responses of Spring Herbs to Chronic Grazing by White-tailed Deer (*Odocoileus virginianus*). Bio. Hon. Thesis, York University, Toronto, Ontario. 53 pp.

Koh, S. 1991b. The Effect of Grazing by White-tailed Deer (*Odocoileus virginianus*) on Deciduous Forest Plant Communities in Southern Ontario Canada: a Multiple Scale Evaluation. Report to the Ontario Ministry of Natural Resources. 39 pp.

Koh, S. 1995. The Response of Four Species of Spring Flowering Perennial Herbs to Grazing by White-tailed Deer in Southern Ontario. M.Sc. Thesis, York University, Toronto, Ontario. 152 pp.

Koh, S. 2002. Effects of Grazing by White-tailed Deer (*Odocoileus virginianus*) on Deciduous Forest Plant Communities in Southern Ontario: A Multiple Scale Evaluation. Ph.D. Thesis, Graduate Program in Biology, York University, Toronto, Ontario. 248 pp.

Koh, S. and D. Bazely. 1994. Responses of Vegetation to Grazing by White-tailed Deer (*Odocoileus virginianus*): Progress Report # 2 - Studies Carried out from 1992-1993. Progress report, Point Pelee National Park. 45 pp.

Koh, S., D.R. Bazely, and M. Timciska. 1999. Grazing Impacts of White-tailed Deer or "Culling Bambi to Save the Forest". Proceedings of the Parks Research Forum of Ontario, Guelph University. Heritage Resources Centre, Waterloo, ON. Pp 187-196.

Koh, S. D.R. Bazely, A.J. Tanentzap, D.R. Voigt and E. DaSilva. 2010. *Trillium grandiflorum* height is an indicator of white-tailed deer density at local and regional scales. Forest Ecology and Management 259 (2010): 1472-1479.

Kurta, A. 1995. Mammals of the Great Lakes Region. Fitzhenry and Whiteside Ltd., Markham, ON. 346 pp.

Landplan Collaborative Ltd, The. 1990. The Effects of Browsing and Trampling by White-tailed Deer on Pinery Provincial Park and its Environs. Prepared for the Ministry of Natural Resources. 62 pp.

Landplan Collaborative Ltd., The. 1991. Vegetation management objectives. Point Pelee National Park. Unpublished Report for Canadian Parks Service.

Larson, M.H. and G.E. Waldron. 2000. Catastrophic windthrow in Rondeau Provincial Park, Ontario. Canadian Field-Naturalist 114(1):78-82.

Layberry, R., P. Hall and D. Lafontaine. The Butterflies of Canada. 1998. University of Toronto Press, Toronto. 280pp.

Leach, M.K. and T.J. Givnish. 1988. Identifying highly restorable savanna remnants. Transactions Wisconsin Academy Sciences, Arts, and Letters 86: 119-128.

Lee, H.T. 2008. Ecological Land Classification Catalogue, Version 8. Unpublished database of the Ontario Ministry of Natural Resources.

Lee, H.T., W.D. Bakowsky, J. Riley, J. Bowles, M. Puddister, P. Uhlig and S. McMurray. 1998. Ecological land classification for Southern Ontario: First approximation and its application. Ontario Ministry of Natural Resources, Southcentral Science Section, Science and Development and Transfer Branch. SCSS Field Guide FG-02.

Lincoln, R.C. 1974. Ontario Humane Society Programme to Remove Deer from Rondeau Provincial Park: Winter 1973-1974. Ontario Ministry of Natural Resources, Chatham District. 5pp.

LTVCA. 2004. Sinclair's Bush. http://www.lowerthames-conservation.on.ca/SinclairsBush.htm. Lower Thames Conservation Authority.

Mac, L. and D. Bazely. 2003. A bee diversity survey in oak savannah habitats in Rondeau Provincial Park, Ontario. pp 327-335 in Proceedings of the Protected Areas and Watershed Management symposium, Parks Research Forum of Ontario.

MacDougall, T. 2008. Assessment of Fish Species Diversity within the Rondeau Provincial Park Coastal Wetland, Lake Erie, Ontario. OMNR Report.

Mandrak, N. and E. Crossman. 1992. A Checklist of Ontario Freshwater Fishes. Royal Ontario Museum Publications in Life Sciences. Royal Ontario Museum, Toronto. 176 pp.

Mann, D. 1978. The Changing Rondeau Landscape. M.A. Thesis, Geography Department, University of Waterloo, Waterloo, Ontario. 297 pp.

Marshall, S.A., M. Buck and S.M. Paiero. 2005. Buprestid sampling at nests of *Cerceris fumipennis* (Hymenoptera, Crabronidae) in southern Ontario: the first Canadian records of three buprestids (Coleoptera: Buprestidae). Canadian Entomologist 137(4):416-19.

Marshall, S.A., S.M. Paiero and M. Buck. 2005b. Rondeau Provincial Park – Insect Survey Report. Research report submitted to Ontario Parks. 8 pp.

Marshall, S. and S. Paiero. 2011. University of Guelph Insect Collection, Species List for Rondeau Provincial Park. Viewed March 14, 2011. http://www.uoguelph.ca/debu/index.htm

McCabe, R.E. and T.R. McCabe. 1984. Of Slings and Arrows: An Historical Retrospection. Pp 19-72 in White-tailed Deer Ecology and Management, ed. Lowell K. Halls. Stackpole Books, Harrisburg, PA. 870 pp.

McCracken, J.D. 1984. Status Report on the Prothonotary Warbler (*Protonotaria citrea*) in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa. 27 pp.

McCracken, J.D. and J.S. Dobbyn. 1997. The 1997 Prothonotary Warbler Nest Box and Census Program. Unpublished report by the Long Point Bird Observatory. 88 pp.

McCracken, J. and K. Somple. 2008. The 2008 Prothonotary Warbler Recovery Program in Canada. Bird Studies Canada, Port Rowan.

Meloche, C. and S. Murphy. 2002. Protecting Carolinian Canada: Controlling the Spread of Tree-of-Heaven (*Ailanthus altissima*) within Rondeau Provincial Park. *In* J.G. Nelson, T.J. Beechey, C.J. Lemieux eds. Parks and Protected Areas Research in Ontario, 2002: Proceedings of the Parks Research Forum of Ontario (PRFO) Annual General Meeting, April 25-27, 2002, Ridgetown, Ontario

McCullough, D.R. 1984. Lessons from the George Reserve, Michigan. Pp 211-244 *in* White-tailed Deer Ecology and Management, ed. Lowell K. Halls. Stackpole Books, Harrisburg, PA. 870 pp.

McKeating, G. 1989. The Erie Sand Spits: Long Point, Rondeau, and Point Pelee. *In*, Legacy: The Natural History of Ontario. John Theberge (ed), McClelland & Stewart Inc., Toronto, Ontario. 397 pp.

McShea, W.J. and J.H. Rappole. 2000. Managing the abundance and diversity of breeding bird populations through manipulation of deer populations. Conservation Biology, 14(4):1161-1170.

MMP. 2008. Marsh Monitoring Program Participant's Handbook for Surveying Marsh Birds. 2008 Edition. Published by Bird Studies Canada in cooperation with Environment Canada and the U.S. Environmental Protection Agency. 17 pp.

MMP. 2008b. Marsh Monitoring Program Participant's Handbook. Surveying Amphibians. 2008 Edition. Published by Bird Studies Canada in cooperation with Environment Canada and the U.S. Environmental Protection Agency. 20 pp.

NABA 2011. North American Butterfly Association Butterfly Counts. http://www.naba.org/butter_counts.html. Accessed February 2, 2011.

NHIC. 2004. Natural Areas Report: Sinclair's Bush. Natural Heritage Information Centre, Ontario Ministry of Natural Resources. http://www.mnr.gov.on.ca/MNR/nhic/areas/areas_report.cfm?areaid=111.

NHIC. 2011. Natural Heritage Information Centre Element Occurrence Reports.

O'Roke, E.C. and F.N. Hamerstrom Jr. 1948. Productivity and yield of the George Reserve deer herd. Journal of Wildlife Management, 12(1): 78-87.

Oldham, M. 2005. Significant Collections made in Ontario Provincial Parks and Conservation Reserves in 2004. Report on field work to Ontario Parks. 6 pp.

Oldham, M.J. and W.F. Weller. 2000. Ontario Herpetofaunal Atlas. Natural Heritage Information Centre, Ontario Ministry of Natural Resources. http://nhic.mnr.gov.on.ca/MNR/nhic/herps/ohs.html (updated 15-01-2010).

Ontario Ministry of Natural Resources. 1972. Student report on Rondeau. Chatham, Ontario.

OMNR. 1973. Historic Ronde Eau. Rondeau Provincial Park, Morpeth, Ontario.

OMNR. 1977. Proposed Methodology of Deer Exclosure and Forest Regeneration Study in Rondeau Provincial Park. Ontario Ministry of Natural Resources, Chatham District. 7 pp.

OMNR. 1978. Ontario Provincial Parks Planning and Management Policies. Parks Planning Section, Toronto.

OMNR. 1981. A Chronological History of the Forest of Rondeau Provincial Park and surrounding area. Ontario Ministry of Natural Resources. 19 pp.

OMNR. 1989. Rondeau Provincial Park Preliminary Management Plan. Queens Printer for Ontario. 64 pp.

OMNR. 1991. Rondeau Provincial Park Management Plan. Queen's Printer for Ontario. 25 pp.

OMNR. 1992. Ontario Provincial Parks: Planning and Management Policies. 1992 Update. Provincial Parks and Natural Heritage Policy Branch.

OMNR. 2001. Rondeau Vegetation Management Plan. Queen's Printer for Ontario.

OMNR. 2002. Clear Creek Forest Interim Management Statement. Queens Printer for Ontario.

OMNR. 2006a. Provincial Parks and Conservation Reserves Act, 2006. S.O. 2006, c. 12.

OMNR. 2006b. Ontario Provincial Parks Statistics 2005. Queens Printer for Ontario. 70 pp.

OMNR. 2006c. State of the Forest Report 2006. Queens Printer for Ontario. Available on-line at http://www.mnr.gov.on.ca/en/Business/Forests/2ColumnSubPage/STEL02_179267.html

OMNR. 2007. Ontario Provincial Parks Statistics 2006. Queens Printer for Ontario. 84 pp.

OMNR. 2008. Ontario Provincial Parks Statistics 2007. Queens Printer for Ontario. 71 pp.

OMNR. 2009. Ontario Provincial Parks Statistics 2008. Queens Printer for Ontario. 69 pp.

OMNR. 2010. Ontario Provincial Parks Statistics 2009. Queens Printer for Ontario. 69 pp.

OMNR. 2010b. Backgrounder on Elk in Ontario. Queens Printer for Ontario. 44 pp.

OMNR. 2012. Species at Risk in Ontario List. http://www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/276722.html Updated January 13, 2012.

Paiero, S.M. and M. Buck. 2004. First Canadian records of the giant resin bee, *Megachile sculpturalis* Smith, and other introduced and native Megachilidae and Andrenidae (Apoidea) from Ontario. Journal of the Entomological Society of Ontario, 134 (2003):141-143.

Paiero, S.M. and S.A. Marshall. 2003. New records of Hemiptera from Canada and Ontario. Journal of the Entomological Society of Ontario, 134 (2003):115-129.

Patterson, H., K. Hartley and B. Crins. Life Science Checksheet Guidelines. October 2003. Ontario Parks, Planning and Research Section, Ontario Ministry of Natural Resources, Peterborough. 38 pp.

PCA. 2007. Recovery Strategy for the Red Mulberry (*Morus rubra*) in Canada. *Species at Risk Act* Recovery Strategy Series. Parks Canada Agency. Ottawa, Ontario. Vi + 47 pp.

Pearl, D.L., S. Koh, D.R. Bazely, D.R. Voigt, M. Tang and W. Soo. 1995. Interactions Between Deer and Vegetation in Southern Ontario, Canada: Monitoring and Restoration of Overgrazed Plant Communities at Pinery and Rondeau Provincial Parks. Report to the Southern Region Science and Technology Transfer Unit, Ontario Ministry of Natural Resources. 49 pp.

Perrins, C.M. and R. Overall. 2001. Effect of increasing numbers of deer on bird populations in Whytham Woods, central England. Forestry, 74(3):299-309.

Peterson, R. 1966. The Mammals of Eastern Canada. Oxford University Press. 465 pp.

Petit, L.J. 1999. Prothonotary Warbler (*Protonotaria citrea*). *In* The Birds of North America, No. 408 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Pratt, P.D. 1975. 1975 Forest Inventory Rondeau Provincial Park. Morpeth, Ontario.25 pp.

Prevett, J.P. 1983. Overview of Rondeau Deer-Forest Situation and Management Recommendations. Ontario Ministry of Natural Resources. 18 pp.

Putman, R.J., P.J. Edwards, J.C.E. Mann, R.C. How and S.D. Hill. 1989. Vegetational and faunal changes in an area of heavily grazed woodland following relief of grazing. Biological Conservation, 47:13-33.

Price, J. 1994. Rondeau Provincial Park: 1894-1994, A Centennial Celebration of the History of Rondeau Provincial Park and Community. Rondeau Park Leaseholder's Association, Morpeth, Ontario.200 pp.

Ramshaw, W. and E. Holm. 1996. Reporting of ROM 1996 Collecting Activities in and around Rondeau Provincial Park. Letter and report to Ontario Parks for Fish Sampling in Rondeau Bay.

Reid, S., N. Mandrak and J. Barnucz. 2005. Inventory and Habitat Characterization for the North-shore Lake Erie Populations of the Channel Darter. Annual report to OMNR. 19 pp.

Remaley, T. and J.M. Swearingen. 2005. Japanese knotweed, (*Fallopia japonica*). Plant Conservation Alliance, Alien Plant Working Group web site; http://www.nps.gov/plants/alien/fact/pocu1.htm

Ribic, C.A., R.R. Koford, J.R. Herkert, D.H. Johnson, N.D. Niemuth, D.E. Naugle, K.K. Bakker, D.W. Sample and R.B. Renfrew. 2009. Area sensitivity in North American grassland birds: patterns and processes. The Aug 126(2): 233-244.

Riley, J.L., J.V. Jalava, M.J. Oldham and H.G. Godschalk. 1997. Natural Heritage Resources of Ontario: Bibliography of Life Science Areas of Natural and Scientific Interest in Ecological Site Regions 6E and 7E, Southern Ontario. First Edition. Ontario Ministry of Natural Resources, Natural Heritage Information Centre, Peterborough, Ontario. 156 pp. + 3 maps.

Rondeau Provincial Park Advisory Committee. 1975. Rondeau Provincial Park Advisory Committee Transcript of Public Hearings.

Rondeau Watershed Coalition. 2004. Website of the Rondeau Watershed Coalition. http://www.rondeauwatershed.ca/

Rooney, T.P. 2001. Deer impacts on forest ecosystems: a North American perspective. Forestry, 74(3):201-208.

Rowe, J.S. 1972. Forest Regions of Canada. Department of the Environment, Canadian Forestry Service, Publication No. 1300. 172 pp.

Ryan, John T. 1970. Historic Pointe Aux Pins: a History of Rondeau Provincial Park. Morpeth, Ontario.

Sauer, P.R. 1984. Physical Characteristics. Pp 73-90 *in* White-tailed Deer Ecology and Management, ed. Lowell K. Halls. Stackpole Books, Harrisburg, PA. 870 pp.

Savanta. 2009. Lake Erie Sand Spit Savannas and Species at Risk: Invasive Species Inventories and Vegetation Restoration Strategy. Savanata Inc., St. Catharine's, ON. 149 pp.

Schalk, G., H. Dewar and M. Cadman. 2002. Recommendations for assessing trends in forest bird populations based on the experience of the Ontario forest bird monitoring program. Journal of Field Ornithology; 73(4):340-350.

Schloesser, D.W., and B.F. Nalepa. 1994. Dramatic decline of unionid bivalves in offshore waters of western Lake Erie after infestation by the zebra mussel, *Dreissena polymorpha*. Can. j. Fish. Aquat. Sci. 51 : 2234-2242.

Seagle, S.W. and J.D. Close. 1996. Modeling white-tailed deer (*Odocoileus virginianus*) population control by contraception. Biological Conservation 76: 87-91.

Senese, T. 2009. Thermal Infrared Deer Inventory; 2009. Geographic Information Ontario, Science and Information Resources Division, Ontario Ministry of Natural Resources. Queens Printer for Ontario.

Sherlock, J.R. 1977. Pollen Analysis of Sediments from Rondeau Lagoon. Department of Geography, University of Western Ontario, London, Ontario.

Sly, P.G. 1976. Lake Erie and its basin. Journal of the Fisheries Research Board of Canada. 33:355-70.

Stephenson, A.B. 1959. The Deer Exclosure Study in Rondeau Provincial Park. Wildlife File Report No. 53, Ontario Department of Lands and Forests, Division of Research.

Stewardship Kent. 2004. Information page on Chatham-Kent. http://www.ontariostewardship.org/KENT/About%20Chatham%20Kent.htm

Stewart, A.J.A. 2001. The impact of deer on lowland woodland invertebrates: a review of the evidence and priorities for future research. Forestry, 74 (3):259-270.

Stewart, W.G. 1982. Mammals of Elgin County Ontario. The St. Thomas Field Naturalist Club, St. Thomas, Ontario. 125 pp.

Stromayer, K.A.K. and R.J. Warren. 1997. Are overabundant deer herds in the eastern United States creating alternate stable states in forest plant communities? Wildlife Society Bulletin, 25(2):227-234.

Sugar, A.,T. Bellhouse, D. Phoenix, N. Dawson, G. Holborn and M. McLaren. 2001. Wildlife Assessment Program Monitoring Protocols: A Sampling Protocol for Red-backed Salamander (*Plethodon cinereus*) Populations in Ontario: The 2nd Pilot Study. Wildlife Assessment Program WAP-2001-01.

Sugar, A.,T. Bellhouse, D. Phoenix, N. Dawson, G. Holborn and M. McLaren. 2003. Wildlife Assessment Program Monitoring Protocols: A Sampling Protocol for Small Mammals in Ontario (version 6.0, January 13, 2003). Ontario Ministry of Natural Resources Wildlife Assessment Program.

Tanentzap, A.J., D.R. Bazely, S. Koh, M. Timciska, E.G. Haggith, T.J. Carleton, D. A. Coomes. 2011. Seeing the forest for the deer: Do reductions in deer-disturbance lead to forest recovery? Biological Conservation, 144(1) 376-382.

Theberge, J.B. 1989. The Carolinian Zone. Pp 259-62 *in* J.B. Theberge (ed). 1989. Legacy, The Natural History of Ontario. McClelland and Stewart Inc., Toronto. 397 pp.

Timmermans, S., R. Archer and T. Crewe. 2005. Marsh Bird, Amphibian and Associated Habitat Inventories at Rondeau Provincial Park. Final Report of 2005 project Activities. Report to the Ministry of Natural Resources from Bird Studies Canada. 65 pp.

Van Zyll de Jong, C.G. 1983. Handbook of Canadian Mammals. 1. Marsupials and Insectivores. National Museum of Natural Sciences, Ottawa. 210 pp.

Van Zyll de Jong, C.G. 1985. Handbook of Canadian Mammals. 2. Bats. National Museum of Natural Sciences, Ottawa. 212 pp.

Voigt, D.R. and J.D. Broadfoot. 1989. Population dynamics of Rondeau deer. Wildlife Research Branch, Ministry of Natural Resources, Maple, Ontario.

Voigt, D.R. and P.C. Smith. 1994. A Summary of Recent Deer Research in Rondeau Provincial Park. Ontario Ministry of Natural Resources.

Voute, O. 1967. Rondeau Provincial Park, Beach Erosion. File 110-D3, Engineering Services, Ontario Department of Lands and Forests.

W.E. Coates and Associates Ltd. 1977. Untitled background report on Rondeau Provincial Park. Guelph, Ontario. 97 pp.

Waldron, G., M. Gartshore, and K. Colthurst. 1996. Pumpkin ash, *Fraxinus profunda*, in southwestern Ontario. Canadian Field-Naturalist 110: 615–619.

Waldron, G. 2003. Trees of the Carolinian Forest: A Guide to Species, their Ecology and Uses. Boston Mills Press, Erin, Ontario.

Warren, W.D. 1974. The Geology and Geomorphology of Rondeau Provincial Park. Environmental Planning Series V.7, Ontario Ministry of Natural Resources, Park Planning Branch, Division of Parks.

Watkinson, A.R., A.E. Riding and N.R. Cowie. 2001. A community and population perspective of the possible role of grazing in determining the ground flora of ancient woodlands. Forestry 74(3):231-239.

William Trow Associates Ltd. 1974. Soil survey: Rondeau Provincial Park, Chatham, Ontario. *Prepared for*, Crysler and Lathem Ltd. Willowdale, Ontario.

Wilson, E., D. Apsinall and K. Denholm. Soils of Kent County, East Sheet. 1996. P.M. 38, Townships of Zone, Orford, Howard and Harwich Ontario. Soil Survey Report No. 64. Geographic Information System Unit, Agricultural Land Use Section, Resources Management Branch, Ontario Ministry of Agriculture, Food and Rural Affairs and the

Canadian Soil Information System (CanSIS), Eastern Cereal and Oilseed Research Centre, Research Branch, Agriculture and Agri-Food Canada, Ottawa, Ontario.

Wood, H.A.H. 1951. Erosion of the Shore of Lake Erie, Point-aux-Pins to Long Point. Unpublished M.A. Thesis, McMaster University. 209 pp.

Woodliffe, P.A. 1997. Annotated List of Vascular Plants of Rondeau. OMNR, Chatham.

Woodliffe, P.A. 2002. An Annotated List of the Vascular Plants of Rondeau Provincial Park Ontario. 39 pp.

Woodliffe, P.A. 2009. Results of Nodding Pogonia (*Triphora trianthophora*) Monitoring Rondeau Provincial Park, Ontario. Unpublished report to Ontario Parks.

Woodliffe, P.A. 2009b. Checklist of the Birds of Rondeau Provincial Park and Area. 5 pp.

Woodliffe, P.A. 2010. Details from Field Notes Regarding Puttyroot (Aplectrum hyemale) at Rondeau Provincial Park. Internal report, Ontario Ministry of Natural Resources.

Yaraskavitch, K.M. 1981. Interim Report on the Rondeau Deer Browse and Forest Regeneration Study from 1978-1980. Ontario Ministry of Natural Resources, Chatham District. 51 pp.

Yaraskavitch, K.M. 1983. The Effects of Deer Browsing on Forest Succession in Rondeau Provincial Park. Ontario Ministry of Natural Resources, Chatham District. 68 pp.

Zanatta, D., G. Mackie, J. Metcalfe-Smith and D. Woolnough. 2002. A refuge for native freshwater mussels (Bivalvia: Unionidae) from impacts of the exotic Zebra Mussel (*Dreissena polylmorpha*) in Lake St. Clair. J. Great Lakes Res. 28(3):479-489.

Appendix 1. Explanation of Codes Used in Appendices

SARO Status

SARO Codes represent species status codes as found on the *Species at Risk in Ontario* (SARO) List. The *Species at Risk in Ontario* list is a summary of the status of species at risk in Ontario as determined by the Committee on the Status of Species at Risk in Ontario (COSSARO). Species assessed as Threatened or Endangered receive both individual and habitat protection under the *Endangered Species Act (2007)*. SARO ranks listed in the appendices are current as of May 2012. An explanation of each of the SARO codes is as follows:

EXP	**Extirpated**	A species that no longer exists in the wild in Ontario but still occurs elsewhere.
END	**Endangered**	A species facing imminent extinction or extirpation in Ontario.
THR	**Threatened**	A species that is at risk of becoming endangered in Ontario if limiting factors are not reversed.
SC	**Special Concern**	A species with characteristics that make it sensitive to human activities or natural events.

COSEWIC Status

COSEWIC status codes are provided for federal jurisdiction species (fishes, mussels). For an explanation of the COSEWIC codes see COSEWIC (2012b).

S-Ranks

S-Ranks in the appendices represent Ontario subnational conservation status ranks (S-ranks) as defined by the Ontario Natural Heritage Information Centre (NHIC). An explanation of each of the codes is as follows:

S-Rank	Definition
SX	**Presumed Extirpated**—Species or community is believed to be extirpated from the province. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.
SH	**Possibly Extirpated (Historical)**—Species or community occurred historically in the province, and there is some possibility that it may be rediscovered. Its presence may not have been verified in the past 20-40 years. A species or community could become SH without such a 20-40 year delay if the only known occurrences in a nation or state/province were destroyed or if it had been extensively and unsuccessfully looked for. The SH rank is reserved for species or communities for which some effort has been made to relocate occurrences, rather than simply using this status for all elements not known from verified extant occurrences.
S1	**Critically Imperilled**—Critically imperilled in the province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.
S2	**Imperilled**—Imperilled in the province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the province.
S3	**Vulnerable**—Vulnerable in the province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
S4	**Apparently Secure**—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5	**Secure**—Common, widespread, and abundant in the province.
SNR	**Unranked**—Provincial conservation status not yet assessed.
SU	**Unrankable**—Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
SNA	**Not Applicable** —A conservation status rank is not applicable because the species is not a suitable target for conservation activities.
S#S#	**Range Rank** —A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).

S#B	**Breeding migrants**. There is no major concentration or staging areas during migration or in the non-breeding season.
S#N	**Non-breeding migrants** for birds which have major concentration or staging areas

Appendix 2. Checklist of the Vascular Plants of Rondeau Provincial Park

The following list is modified from Woodliffe (2002) with additions based on field work during the Life Science Inventory and other field work by MNR staff and external researchers. For further information on the status of the vascular plants of Rondeau, consult the Annotated List of Vascular Plants of Rondeau (Woodliffe 1997).

This list contains 916 species of plants known in the park as of May 2012. Of the 916 species 72 are provincially significant, 14 are listed on the SARO list and 224 are non-native.

Taxonomy generally follows the NHIC as of April 2011.

Abbreviations used specifically in the plant list:

N=Native to Rondeau.
I=Introduced to Rondeau
* =Introduced to the park and found on current or retired leaseholds and in other disturbed areas, but not known to be spreading.
RK=Rare in Kent County

S1, S2, etc. refer to Ontario subnational conservation status ranks (S-ranks) as defined by the NHIC (see Appendix 1). S-Ranks are current as of April 2011. SARO status (SC, THR, END) represent species status as identified on the Species at Risk in Ontario (SARO) list (see Appendix 1).

SCIENTIFIC NAME	COMMON NAME	STATUS
PTERIDOPHYTA	FERNS AND FERN ALLIES	
ASPLENIACEAE	SPLEENWORT FAMILY	
Asplenium platyneuron	Ebony Spleenwort	N S4 RK
DENNSTAEDTIACEAE	BRACKEN FAMILY	
Dennstaedtia punctiloba	Eastern Hay-scented Fern	N S5 RK
Pteridium aquilinum	Bracken Fern	N S5
DRYOPTERIDACEAE	WOOD FERN FAMILY	
Athyrium filix-femina	Lady Fern	N S5
Cystopteris tenuis	Mckay's Fragile Fern	N S5
Diplazium pycnocarpon	Glade Fern	N S4 RK
Deparia acrostichoides	Silvery Spleenwort	N S4
Dryopteris carthusiana	Spinulose Wood Fern	N S5
Dryopteris clintoniana	Clinton's Wood Fern	N S4 RK
Dryopteris cristata	Crested Wood Fern	N S5
Onoclea sensibilis	Sensitive Fern	N S5
Polystichum acrostichoides	Christmas Fern	N S5
EQUISETACEAE	HORSETAIL FAMILY	
Equisetum arvense	Field Horsetail	N S5
Equisetum fluviatile.	Water Horsetail	N S5 RK
Equisetum hyemale var. *affine*	Common Scouring-rush	N S5
Equisetum pratense	Meadow Horsetail	N S5 RK
Equisetum variegatum	Variegated Horsetail	N S5 RK
LYCOPODIACEAE	CLUBMOSS FAMILY	
Huperzia lucidula	Shining Clubmoss	N S5
OSMUNDACEAE	ROYAL FERN FAMILY	

SCIENTIFIC NAME	COMMON NAME	STATUS
Osmunda cinnamomea	Cinnamon Fern	N S5
Osmunda claytoniana	Interrupted Fern	N S5
Osmunda regalis	Royal Fern	N S5
PTERIDACEAE	BRAKE FERN FAMILY	

SCIENTIFIC NAME	COMMON NAME	STATUS
Adiantum pedatum ssp. *pedatum*	Maidenhair Fern	N S5
THELYPTERIDACEAE	MARSH FERN FAMILY	
Phegopteris hexagonoptera	Broad Beech Fern	N S3 RK SC
Thelypteris noveboracensis	New York Fern	N S4S5 RK
Thelypteris palustris	Marsh Fern	N S5
GYMNOSPERMAE	GYMNOSPERMS	
CUPRESSACEAE	CYPRESS FAMILY	
Juniperus virginiana	Eastern Red Cedar	N S5
PINACEAE	PINE FAMILY	
Picea abies	Norway Spruce	I SNA
Picea glauca	White Spruce	I S5*
Picea pungens	Blue Spruce	I SNA*
Pinus banksiana	Jack Pine	I S5*
Pinus nigra	Black (Austrian) Pine	I SNA*
Pinus strobus	Eastern White Pine	N S5 RK
Pinus sylvestris	Scots Pine	I SNA
MONOCOTYLEDONEAE	MONOCOTS	
ACORACEAE		
Acorus americanus	Sweetflag	N S4
ALISMATACEAE	WATER-PLANTAIN FAMILY	
Alisma subcordatum	Southern Water-plantain	N S4?
Sagittaria cuneata	Arrowhead	N S4? RK
Sagittaria graminea var. *graminea*	Grass-leaved Arrowhead	N S4S5 RK
Sagittaria latifolia	Duck Potato; Broadleaf (Common) Arrowhead	N S5
Sagittaria rigida	Sessile-fruited Arrowhead	N S4? RK

SCIENTIFIC NAME	COMMON NAME	STATUS
ARACEAE	ARUM FAMILY	
Arisaema triphyllum ssp. *triphyllum*	Jack-in-the-pulpit	N S5
BUTOMACEAE	FLOWERING RUSH FAMILY	
Butomus umbellatus	Flowering Rush	I SNA
COMMELINACEAE	SPIDERWORT FAMILY	
Commelina communis	Asiatic Dayflower	I SNA
Tradescantia virginiana	Spiderwort	I SNA
CYPERACEAE	SEDGE FAMILY	
Carex albicans var. *albicans*	White-tinged Sedge	N S3
Carex albursina	White Bear Sedge	N S5
Carex amphibola	Narrow-leaf Sedge	N S2 RK
Carex aquatilis	Water Sedge	N S5
Carex aurea	Golden Sedge	N S5
Carex bebbii	Bebb's Sedge	N S5
Carex blanda	Woodland Sedge	N S5
Carex brevior	Short-headed Sedge	N S4S5 RK
Carex cephalophora	Oval-leaf Sedge	N S5
Carex communis	Fibrous-root Sedge	N S5
Carex comosa	Bearded Sedge	N S5
Carex crinita	Fringed Sedge	N S5
Carex cristatella	Crested Sedge	N S5
Carex deweyana	Short-scale Sedge	N S5 RK
Carex diandra	Lesser Panicled Sedge	N S5 RK
Carex eburnea	Ebony Sedge	N S5 RK
Carex echinodes	Quill Sedge	N S4

SCIENTIFIC NAME	COMMON NAME	STATUS
Carex gracillima	Graceful Sedge	N S5
Carex granularis	Meadow Sedge	N S5
Carex grayi	Asa Gray's Sedge	N S4
Carex grisea	Inflated Narrow-leaf Sedge	N S4
Carex hitchcockiana	Hitchcock's Sedge	N S5
Carex hystericina	Porcupine Sedge	N S5
Carex lacustris	Lake Sedge	N S5
Carex laxiflora	Distant-flowered Sedge	N S5
Carex leptonervia	Finely-nerved Sedge	N S4 RK
Carex lupulina	Hop Sedge	N S5
Carex molesta	Troublesome Sedge	N S4?
Carex muehlenbergii	Muhlenberg's Sedge	N S4S5
Carex normalis	Right-angled Sedge	N S4 RK
Carex pedunculata	Peduncled Sedge	N S5
Carex pellita	Woolly Sedge	N S5
Carex pensylvanica	Pennsylvania Sedge	N S5
Carex pseudocyperus	Cyperus-like Sedge	N S5 RK
Carex radiata	Stellate Sedge	N S4
Carex retrorsa	Retrorse Sedge	N S5 RK
Carex richardsonii	Richardson Sedge	N S4?
Carex rosea	Rosy Sedge	N S5
Carex sartwellii	Sartwell's Sedge	N S4 RK
Carex sparganioides	Bur-reed Sedge	N S5
Carex stipata	Awl-fruited Sedge	N S5
Carex stricta	Tussock Sedge	N S5

SCIENTIFIC NAME	COMMON NAME	STATUS
Carex tetanica	Rigid Sedge	N S3 RK
Carex umbellata	Umbellate Sedge	N S5 RK
Carex viridula ssp. *viridula*	Greenish Sedge	N S5 RK
Carex vulpinoidea	Fox Sedge	N S5
Cladium mariscoides	Twig Rush	N S5
Cyperus bipartitus	Shining Cyperus	N S5
Cyperus diandrus	Low Sedge	N S4 RK
Cyperus erythrorhizos	Red-rooted Cyperus	N S4
Cyperus flavescens	Yellow Cyperus	N S2 RK
Cyperus lupulinus	Slender-stemmed Cyperus	N S4 RK
Cyperus odoratus	Coarse Cyperus	N S5
Cyperus strigosus	Straw-colored Cyperus	N S5
Dulichium arundinaceum	Three-way Sedge	N S5
Eleocharis acicularis	Needle Spike-rush	N S5
Eleocharis geniculata	Bent Spike-rush	N S1 RK END
Eleocharis elliptica	Elliptic Spike-rush	N S5
Eleocharis erythropoda	Red-based Spike-rush	N S5
Eleocharis intermedia	Intermediate Spike-rush	N S4 RK
Eleocharis obtusa	Blunt Spike-rush	N S5
Eleocharis quadrangulata	Square-stemmed Spike-rush	N S1 RK
Eleocharis ovata	Ovate Spike-rush	N S5
Eleocharis smallii	Small's Spike-rush	N S5
Schoenoplectus acutus	Hardstem Bulrush (Club-rush)	N S5 RK
Schoenoplectus fluviatilis	River Club-rush	N S4S5 RK

SCIENTIFIC NAME	COMMON NAME	STATUS
Schoenoplectus tabernaemontani	Soft-stem Bulrush (Club-rush)	N S5
Schoenoplectus pungens	Three-square	N S5
Schoenoplectus smithii	Smith's Club-rush	N S3 RK
Scirpus atrovirens	Dark Green Bulrush	N S5
Scirpus cyperinus	Wool-grass	N S5
Scirpus microcarpus	Red-sheathed Bulrush	N S5 RK
Scirpus pendulus	Nodding Bulrush	N S5
DIOSCOREACEAE	YAM FAMILY	
Dioscorea quaternata	Wild Yam Root	N S4
HYDROCHARITACEAE	FROG'S-BIT FAMILY	
Elodea canadensis	Canada Water-weed	N S5
Elodea nuttallii	Nuttall's Water-weed	N S3 RK
Hydrocharis morsus-ranae	Frog's-bit	I SNA
Vallisneria americana	Water Celery	N S5
IRIDACEAE	IRIS FAMILY	
Iris pseudacorus	Yellow-flag	I SNA
Iris versicolor	Wild Blue-flag Iris	N S5
Iris virginica	Southern Blue-flag Iris	N S5
Sisyrinchium angustifolium	Narrow-leaved Blue-eyed Grass	N S4 RK
Sisyrinchium montanum	Little Blue-eyed Grass	N S5
JUNCACEAE	RUSH FAMILY	
Juncus alpinoarticulatus	Alpine Rush	N S5 RK
Juncus balticus	Baltic Rush	N S5
Juncus brachycephalus	Short-headed Rush	N S5

SCIENTIFIC NAME	COMMON NAME	STATUS
Juncus bufonius	Toad Rush	N S5
Juncus canadensis	Canadian Rush	N S5 RK
Juncus dudleyi	Dudley's Rush	N S5
Juncus nodosus	Knotted Rush	N S5
Juncus tenuis	Path Rush	N S5
Juncus torreyi	Torrey's Rush	N S5
LEMNACEAE	DUCKWEED FAMILY	
Lemna minor	Common Duckweed	N S5
Lemna trisulca	Star Duckweed	N S5 RK
Spirodela polyrhiza	Greater Duckweed	N S5
Wolffia borealis	Dotted Watermeal	N S4S5 RK
Wolffia columbiana	Columbia (Common) Watermeal	N S4S5 RK
LILIACEAE	LILY FAMILY	
Allium tricoccum	Wild Leek	N S5
Asparagus officinalis	Wild Asparagus	I SNA
Belamcanda chinensis	Blackberry-lily	I SNA
Convallaria majalis	Lily-of-the-valley	I SNA
Prosartes lanuginosa	Yellow Mandarin	N S4
Erythronium americanum	Yellow Trout Lily	N S5
Hemerocallis fulva	Orange Day-lily	I SNA
Hypoxis hirsuta	Yellow Stargrass	N S3 RK
Lilium lancifolium	Tiger Lily	I SNA
Lilium michiganense.	Michigan Lily	N S5
Lilium philadelphicum	Wood Lily	N S5 RK
Maianthemum canadense	Canada Mayflower	N S5

SCIENTIFIC NAME	COMMON NAME	STATUS
Maianthemum racemosum	False Solomon's-seal	N S5
Maianthemum stellatum	Starry False Solomon's-seal	N S5
Medeola virginiana	Indian Cucumber-root	N S5 RK
Ornithogalum umbellatum	Star-of-Bethlehem	I SNA
Polygonatum biflorum	Smooth Solomon's-seal	N S4
Polygonatum pubescens	Hairy Solomon's-seal	N S5
Trillium erectum	Red Trillium	N S5
Trillium grandiflorum	White Trillium	N S5
Uvularia grandiflora	Large-flowered Bellwort	N S5
Yucca filamentosa	Yucca	I SNA
NAJADACEAE	NAIAD FAMILY	
Najas flexilis	Bushy Naiad	N S5
Najas gracillima	Thread-like Naiad	N S2 RK
Najas minor	Naiad	I SNA
Najas quadalupensis	Southern Naiad	N S3
OPHIOGLOSSACEAE	ADDER'S-TONGUE FAMILY	
Botrychium dissectum	Cut-leaved Grape Fern	N S5
Botrychium matricarifolium	Matricary Grape Fern	N S4S5 RK
Botrychium multifidum	Leather-leaved Grape Fern	N S5 RK
Botrychium virginianum	Rattlesnake Fern	N S5
Ophioglossum pusillum	Common Adder's-tongue	N S4S5 RK
ORCHIDACEAE	ORCHID FAMILY	
Aplectrum hyemale	Putty-root	N S2 RK
Calopogon tuberosus	Tuberous Grass-pink	N S4S5 RK
Corallorhiza maculata	Spotted Coral-root	N S5 RK

SCIENTIFIC NAME	COMMON NAME	STATUS
Corallorhiza odontorhiza	Autumn Coral-root	N S2 RK
Cypripedium parviflorum ssp. *makasin*	Small Yellow Lady's-slipper	N S4S5 RK
Cypripedium parviflorum ssp. *pubescens*	Large Yellow Lady's-slipper	N S5 RK
Epipactis helleborine	Helleborine	I SNA
Galearis spectabilis	Showy Orchis	N S4 RK
Goodyera pubescens	Downy Rattlesnake-plantain	N S4 RK
Liparis loeselii	Loesel's Twayblade	N S4S5 RK
Platanthera clavellata	Small Green Wood Orchis	N S4S5 RK
Platanthera flava var. *herbiola*	Tubercled Orchid	N S3 RK
Platanthera hookeri	Hooker's Orchid	N S3 RK
Platanthera huronensis	Tall Northern Green Orchid	N SU RK
Platanthera lacera	Ragged Fringed Orchid	N S4S5 RK
Platanthera orbiculata	Large Round-leaved Orchid	N S4S5 RK
Platanthera psycodes	Purple Fringed Orchid	N S5 RK
Spiranthes cernua	Nodding Ladies'-tresses	N S5
Spiranthes lucida	Shining Ladies'-tresses	N S4 RK
Spiranthes magnicamporum	Great Plain's Ladies'-tresses	N S3? RK
Triphora trianthophora	Nodding Pogonia	N S1 RK END
POACEAE (GRAMINEAE)	GRASS FAMILY	
Agrostis gigantea	Red Top	I SNA
Agrostis perennans	Upland Bent-grass	N S5
Agrostis scabra	Ticklegrass	N S5
Alopecurus aequalis	Short-leaved Foxtail	N S5 RK
Ammophila breviligulata	Sand-reed (Beach Grass)	N S4 RK
Andropogon gerardii	Big Bluestem	N S4

SCIENTIFIC NAME	COMMON NAME	STATUS
Anthoxanthum odoratum ssp. *odoratum*	Sweet Vernal Grass	I SNA
Brachyelytrum erectum	Bearded Shorthusk	N S4? RK
Bromus ciliatus	Fringed Brome Grass	N S5
Bromus kalmii	Kalm's Brome Grass	N S4
Bromus inermis	Smooth Brome Grass	I SNA
Bromus X pseudothominii		I SNA
Bromus pubescens	Canada Brome Grass	N S4
Bromus tectorum	Cheatgrass	I SNA
Calamagrostis canadensis	Canada Blue-joint	N S5
Calamovilfa longifolia var. *magna*	Great Lakes Sand Reed	N S3 RK
Cenchrus longispinus	Long-spined Sandbur	N S4 RK
Cinna arundinacea	Stout Wood Reed	N S4
Cinna latifolia	Drooping Woodreed	N S5 RK
Dactylis glomerata	Orchard Grass	I SNA
Danthonia spicata	Poverty Oat Grass	N S5
Digitaria ischaemum	Small Crabgrass	I SNA
Digitaria sanguinalis	Large Crab-Grass	I SNA
Dichanthelium acuminatum	Woolly Panic Grass	N S5
Dichanthelium latifolium	Broadleaf Panic Grass	N S4
Dichanthelium oligosanthes	Few-flowered Panic Grass	N S4
Echinochloa crus-galli	Barnyard Grass	I SNA
Echinochloa muricata var. *microstachya*	Barnyard Grass	N S4S5 RK
Echinochloa walteri	Coast Barnyard Grass	N S3
Elymus canadensis	Canada Wild Rye	N S4S5
Elymus hystrix	Bottlebrush Grass	N S5

SCIENTIFIC NAME	COMMON NAME	STATUS
Elymus repens	Quack Grass	I SNA
Elymus riparius	River Bank Wild Rye	N S4? RK
Elymus villosus	Slender Wild Rye	N S4
Elymus virginicus	Virginia Wild Rye	N S5
Eragrostis frankii	Frank's Love Grass	N S4
Eragrostis hypnoides	Moss-like Love Grass	N S4 RK
Eragrostis minor	Little Love Grass	I SNA
Eragrostis pectinacea	Small Tufted Love Grass	N S5
Festuca subverticillata	Nodding Fescue	N S4
Festuca trachyphylla	Hard Fescue	I SNA
Glyceria borealis	Northern Manna Grass	N S5 RK
Glyceria septentrionalis	Eastern Manna Grass	N S4 RK
Glyceria striata	Fowl Manna Grass	N S4S5
Hesperostipa spartea	Porcupine Grass	N S4 RK
Hordeum jubatum ssp. *intermedium*	Foxtail Barley	I SNA
Leersia oryzoides	Rice Cut-Grass	N S5
Leersia virginica	White Grass	N S4
Lolium arundinaceum	Tall Fescue	I SNA
Lolium pratense	Meadow Fescue	I SNA
Millium effusum	Millet Grass	N S4S5
Muhlenbergia frondosa	Wire-stemmed Muhly	N S4
Muhlenbergia mexicana	Mexican Muhly	N S5
Muhlenbergia schreberi	Nimble Will	N S4
Muhlenbergia sylvatica	Woodland Muhly	N S2 RK
Muhlenbergia tenuiflora	Slim-flowered Muhly	N S2

SCIENTIFIC NAME	COMMON NAME	STATUS
Oryzopsis asperifolia	Rough-leaved Mountain-rice	N S5 RK
Panicum capillare	Witch Grass	N S5
Panicum dichotomiflorum	Fall Panic Grass	I SNA
Panicum tuckermanii	Tuckerman's Witch Grass	N S4 RK
Panicum virgatum	Switch Grass	N S4
Paspalum setaceum	Slender Paspalum	N S2 RK
Phalaris arundinacea	Reed Canary Grass	N S5
Phleum pratense	Timothy	I SNA
Phragmites australis ssp. *americanus*	Common Reed	N S4?
Phragmites australis ssp. *australis*	Common Reed	I SNA
Piptatherum racemosa	Black-fruit Mountain-ricegrass	N S4 RK
Poa alsodes	Woodland Poa	N S4 RK
Poa annua	Annual Bluegrass	I SNA
Poa bulbosa	Bulbous Bluegrass	I SNA
Poa compressa	Canada Bluegrass	I SNA
Poa pratensis ssp. *pratensis*	Kentucky Bluegrass	N S5
Poa saltuensis ssp. *languida*	Weak Bluegrass	N S3 RK
Poa sylvestris	Woodland Bluegrass	N S1 RK
Poa trivialis	Rough Bluegrass	I SNA
Puccinella distans	Reflexed Saltmarsh Grass	I SNA
Schizachyrium scoparium	Little Bluestem	N S4
Setaria pumila	Yellow/White Foxtail	I SNA
Setaria viridis	Green Foxtail	I SNA
Sorghastrum nutans	Indian Grass	N S4
Spartina pectinata	Tall Cord Grass	N S4

SCIENTIFIC NAME	COMMON NAME	STATUS
Sphenopholis intermedia	Slender Wedge Grass	N S4S5
Sphenopholis obtusata	Prairie Wedge Grass	N S1 RK
Sporobolus cryptandrus	Sand Dropseed	N S4
Sporobolus neglectus	Overlooked Dropseed	N S4 RK
Sporobolus vaginiflorus var. *vaginiflorus*	Ensheathed Dropseed	N S5
Triplasis purpurea	Sand Grass	N S4? RK
Zizania aquatica	Indian (Southern) Wild Rice	N S3 RK
PONTEDERIACEAE	PICKEREL-WEED FAMILY	
Heteranthera dubia	Water Stargrass	N S5
Pontederia cordata	Pickerel-weed	N S5
POTAMOGETONACEAE	PONDWEED FAMILY	
Potamogeton amplifolius	Large-leaved Pondweed	N S5 RK
Potamogeton crispus	Curly Pondweed	I SNA
Potamogeton filiformis	Pondweed	N S5 RK
Potamogeton foliosus	Leafy Pondweed	N S5 RK
Potamogeton gramineus	Variable-leaved Pondweed	N S5 RK
Potamogeton illinoensis	Illinois Pondweed	N S4 RK
Potamogeton natans	Floating Pondweed	N S5
Potamogeton nodosus	Knotty Pondweed	N S5 RK
Potamogeton pectinatus	Sago Pondweed	N S5
Potamogeton perfoliatus	Perfoliate (Clasping-leaved) Pondweed	N S4 RK
Potamogeton praelongus	White-stem Pondweed	N S4S5 RK
Potamogeton pulcher	Spotted Pondweed	N SH RK
Potamogeton richardsonii	Richardson's Pondweed	N S5 RK
Potamogeton strictifolius	Slender Pondweed	N S4 RK

SCIENTIFIC NAME	COMMON NAME	STATUS
Potamogeton zosteriformis	Flat-stem Pondweed	N S5 RK
SMILACACEAE	SMILAX FAMILY	
Smilax ecirrhata	Upright Carrion Flower	N S3? RK
Smilax herbacea	Carrion Flower	N S4 RK
Smilax lasioneura	Carrion Flower	N S4
Smilax tamnoides	Bristly (Hispid) Greenbrier	N S4
SPARGANIACEAE	BUR-REED FAMILY	
Sparganium emersum ssp. *emersum*	Green-fruited Bur-reed	N S5 RK
Sparganium eurycarpum	Giant Bur-reed	N S5
Sparganium natans	Small Bur-reed	N S5 RK
TYPHACEAE	CATTAIL FAMILY	
Typha angustifolia	Narrow-leaved Cattail	I SNA
Typha latifolia	Broad-leaved Cattail	N S5
DICOTYLEDONEAE	DICOTS	
ACANTHACEAE	WATER-WILLOW FAMILY	
Justicia americana	American Water-willow	N S1 RK THR
ACERACEAE	MAPLE FAMILY	
Acer negundo	Manitoba Maple	N S5
Acer nigrum	Black Maple	N S4?
Acer platanoides	Norway Maple	I SNA
Acer rubrum	Red Maple	N S5
Acer saccharinum	Silver Maple	N S5
Acer saccharum	Sugar Maple	N S5
Acer x freemanii	(Freeman's) Swamp Maple	N SNR

SCIENTIFIC NAME	COMMON NAME	STATUS
AMARANTHACEAE	AMARANTH FAMILY	
Amaranthus albus	Tumbling Pigweed	I SNA
Amaranthus blitoides	Prostrate Pigweed	I SNA
Amaranthus cruentus	Pigweed	I SNA
Amaranthus retroflexus	Redroot Pigweed	I SNA
ANACARDIACEAE	CASHEW FAMILY	
Rhus aromatica	Fragrant Sumac	N S5 RK
Rhus typhina	Staghorn Sumac	N S5
Toxicodendron radicans	Western Poison Ivy	N S5
Toxicodendron vernix	Poison Sumac	N S4 RK
APIACEAE (UMBELLIFERAE)	PARSLEY FAMILY	
Cicuta bulbifera	Bulb-bearing Water Hemlock	N S5
Cicuta maculata	Spotted Cowbane	N S5
Cryptotaenia canadensis	Honewort	N S5
Daucus carota	Wild Carrot (Queen Anne's Lace)	I SNA
Osmorhiza claytonii	Sweet Cicely	N S5
Sanicula odorata	Yellow Snakeroot	N S5
Sanicula marilandica	Black Snakeroot	N S5 RK
Sanicula trifoliata	Large-fruited Snakeroot	N S4
Sium suave	Water Parsnip	N S5
Taenidia integerrima	Yellow Pimpernel	N S4
Thaspium chapmanii	Chapman's Meadow-parsnip	N S2
Zizia aurea	Golden Alexanders	N S5 RK
APOCYNACEAE	DOGBANE FAMILY	
Apocynum androsaemifolium	Spreading Dogbane	N S5

SCIENTIFIC NAME	COMMON NAME	STATUS
Apocynum cannabinum	Indian Hemp	N S5
Apocynum sibiricum	Clasping-leaved Dogbane	N S4?
Vinca minor	Periwinkle	I SNA
AQUIFOLIACEAE	HOLLY FAMILY	
Ilex verticillata	Common Winterberry	N S5
ARALIACEAE	GINSENG FAMILY	
Aralia nudicaulis	Wild Sarsaparilla	N S5
Aralia racemosa ssp. *racemosa*	Spikenard	N S5 RK
Panax quinquefolius	American Ginseng	N S2 END
ASCLEPIADACEAE	MILKWEED FAMILY	
Asclepias exaltata	Poke Milkweed	N S4 RK
Asclepias incarnata ssp. *incarnata*	Swamp Milkweed	N S5
Asclepias purpurascens	Purple Milkweed	N S2 RK
Asclepias syriaca	Common Milkweed	N S5
Asclepias tuberosa	Butterfly Weed	N S4
Asclepias verticillata	Whorled Milkweed	N S4 RK
Asclepias viridiflora	Green Milkweed	N S2 RK
ASTERACEAE (COMPOSITAE)	COMPOSITE FAMILY	
Achillea millefolium ssp. *lanulosa*	Wolly Yarrow	N S5
Ambrosia artemesiifolia	Common Ragweed	N S5
Ambrosia trifida	Giant Ragweed	N S5
Antennaria howellii	Pussytoes	N S5
Antennaria parlinii	Plantain-leaved Pussytoes	N S5
Anthemis cotula	Stinking Mayweed	I SNA
Arctium lappa	Great Burdock	I SNA

SCIENTIFIC NAME	COMMON NAME	STATUS
Arctium minus	Common Burdock	I SNA
Ageratina altissima var. *altissima*	White Snakeroot	N S5
Artemisia biennis	Biennial Wormwood	I SNA
Artemisia campestris ssp. *caudata*	Sagewort (Beach) Wormwood	N S4S5 RK
Eurybia macrophylla	Large-leaved Wood-aster	N S5
Bidens cernua	Nodding Beggarticks	N S5
Bidens frondosa	Devil's Beggarticks	N S5
Bidens trichosperma	Southern Tickseed	N S2
Bidens tripartita	Beggarticks	N S5
Centaurea stoebe ssp. *micranthos*	Spotted Knapweed	I SNA
Cichorium intybus	Chicory	I SNA
Cirsium arvense	Canada Thistle	I SNA
Cirsium muticum	Swamp Thistle	N S5 RK
Cirsium vulgare	Bull Thistle	I SNA
Conyza canadensis	Horseweed, Fleabane	N S5
Coreopsis lanceolata	Lance-leaved Coreopsis	N S4? RK
Erechtites hieracifolia	Fireweed	N S5
Erigeron annuus	Daisy Fleabane	N S5
Erigeron philadelphicus	Philadelphia Fleabane	N S5
Erigeron pulchellus	Robin's-plantain	N S5
Erigeron strigosus	Narrow-leaved Fleabane	N S5
Eupatorium coelestinum	Mistflower	I SNA
Eupatorium maculatum	Spotted Joe-Pye-Weed	N S5
Eupatorium perfoliatum	Boneset	N S5
Eupatorium purpureum	Sweet Joe-Pye-Weed	N S4

SCIENTIFIC NAME	COMMON NAME	STATUS
Euthamia graminifolia	Grass-leaved Goldenrod	N S5
Galinsoga quadriradiata	Hairy Galinsoga	I SNA
Gnaphalium obtusifolium	Fragrant Cudweed	N S5 RK
Helianthus annuus	Common Sunflower	I SNA
Helianthus decapetalus	Thin-leaved Sunflower	N S5 RK
Helianthus divaricatus	Woodland Sunflower	N S5 RK
Helianthus strumosus	Pale-leaved Sunflower	N S5 RK
Heliopsis helianthoides var. *helianthoides*	False Sunflower	N S5
Hieracium aurantiacum	Devil's Paintbrush	I SNA
Hieracium piloselloides	King Devil	I SNA
Lactuca canadensis	Wild Lettuce	N S5
Lactuca serriola	Prickly Lettuce	I SNA
Leucanthemum vulgare	Oxeye Daisy	I SNA
Liatris aspera	Rough (Tall) Blazing-star	N S2 RK
Liatris cylindracea	Cylindrical (Slender) Blazing-star	N S3 RK
Matricaria matricarioides	Pineapple Weed	I SNA
Prenanthes alba	White Lettuce (Rattlesnake-root)	N S5
Prenanthes altissima	Tall White Lettuce (Rattlesnake-root)	N S5 RK
Prenanthes racemosa	Smooth White Lettuce	N SU RK
Rudbeckia hirta	Black-eyed Susan	N S5
Rudbeckia triloba	Thin-leaved Coneflower	I SNA
Packera aurea	Golden Ragwort	N S5 RK
Packera paupercula	Balsam Ragwort	N S5 RK

SCIENTIFIC NAME	COMMON NAME	STATUS
Solidago altissima var. *altissima*	Late Goldenrod	N S5
Solidago bicolor	Silverrod	N S4? RK
Solidago caesia	Blue-stem Goldenrod	N S5
Solidago canadensis	Canada Goldenrod	N S5
Solidago flexicaulis	Zig-zag Goldenrod	N S5 RK
Solidago gigantea	Giant Goldenrod	N S5
Solidago hispida	Hairy Goldenrod	N S5 RK
Solidago nemoralis	Gray Goldenrod	N S5
Solidago riddellii	Riddell's Goldenrod	N S3 RK SC
Solidago rugosa ssp. *rugosa*	Rough Goldenrod	N S5
Sonchus arvensis ssp. *arvensis*	Perennial Sow-thistle	I SNA
Sonchus arvensis ssp. *uliginosus*	Smooth Perennial Sow-thistle	I SNA
Sonchus asper	Spiny-leaved Sow-thistle	I SNA
Sonchus oleraceus	Annual Sow-thistle	I SNA
Symphyotrichum cordifolium	Heart-leaved Aster	N S5
Symphyotrichum dumosum var *strictior*	Bushy Aster	N S2 RK
Symphyotrichum ericoides	Heath Aster	N S5
Symphyotrichum laeve	Smooth Aster	N S5 RK
Symphyotrichum lanceolatum ssp. lanceolatum	Panicled Aster	N S5
Symphyotrichum lateriflorum	Calico Aster	N S5
Symphyotrichum novae-angliae	New England Aster	N S5
Symphyotrichum oolentangiense	Azure Aster	N S5 RK
Symphyotrichum pilosum	Hairy Aster	N S4
Symphyotrichum praealtum	Willowleaf Aster	N S2 RK

SCIENTIFIC NAME	COMMON NAME	STATUS
		THR
Symphyotrichum urophyllum	Arrow-leaved Aster	N S4 RK
Taraxacum erythrospermum	A Dandelion	I SNA
Taraxacum officinale	Common Dandelion	I SNA
Taraxacum palustre	Marsh Dandelion	I SNA
Tragopogon dubius	Doubtful Goat's-beard	I SNA
Tragopogon pratensis ssp. pratensis	Meadow Goat's Beard	I SNA
Tussilago farfara	Coltsfoot	I SNA
Verbesina alternifolia	Wingstem	N S3
Xanthium strumarium	Cocklebur	N S5
BALSAMINACEAE	TOUCH-ME-NOT FAMILY	
Impatiens capensis	Spotted Jewelweed	N S5
Impatiens pallida	Pale Jewelweed	N S5
BERBERIDACEAE	BARBERRY FAMILY	
Berberis thunbergii	Japanese Barberry	I SNA
Podophyllum peltatum	Mayapple	N S5
BETULACEAE	BIRCH/HAZEL FAMILY	
Betula alleghaniensis	Yellow Birch	N S5
Betula papyrifera	White Birch	N S5
Betula pendula	European White Birch	I SNA
Carpinus caroliniana	Blue Beech, Ironwood	N S5
Corylus americana	American Hazel	N S5
Ostrya virginiana	Hop Hornbeam, Ironwood	N S5
BIGNONIACEAE	CATALPA FAMILY	
Catalpa speciosa	Northern Catalpa	I SNA

SCIENTIFIC NAME	COMMON NAME	STATUS
BORAGINACEAE	BORAGE FAMILY	
Buglossoides arvensis	Corn Gromwell	I SNA
Cynoglossum officinale	Common Hound's-tongue	I SNA
Echium vulgare	Viper's-bugloss	I SNA
Hackelia virginiana	Stickseed	N S5 RK
Lithospermum caroliniense	Golden (Hoary) Puccoon	N S3 RK
Lithospermum latifolium	American Gromwell	N S3 RK
Myosotis laxa	Smaller Forget-me-not	N S5 RK
Myosotis scorpioides	True Forget-me-not	I SNA
Myosotis stricta	Forget-me-not	I SNA
BRASSICACEAE (CRUCIFERAE)	MUSTARD FAMILY	
Alliaria petiolata	Garlic Mustard	I SNA
Alyssum alyssoides	Yellow Alyssum	I SNA
Alyssum murale	Yellow-tuft	I SNA
Arabis canadensis	Sickle-pod	N S4 RK
Arabis hirsuta ssp. *pycnocarpa*	Hairy Rock-cress	N S5 RK
Arabis laevigata	Smooth Rock-cress	N S5 RK
Arabis lyrata	Lyre-leaved Rock-cress	N S4 RK
Armoracia rusticana	Horseradish	I SNA
Barbarea verna	Early Winter Cress	I SNA
Barbarea vulgaris	Yellow Rocket	I SNA
Berteroa incana	Hoary Alyssum	I SNA
Brassica nigra	Black Mustard	I SNA
Cakile edentula	Sea Rocket	N S4 RK
Camelina microcarpa	Small-seeded False Flax	I SNA

SCIENTIFIC NAME	COMMON NAME	STATUS
Capsella bursa-pastoris	Shepherd's Purse	I SNA
Cardamine bulbosa	Spring Cress	N S4
Cardamine concatenata	Cut-leaved Toothwort	N S5
Cardamine diphylla	Two-leaved Toothwort	N S5
Cardamine douglassii	Purple Spring Cress	N S4
Cardamine hirsuta	Hairy Bitter-cress	I SNA
Cardamine pensylvanica	Pennsylvania Bitter-cress	N S5 RK
Cardamine pratensis	Cuckooflower	N S5 RK
Diplotaxis muralis	Wall Rocket	I SNA
Diplotaxis tenuifolia	Narrow-leaved Wall Rocket	I SNA
Draba reptans	Carolina Whitlow-grass	N S3 RK
Draba verna	Whitlow-grass	I SNA
Erysimum cheiranthoides	Wormseed Mustard	I SNA
Hesperis matronalis	Dame's Rocket	I SNA
Lepidium campestre	Field Cress	I SNA
Lepidium ruderale	Pepper-grass	I SNA
Lepidium virginicum	Poorman's Pepper-grass	N S5
Rorippa palustris	Marsh Yellow Cress	N S5
Sinapis arvensis	Charlock	I SNA
Sisymbrium altissimum	Tumble Mustard	I SNA
Thlaspi arvense	Penny Cress	I SNA
CABOMBACEAE	WATER-SHIELD FAMILY	
Brasenia schreberi	Water-shield	N S5 RK
CACTACEAE	CACTUS FAMILY	
Opuntia humifusa	Eastern Prickly Pear Cactus	I (Rondeau) S1 (END)

SCIENTIFIC NAME	COMMON NAME	STATUS
CAMPANULACEAE	BLUEBELL FAMILY	
Campanula aparinoides	Marsh Bellflower	N S5 RK
Campanula persicifolia	Peach-leaved Bellflower	I SNA*
Campanula rapunculoides	Creeping Bellflower	I SNA
Campanulastrum americanum	Tall Bellflower	N S4
Lobelia cardinalis	Cardinal Flower	N S5
Lobelia inflata	Indian Tobacco	N S5
Lobelia siphilitica	Great Lobelia	N S5
Lobelia spicata	Pale-spike Lobelia	N S4 RK
CAPPARIDACEAE	CAPER FAMILY	
Polanisia dodecandra var. *dodecandra*	Clammyweed	N S4 RK
CAPRIFOLIACEAE	HONEYSUCKLE FAMILY	
Lonicera x bella	Hybrid Honeysuckle	I SNA
Lonicera dioica	Glaucous Honeysuckle	N S5
Lonicera japonica	Japanese Honeysuckle	I SNA
Lonicera maackii	Amur Honeysuckle	I SNA
Lonicera morrowii	Morrow Honeysuckle	I SNA
Lonicera tatarica	Tartarian Honeysuckle	I SNA
Sambucus nigra ssp. *canadensis*	Common Elderberry	N S5
Sambucus racemosa	Red-berried Elder	N S5 RK
Symphoricarpos albus	Snowberry	N S4S5 RK
Triosteum aurantiacum	Wild Coffee	N S5 RK
Viburnum acerifolium	Maple-leaved Viburnum	N S5
Viburnum nudum var. *cassinoides*	Wild Raisin	N S5 RK
Viburnum lantana	Wayfaring Tree	I SNA

SCIENTIFIC NAME	COMMON NAME	STATUS
Viburnum lentago	Nannyberry	N S5
Viburnum opulus	European Highbush Cranberry	I SNA
Viburnum plicatum	Japanese Snowball	I SNA*
Viburnum rafinesquianum	Downy Arrow-wood	N S5
CARYOPYHLLACEAE	PINK FAMILY	
Arenaria serpyllifolia	Thyme-leaved Sandwort	I SNA
Cerastium fontanum ssp. *triviale*	Mouse-eared Chickweed	I SNA
Cerastium semidecandrum	Spring Mouse-eared Chickweed	I SNA
Holosteum umbellatum	Jagged Chickweed	I SNA
Minuartia michauxii	Rock Sandwort	N S5 RK
Moehringia lateriflora	Grove Sandwort	N S5 RK
Petrorhagia saxifraga	Saxifrage Pink	I SNA
Saponaria officinalis	Bouncing Bet	I SNA
Silene antirrhina	Sleepy Catchfly	N S5
Silene armeria	Sweet William Catchfly	I SNA
Silene latifolia	White Cockle	I SNA
Silene noctiflora	Night-flowering Catchfly	I SNA
Silene vulgaris	Bladder Campion	I SNA
Stellaria longifolia	Long-leaved Chickweed	N S5
Stellaria media	Common Chickweed	I SNA
CELASTRACEAE	STAFF-TREE FAMILY	
Celastrus orbiculata	Oriental Bitter-sweet	I SNA
Celastrus scandens	Climbing Bitter-sweet	N S5
Euonymus alata	Winged Spindle-tree	I SNA

SCIENTIFIC NAME	COMMON NAME	STATUS
Euonymus obovata	Running Strawberry-bush	N S5
CERATOPHYLLACEAE	HORNWORT FAMILY	
Ceratophyllum demersum	Common Coontail	N S5
CHENOPODIACEAE	GOOSEFOOT FAMILY	
Chenopodium album var. *album*	Lamb's-quarters	I SNA
Chenopodium bonus-henricus	Good King Henry	I SNA
Chenopodium salinum	Oak-leaved Goosefoot	N S4
Chenopodium simplex	Maple-leaved Goosefoot	N S5 RK
Corispermum pallassii	Bug-seed	N S1S3 RK
Cycloloma atriplicifolium	Winged Pigweed	N S4
Salsola kali ssp. *ruthenica*	Russian Thistle	I SNA
CISTACEAE	ROCK ROSE FAMILY	
Lechea mucronata	Hairy Pinweed	N S3 RK
CLUSIACEAE	ST. JOHN'S-WORT FAMILY	
Hypericum kalmianum	Kalm's St. John's-wort	N S4 RK
Hypericum mutilum ssp. *boreale*	Northern St. John's-wort	N S5 RK
Hypericum perforatum	Common St. John's-wort	I SNA
Hypericum prolificum	Shrubby St. John's-wort	N S2 RK
Hypericum punctatum	Spotted St. John's-wort	N S5
Triadenum fraseri	Fraser's (Marsh) St. John's-wort	N S5 RK
CONVOLVULACEAE	MORNING-GLORY FAMILY	
Calystegia sepium	Hedge Bindweed	N S5
Convolvulus arvensis	Field Bindweed	I SNA
Cuscuta gronovii	Common Dodder	N S5
CORNACEAE	DOGWOOD FAMILY	

SCIENTIFIC NAME	COMMON NAME	STATUS
Cornus alternifolia	Alternate-leaved Dogwood	N S5 RK
Cornus amomum ssp. *obliqua*	Silky Dogwood	N S5
Cornus drummondii	Rough-leaved Dogwood	N S4 RK
Cornus florida	Flowering Dogwood	N S2? RK END
Cornus foemina ssp. *racemosa*	Gray Dogwood	N
Cornus rugosa	Round-leaved Dogwood	N S5 RK
Cornus sericea	Red-osier Dogwood	N S5
CRASSULACEAE	ORPINE FAMILY	
Sedum acre	Mossy Stonecrop	I SNA
Sedum telephioides ssp. *fabaria*	Live-forever	I SNA
Sedum ternatum	Wild Live-forever	I SNA
CUCURBITACEAE	GOURD FAMILY	
Sicyos angulatus	One-seeded Bur Cucumber	N S5 RK
Thladiantha dubia	Bur Cucumber	I SNA
DIPSACACEAE	TEASEL FAMILY	
Dipsacus fullonum ssp. *sylvestris*	Teasel	I SNA
ELAEAGNACEAE	OLEASTER FAMILY	
Elaeagnus angustifolia	Russian Olive	I SNA
Elaeagnus umbellata	Autumn Olive	I SNA
Shepherdia canadensis	Buffalo Berry	N S5 RK
ERICACEAE	HEATH FAMILY	
Arctostaphylos uva-ursi	Bearberry	N S5 RK
Gaylussacia baccata	Black Huckleberry	N S4 RK
Vaccinium corymbosum	Highbush Blueberry	N S4
EUPHORBIACEAE	SPURGE FAMILY	

SCIENTIFIC NAME	COMMON NAME	STATUS
Acalypha virginica	Three-seeded Mercury	N S5
Chamaesyce maculata	Hairy-fruited Spurge	I SNA
Chamaesyce polygonifolia	Seaside Spurge	N S4 RK
Euphorbia corollata	Flowering Spurge	N S4 RK
Euphorbia cyparissias	Cypress Spurge	I SNA
FABACEAE (LEGUMINOSAE)	LEGUME FAMILY	
Amphicarpaea bracteata	Hog-peanut	N S5
Apios americana	Groundnut	N S5
Astragalus canadensis	Canada Milk-vetch	N S4 RK
Coronilla varia	Common Crown-vetch	I SNA
Desmodium canadense	Canada Tick Trefoil	N S4
Desmodium canescens	Hoary Tick Trefoil	N S2 RK
Desmodium glutinosum	Pointed-leaved Tick Trefoil	N S4 RK
Desmodium nudiflorum	Naked-flowered Tick Trefoil	N S4 RK
Desmodium paniculatum var. *dillenii*	Tick Trefoil	N S4 RK
Gleditsia triacanthos	Honey-locust	I S2
Lathyrus japonicus	Beach Pea	N S4 RK
Lathyrus latifolius	Everlasting Pea	I SNA
Lathyrus ochroleucus	Pale Vetchling	N S4 RK
Lathyrus palustris	Marsh Vetchling	N S5 RK
Lespedeza capitata	Round-headed Bush-clover	N S4
Lotus corniculatus	Bird's-foot Trefoil	I SNA
Medicago lupulina	Black Medick	I SNA
Medicago sativa ssp. *sativa*	Alfalfa	I SNA
Melilotus alba	White Sweet Clover	I SNA

SCIENTIFIC NAME	COMMON NAME	STATUS
Melilotus officinalis	Yellow Sweet Clover	I SNA
Robinia pseudo-acacia	Black Locust	I SNA
Strophostyles helvula	Trailing Wild Bean	N S4 RK
Trifolium aureum	Hop Clover	I SNA
Trifolium hybridum ssp. *elegans*	Alsike Clover	I SNA
Trifolium pratense	Red Clover	I SNA
Trifolium repens	White Clover	I SNA
Vicia sativa ssp. *nigra*	Common Vetch	I SNA
FAGACEAE	BEECH FAMILY	
Fagus grandifolia	American Beech	N S4
Quercus alba	White Oak	N S5
Quercus bicolor	Swamp White Oak	N S4
Quercus macrocarpa	Bur Oak	N S5
Quercus muehlenbergii	Chinquapin Oak	N S4 RK
Quercus rubra	Red Oak	N S5
Quercus shumardii	Shumard's Oak	N S3 SC
Quercus velutina	Black Oak	N S4
FUMARIACEAE	FUMITORY FAMILY	
Adlumia fungosa	Climbing Fumitory	N S4 RK
Dicentra canadensis	Squirrel-corn	N S5 RK
Dicentra cucullaria	Dutchman's-breeches	N S5
GENTIANACEAE	GENTIAN FAMILY	
Centaurium pulchellum	Beautiful Centaury	I SNA
Gentiana andrewsii	Closed Gentian	N S4
Gentianopsis crinita	Fringed Gentian	N S5 RK

SCIENTIFIC NAME	COMMON NAME	STATUS
GERANIACEAE	GERANIUM FAMILY	
Geranium maculatum	Wild Geranium	N S5
Geranium robertianum	Herb Robert	I SNA
GROSSULARIACEAE	CURRANT FAMILY	
Ribes americanum	Wild Black Currant	N S5
Ribes cynosbati	Prickly Gooseberry	N S5
Ribes hirtellum	Wild Gooseberry	N S5 RK
HALORAGACEAE	WATER-MILFOIL FAMILY	
Myriophyllum heterophyllum	Water-milfoil	N S4? RK
Myriophyllum sibiricum	Northern Water-milfoil	N S5 RK
Myriophyllum spicatum	Eurasian Water-milfoil	I SNA
Myriophyllum verticillatum	Whorled Water-milfoil	N S5 RK
Proserpinaca palustris	Mermaid-weed	N S4 RK
HAMAMELIDACEAE	WITCH-HAZEL FAMILY	
Hamamelis virginiana	Witch-hazel	N S5
HIPPOCASTANACEAE	HORSE-CHESTNUT FAMILY	
Aesculus hippocastanum	Horse-chestnut	I SNA
HYDROPHYLLACEAE	WATERLEAF FAMILY	
Hydrophyllum virginianum	Virginia Waterleaf	N S5
JUGLANDACEAE	WALNUT FAMILY	
Carya cordiformis	Bitternut Hickory	N S5
Carya glabra	Red (Pignut) Hickory	N S3 RK
Carya ovata	Shagbark Hickory	N S5
Juglans cinerea	Butternut	N S3? END
Juglans nigra	Black Walnut	N S4

SCIENTIFIC NAME	COMMON NAME	STATUS
LAMIACEAE (LABIATAE)	MINT FAMILY	
Agastache nepetoides	Yellow Giant Hyssop	N S4 RK
Agastache scrophulariifolia	Purple Giant Hyssop	N S1 RK
Ajuga reptans	Bugleweed	I SNA
Clinopodium vulgare	Basil	N S5
Collinsonia canadensis	Richweed (Horsebalm)	N S4
Glechoma hederacea	Creeping Charlie	I SNA
Leonurus cardiaca ssp. *cardiaca*	Common Motherwort	I SNA
Lycopus americanus	Cut-leaved Water Horehound	N S5
Lycopus rubellus	Stalked Water Horehound	N S3 RK
Lycopus uniflorus	Northern Bugleweed	N S5
Mentha arvensis ssp. *borealis*	Field (Wild) Mint	N S5
Mentha spicata	Spearmint	I SNA
Monarda didyma	Oswego Tea	N S3 RK
Monarda fistulosa	Wild Bergamot	N S5
Nepeta cataria	Catnip	I SNA
Origanum vlugare	Wild Marjoram	I SNA
Prunella vulgaris	Heal-all	N S5
Pycnanthemum verticillatum var. *pilosum*	Hairy Mountain-mint	N S1 RK
Pycnanthemum virginianum	Virginia Mountain-mint	N S4
Scutellaria galericulata	Common (Hooded) Skullcap	N S5
Scutellaria lateriflora	Mad-dog Skullcap	N S5
Stachys palustris	Marsh Hedge-nettle	I SNA
Stachys tenuifolia var. *hispida*	Rough (Hispid) Hedge-nettle	N S4S5 RK
Teucrium canadense ssp. *canadense*	Wild Germander	N S5? RK

SCIENTIFIC NAME	COMMON NAME	STATUS
Teucrium canadense ssp. *viscidum*	Germander	N SU RK
LAURACEAE	LAUREL FAMILY	
Lindera benzoin	Spicebush	N S5
Sassafras albidum	Sassafras	N S4
LENTIBULARIACEAE	BLADDERWORT FAMILY	
Utricularia gibba	Humped Bladderwort	N S4 RK
Utricularia intermedia	Flat-leaved Bladderwort	N S5 RK
Utricularia minor	Small Bladderwort	N S5 RK
Utricularia purpurea	Purple Bladderwort	N S4 RK
Utricularia vulgaris	Large Bladderwort	N S5 RK
LIMNANTHACEAE	FALSE MERMAID FAMILY	
Floerkea proserpinacoides	False Mermaid	N S4
LINACEAE	FLAX FAMILY	
Linum medium var. *medium*	Stiff Yellow Flax	N S3? RK
Linum virginianum	Woodland Flax	N S2 RK
LYTHRACEAE	LOOSESTRIFE FAMILY	
Decodon verticillatus	Swamp Loosestrife	N S5 RK
Lythrum salicaria	Purple Loosestrife	I SNA
MAGNOLIACEAE	MAGNOLIA FAMILY	
Liriodendron tulipifera	Tuliptree	N S4
MALVACEAE	MALLOW FAMILY	
Abutilon theophrasti	Velvet-leaf	I SNA
Hibiscus moscheutos ssp. *moscheutos*	Swamp Rose Mallow	N S3 SC
Malva moschata	Musk Mallow	I SNA
Malva neglecta	Cheeses	I SNA

SCIENTIFIC NAME	COMMON NAME	STATUS
MENISPERMACEAE	MOONSEED FAMILY	
Menispermum canadense	Moonseed	N S4
MONOTROPACEAE	PYROLA FAMILY	
Monotropa hypopithys	Pinesap	N S4 RK
Monotropa uniflora	Indian Pipe	N S5 RK
MORACEAE	MULBERRY FAMILY	
Morus alba	White Mulberry	I SNA
Morus rubra	Red Mulberry	N S2 RK END
NYCTAGINACEAE	FOUR-O'CLOCK FAMILY	
Mirabilis nyctaginea	Wild Four-o'clock	N S4
NYMPHAEACEAE	WATER-LILY FAMILY	
Nelumbo lutea	American Lotus	N S2 RK
Nuphar advena	Large Yellow Pond-lily	N S3 RK
Nuphar variegatum	Bullhead (Pond-)Lily	N S5 RK
Nymphaea odorata	Fragrant Water-lily	N S5? RK
OLEACEAE	OLIVE FAMILY	
Forsythia viridissima	Forsythia	I SNA
Fraxinus americana	White Ash	N S5
Fraxinus nigra	Black Ash	N S5
Fraxinus pennsylvanica var. *pennsylvanica*	Red Ash	N S5
Fraxinus pennsylvanica var. *subintegerrima*	Green Ash	N S5
Fraxinus profunda	Pumpkin Ash	N S2? RK
Ligustrum obtusifolium	Border Privet	I SNA
Ligustrum ovalifolium	California Privet	I SNA
Syringa vulgaris	Common Lilac	I SNA*

SCIENTIFIC NAME	COMMON NAME	STATUS
ONAGRACEAE	EVENING-PRIMROSE FAMILY	
Circaea alpina	Small Enchanter's-nightshade	N S5 RK
Circaea lutetiana ssp. *canadensis*	Enchanter's-nightshade	N S5
Epilobium angustifolium	Fireweed	N S5 RK
Epilobium coloratum	Purple-leaved Willow-herb	N S5 RK
Epilobium hirsutum	Great Hairy Willow-herb	I SNA
Epilobium leptophyllum	Narrow-leaved Willow-herb	N S5 RK
Ludwigia palustris	Water-purslane	N S5 RK
Oenothera biennis	Hairy Yellow (Common) Evening-primrose	N S5
Oenothera parviflora	Northern (Small-flowered) Evening-primrose	N S4?
OROBANCHACEAE	BROOM-RAPE FAMILY	
Conopholis americana	Squawroot	N S4? RK
Epifagus virginiana	Beech-drops	N S5
Orobanche uniflora	One-flowered Cancer-root	N S4 RK
OXALIDACEAE	WOOD-SORREL FAMILY	
Oxalis stricta	European Wood-sorrel	N S5
PAPAVERACEAE	POPPY FAMILY	
Chelidonium majus	Celandine	I SNA
Sanguinaria canadensis	Bloodroot	N S5
PHYTOLACCACEAE	POKEWEED FAMILY	
Phytolacca americana	Pokeweed	N S4
PLANTAGINACEAE	PLANTAIN FAMILY	
Plantago lanceolata	English Plantain/Ribgrass	I SNA

SCIENTIFIC NAME	COMMON NAME	STATUS
Plantago major	Common Plantain	N S5
Plantago rugelii	Rugel's Plantain	N S5
Plantago virginica	Hoary Plantain	I SNA
PLATANACEAE	PLANE-TREE FAMILY	
Platanus occidentalis	Sycamore	N S4
POLEMONIACEAE	PHLOX FAMILY	
Phlox divaricata	Wild Blue Phlox	N S4
Phlox paniculata	Garden Phlox	I SNA
POLYGALACEAE	MILKWORT FAMILY	
Polygala senega	Seneca Snakeroot	N S4 RK
POLYGONACEAE	BUCKWHEAT FAMILY	
Fallopia convolvulus	Wild Buckwheat	I SNA
Fallopia japonica	Japanese Knotweed	I SNA
Fallopia scandens	Climbing False Buckwheat	N S4S5
Persicaria amphibia	Water Smartweed	N S5 RK
Persicaria hydropiper	Water-pepper	I SNA
Persicaria hydropiperoides	Mild Water-pepper	N S5 RK
Persicaria lapathifolia	Pale Smartweed	N S5
Persicaria maculosa	Lady's-thumb	I SNA
Persicaria punctata	(Dotted) Smartweed	N S5
Persicaria sagittata	Arrow-leaved Tear-thumb	N S4 RK
Persicaria virginiana	Jumpseed	N S4
Polygonum aviculare	Prostrate Knotweed	I SNA
Rumex acetosella	Sheep Sorrel	I SNA
Rumex crispus	Curly Dock	I SNA

SCIENTIFIC NAME	COMMON NAME	STATUS
Rumex obtusifolius	Bitter Dock	I SNA
Rumex orbiculatus	Great Water Dock	N S4S5
Rumex verticillatus	Swamp Dock	N S4
PORTULACACEAE	PURSLANE FAMILY	
Claytonia virginica	Narrow-leaved Spring Beauty	N S5
Portulaca oleracea	Common Purslane	I SNA
PRIMULACEAE	PRIMROSE FAMILY	
Lysimachia ciliata	Fringed Loosestrife	N S5
Lysimachia nummularia	Moneywort	I SNA
Lysimachia terrestris	Swamp Candles	N S5 RK
Lysimachia thyrsifolia	Tufted Loosestrife	N S5 RK
Lysimachia vulgaris	Golden Loosestrife	I SNA
PYROLACEAE	WINTERGREEN FAMILY	
Orthilia secunda	One-sided Wintergreen	N S5 RK
Pyrola elliptica	Shinleaf	N S5 RK
RANUNCULACEAE	CROWFOOT FAMILY	
Actaea pachypoda	White Baneberry	N S5
Actaea rubra	Red Baneberry	N S5
Anemone canadensis	Canada Anemone	N S5 RK
Anemone cylindrica	Long-headed Anemone	N S4 RK
Anemone quinquefolia	Wood Anemone	N S5
Anemone virginiana	Thimbleweed	N S5
Aquilegia canadensis	Wild Columbine	N S5
Hepatica acutiloba	Sharp-lobed Hepatica	N S5
Hepatica americana	Round-lobed Hepatica	N S5

SCIENTIFIC NAME	COMMON NAME	STATUS
Hydrastis canadensis	Goldenseal	N S2 THR
Ranunculus abortivus	Kidney-leaved Buttercup	N S5
Ranunculus acris	Common Buttercup	I SNA
Ranunculus aquatilis var. *diffusus*	White Water Buttercup	N S5
Ranunculus fascicularis	Early Buttercup	N S4 RK
Ranunculus flabellaris	Yellow Water Buttercup	N S4?
Ranunculus recurvatus	Hooked Crowfoot	N S5
Ranunculus rhomboideus	Prairie Buttercup	N S4 RK
Ranunculus sceleratus	Cursed Crowfoot	N S5
Thalictrum dasycarpum	Purple Meadow-rue	N S4? RK
Thalictrum dioicum	Early Meadow-rue	N S5
Thalictrum pubescens	Tall Meadow-rue	N S5
Thalictrum revolutum	Waxy (Skunk) Meadow-rue	N S2 RK
Thalictrum thalictroides	Rue-anemone	N S3 RK
RHAMNACEAE	BUCKTHORN FAMILY	
Ceanothus americanus	New Jersey Tea	N S4 RK
Ceanothus herbaceus	Narrow-leaved New Jersey Tea	N S4 RK
ROSACEAE	ROSE FAMILY	
Agrimonia gryposepala	Agrimony	N S5
Agrimonia parviflora	Small-flowered Agrimony	N S4
Amelanchier laevis	Smooth Juneberry	N S5
Amelanchier spicata	Tall Juneberry	N S4?
Comarum palustre	Marsh Five-fingers	N S5 RK
Crataegus crus-galli	Cockspur Thorn	N S5
Crataegus monogyna	English Hawthorn	I SNA

SCIENTIFIC NAME	COMMON NAME	STATUS
Crataegus pruinosa	Waxy-fruited Thorn	N S4?
Crataegus punctata	Dotted Hawthorn	N S5
Dasiphora fruticosa ssp. *floribunda*	Shrubby Cinquefoil	N S5 RK
Fragaria vesca	Woodland Strawberry	N S5 RK
Fragaria virginiana	(Common) Wild Strawberry	N S5
Geum canadense	White Avens	N S5
Malus coronaria	Wild Crab	N S4
Malus pumila	Apple	I SNA
Photinia melanocarpa	Chokeberry	N S5
Potentilla anserina ssp. *anserina*	Silverweed	N S5
Potentilla argentea	Silvery Cinquefoil	I SNA
Potentilla inclinata	Downy Cinquefoil	I SNA
Potentilla norvegica	Rough Cinquefoil	N S5
Potentilla simplex	Cinquefoil	N S5 RK
Potentilla recta	Rough-fruited Cinquefoil	I SNA
Potentilla supina ssp. *paradoxa*	Strange Cinquefoil	N S4 RK
Prunus avium	Sweet Cherry	I SNA
Prunus nigra	Canada Plum	N S4 RK
Prunus pensylvanica	Pin Cherry	N S5
Prunus pumila var. pumila	Sand Cherry	N S3 RK
Prunus serotina	Wild Black Cherry	N S5
Prunus virginiana ssp. *virginiana*	Choke Cherry	N S5
Rhodotypos scandens	Jetbead	I SNA
Rosa acicularis	Prickly Wild Rose	N S5 RK
Rosa blanda	Smooth Wild Rose	N S5

SCIENTIFIC NAME	COMMON NAME	STATUS
Rosa carolina	Carolina Rose	N S4
Rosa eglanteria	Sweet-brier	I SNA
Rosa multiflora	Multiflora Rose	I SNA
Rosa palustris	Swamp Rose	N S5
Rubus allegheniensis	Common Blackberry	N S5
Rubus flagellaris	Northern Dewberry	N S4
Rubus hispidus	Swamp Dewberry	N S4S5
Rubus idaeus ssp. *strigosus*	Wild Red Raspberry	N S5
Rubus occidentalis	Black Raspberry	N S5
Rubus odoratus	Purple-flowering Raspberry	N S5 RK
Spiraea alba	Narrow-leaved Meadowsweet	N S5
Spiraea tomentosa	Steeplebush	N S4S5 RK
Spiraea x vanhouttei	Bridal-wreath	I SNA
RUBIACEAE	MADDER FAMILY	
Cephalanthus occidentalis	Buttonbush	N S5
Galium aparine	Cleavers	N S5
Galium asprellum	Rough Bedstraw	N S5 RK
Galium circaezans	Wild Licorice	N S5
Galium lanceolatum	’s Wild Licorice	N S5
Galium obtusum	Obtuse (Blunt-leaved) Bedstraw	N S4S5
Galium palustre	Marsh Bedstraw	N S5
Galium pilosum	Hairy Bedstraw	N S3 RK
Galium trifidum	Three-cleft Bedstraw	N S5 RK
Galium triflorum	(Fragrant) Sweet-scented	N S5

SCIENTIFIC NAME	COMMON NAME	STATUS
	Bedstraw	
Mitchella repens	Partridgeberry	N S5 RK
RUTACEAE	RUE FAMILY	
Ptelea trifoliata var. *trifoliata*	Common Hoptree	N S3 RK THR
Zanthoxylum americanum	Prickly Ash	N S5
SALICACEAE	WILLOW FAMILY	
Populus alba	European White Poplar	I SNA
Populus balsalmifera	Balsalm Poplar	N S5 RK
Populus deltoides	Eastern Cottonwood	N S5
Populus grandidentata	Large-toothed Aspen	N S5
Populus nigra	Black Cottonwood/Lombardy Popular	I SNA
Populus tremuloides	Trembling Aspen	N S5
Salix alba var. *vitellina*	White Willow	I SNA
Salix bebbiana	Bebb's Willow	N S5
Salix discolor	Pussy Willow	N S5
Salix eriocephala	Heart-leaved Willow	N S5
Salix exigua	Sandbar Willow	N S5
Salix fragilis	Crack Willow	I SNA
Salix lucida	Shining Willow	N S5
Salix nigra	Black Willow	N S4?
Salix pentandra	Bay-leaved Willow	I SNA
Salix petiolaris	Slender Willow	N S5 RK
Salix purpurea	Basket Willow	I SNA
Salix viminalis	Basket Willow	I SNA

SCIENTIFIC NAME	COMMON NAME	STATUS
SANTALACEAE	SANDALWOOD FAMILY	
Comandra umbellata	Bastard-toadflax	N S5 RK
SAXIFRAGACEAE	SAXIFRAGE FAMILY	
Mitella diphylla	Mitrewort	N S5
Parnassia glauca	Grass-of-Parnassus	N S5 RK
Penthorum sedoides	Ditch Stonecrop	N S5 RK
Tiarella cordifolia	Foamflower	N S5 RK
SCROPHULARIACEAE	FIGWORT FAMILY	
Agalinis paupercula	Purple Gerardia	N S4S5 RK
Agalinis tenuifolia	Slender Gerardia	N S4S5 RK
Castilleja coccinea	Painted Cup	N S5 RK
Chelone glabra	Turtlehead	N S5
Linaria vulgaris	Butter-and-eggs	I SNA
Melampyrum lineare	Cow Wheat	N S4S5 RK
Mimulus alatus	Sharp-winged Monkey Flower	N S2 RK
Mimulus ringens	Monkey Flower	N S5
Pedicularis canadensis	Wood Betony	N S5 RK
Pedicularis lanceolata	Swamp Lousewort	N S4 RK
Penstemon hirsutus	Hairy Beardstongue	N S4 RK
Scrophularia marilandica	Figwort	N S4 RK
Verbascum blattaria	Moth Mullein	I SNA
Verbascum thapsus	Common Mullein	I SNA
Veronica arvensis	Corn Speedwell	I SNA
Veronica officinalis	Common Speedwell	I SNA
Veronica scutellata	Marsh Speedwell	N S5 RK

SCIENTIFIC NAME	COMMON NAME	STATUS
Veronica serpyllifolia ssp. *serpyllifolia*	Thyme-leaved Speedwell	I SNA
Veronica verna	Spring Speedwell	I SNA
SIMAROUBACEAE	QUASSIA FAMILY	
Ailanthus altissima	Tree-of-heaven	I SNA
SOLANACEAE	NIGHTSHADE FAMILY	
Datura stramonium	Jimsonweed	I SNA
Hyoscyamus niger	Henbane	I SNA
Physalis heterophylla	Clammy Ground Cherry	N S4
Physalis longifolia var. *subglabrata*	Smooth Ground Cherry	N S4? RK
Solanum dulcamara	Bittersweet Nightshade	I SNA
Solanum ptycanthum	Eastern Black Nightshade	N S5
STAPHYLEACEAE	BLADDERNUT FAMILY	
Staphylea trifolia	Bladdernut	N S4
TILIACEAE	LINDEN FAMILY	
Tilia americana	Basswood	N S5
ULMACEAE	ELM FAMILY	
Celtis occidentalis	Hackberry	N S4
Ulmus americana	White Elm	N S5
Ulmus pumila	Siberian Elm	I SNA
Ulmus rubra	Slippery Elm	N S5
Ulmus thomasii	Rock Elm	N S4? RK
URTICACEAE	NETTLE FAMILY	
Boehmeria cylindrica	False Nettle	N S5
Laportea canadensis	Wood Nettle	N S5
Parietaria pensylvanica	Pellitory	N S4

SCIENTIFIC NAME	COMMON NAME	STATUS
Pilea fontana	Richweed	N S4 RK
Pilea pumila	Clearweed	N S5
Urtica dioica ssp. *gracilis*	American Stinging Nettle	N S5
VERBENACEAE	VERVAIN FAMILY	
Phryma leptostachya	Lopseed	N S4S5
Verbena hastata	Blue Vervain	N S5
Verbena stricta	Hoary Vervain	N S4 RK
Verbena urticifolia	White Vervain	N S5
VIOLACEAE	VIOLET FAMILY	
Viola adunca	Sand Violet	N S4S5 RK
Viola affinis	Le Conte's Marsh Violet	N S4? RK
Viola blanda	Sweet White Violet	N S4S5 RK
Viola canadensis	Canada Violet	N S5 RK
Viola conspersa	Dog Violet	N S5
Viola cucullata	Marsh Blue Violet	N S5 RK
Viola macloskeyi	Smooth White Violet	N S5
Viola palmata	Wood Violet	N S2S3 RK
Viola pubescens	Downy Yellow Violet	N S5
Viola rostrata	Long-spurred Violet	N S5 RK
Viola sororia	Common Blue Violet	N S5
VITACEAE	VINE FAMILY	
Parthenocissus quinquefolia	Virginia Creeper	N S4?
Parthenocissus vitacea	Virginia Creeper	N S5
Vitis aestivalis	Summer Grape	N S4
Vitis labrusca	Fox Grape	N S1 RK

SCIENTIFIC NAME	COMMON NAME	STATUS
Vitis riparia	Riverbank Grape	N S5

Appendix 4. Checklist of the Birds of Rondeau Provincial Park

(From Woodliffe 2009b)

The following list contains 354 species of birds that have been recorded in the Rondeau Provincial Park checklist area. The taxonomic order and common names given follow the seventh edition of the American Ornithologist's Union Checklist (1998) as well as changes made in the 42nd - 48th supplement to the Checklist. The Park's checklist area corresponds with the Christmas Bird Count circle, and includes locations such as the Blenheim Sewage Lagoons and Erieau. Eleven species denoted by (NP) are not known to have occurred within the park proper (recorded elsewhere in the count circle) and would not be included in the park species total, bringing the total number recorded in the park proper to 343.

Of the 354 listed species, 147 have been confirmed breeding, and are marked as *. Almost 20 other species noted as (*), have evidence for 'probable breeding' but as yet have not been confirmed. Species denoted by *(NB) or (*)(NB) have no evidence of breeding within the park proper, bringing the number of species with confirmed breeding within the park to 137.

Species in **bold** require documentation according to Southern Ontario Review List provided by the Ontario Bird Records Committee. For those *italicized*, the local bird records committee would like documentation. For more details, and a Rare Bird Report form, please inquire at the Park's Visitor Centre.

Documentation should be provided to the staff at the Visitor Centre, c/o Rondeau Provincial Park, R. R. #1, Morpeth, ON N0P 1X0.

DUCKS, GEESE & SWANS

Fulvous Whistling-Duck

Greater White-fronted Goose

Snow Goose

Ross's Goose(NP)

Brant

Cackling Goose

Canada Goose*

Mute Swan*

Trumpeter Swan

Tundra Swan

Wood Duck*

Gadwall

Eurasian Wigeon

American Wigeon*

American Black Duck*

Mallard*

Blue-winged Teal*

Cinnamon Teal

Northern Shoveler*(NB)

Northern Pintail*

Green-winged Teal*

Canvasback (*)

Redhead

Ring-necked Duck

Tufted Duck

Greater Scaup

HUMMINGBIRDS

Ruby-throated Hummingbird*

KINGFISHERS

Belted Kingfisher*

WOODPECKERS

Red-headed Woodpecker* SC

Red-bellied Woodpecker*

Yellow-bellied Sapsucker

Downy Woodpecker*

Hairy Woodpecker*

American Three-toed Woodpecker

Black-backed Woodpecker

Northern Flicker*

Pileated Woodpecker*

TYRANT FLYCATCHERS

Olive-sided Flycatcher SC

Eastern Wood-pewee*

Yellow-bellied Flycatcher

Acadian Flycatcher* END

Alder Flycatcher*

Willow Flycatcher*

Least Flycatcher*

Eastern Phoebe*

Great Crested Flycatcher*

Tropical Kingbird(NP)

Western Kingbird

Eastern Kingbird*

Lesser Scaup

King Eider

Common Eider

Harlequin Duck

Surf Scoter

White-winged Scoter

Black Scoter

Long-tailed Duck

Bufflehead

Common Goldeneye

Barrow's Goldeneye

Hooded Merganser*

Common Merganser*

Red-breasted Merganser

Ruddy Duck*(NB)

PARTRIDGES, GROUSE & TURKEYS

Ring-necked Pheasant*

Ruffed Grouse*

Wild Turkey*

NEW WORLD QUAIL

*Northern Bobwhite** END

LOONS

Red-throated Loon

Common Loon (*)

GREBES

Pied-billed Grebe*

Horned Grebe SC

Scissor-tailed Flycatcher

SHRIKES

Loggerhead Shrike*(NB) END

Northern Shrike

VIREOS

White-eyed Vireo*

Bell's Vireo

Yellow-throated Vireo (*)

Plumbeous Vireo

Blue-headed Vireo (*)

Warbling Vireo*

Philadelphia Vireo

Red-eyed Vireo*

JAYS, MAGPIES & CROWS

Blue Jay*

Black-billed Magpie

American Crow*

Fish Crow

Common Raven

LARKS

Horned Lark*(NB)

SWALLOWS

Purple Martin*

Tree Swallow*

Northern Rough-winged Swallow*

Bank Swallow*(NB)

Cliff Swallow*(NB)

Red-necked Grebe

Eared Grebe

FRIGATEBIRDS

Magnificent Frigatebird

GANNETS

Northern Gannet(NP)

PELICANS

American White Pelican THR

CORMORANTS

Double-crested Cormorant*

HERONS, BITTERNS & EGRETS

American Bittern*

Least Bittern* THR

Great Blue Heron*

Great Egret

Snowy Egret

Little Blue Heron

Tricolored Heron

Cattle Egret

Green Heron*

Black-crowned Night-Heron*

Yellow-crowned Night-Heron

IBISES

Glossy Ibis

VULTURES

Black Vulture

Turkey Vulture*(NB)

Cave Swallow

Barn Swallow* THR

CHICKADEES & TITMICE

Black-capped Chickadee*

Boreal Chickadee

Tufted Titmouse *

NUTHATCHES & CREEPERS

Red-breasted Nuthatch

White-breasted Nuthatch*

Brown Creeper*

WRENS

Carolina Wren*

Bewick's Wren

House Wren*

Winter Wren*

Sedge Wren*

Marsh Wren*

KINGLETS & GNATCATCHERS

Golden-crowned Kinglet

Ruby-crowned Kinglet

Blue-gray Gnatcatcher*

THRUSHES

Northern Wheatear(NP)

Eastern Bluebird*

Townsend's Solitaire

Veery*

Gray-cheeked Thrush

HAWKS, EAGLES & FALCONS

Osprey (*)(NB)

Mississippi Kite

Bald Eagle* SC

Northern Harrier*

Sharp-shinned Hawk *

Cooper's Hawk*

Northern Goshawk

Red-shouldered Hawk*

Broad-winged Hawk (*)

Swainson's Hawk(NP)

Red-tailed Hawk*

Rough-legged Hawk

Golden Eagle END

American Kestrel*

Merlin

Peregrine Falcon THR

RAILS, GALLINULES & COOTS

Yellow Rail SC

Black Rail

King Rail* END

Virginia Rail*

Sora*

Common Moorhen*

American Coot*

CRANES

Sandhill Crane*

Swainson's Thrush

Hermit Thrush

Wood Thrush*

Eurasian Blackbird(NP)

American Robin*

Varied Thrush

MIMIDS

Gray Catbird*

Northern Mockingbird*

Sage Thrasher

Brown Thrasher*

STARLINGS

European Starling*

PIPITS

American Pipit

WAXWINGS

Bohemian Waxwing

Cedar Waxwing*

WOOD WARBLERS

Blue-winged Warbler*

Golden-winged Warbler* SC

Tennessee Warbler

Orange-crowned Warbler

Nashville Warbler

Northern Parula

Yellow-Warbler*

Chestnut-sided Warbler*

PLOVERS

Black-bellied Plover

American Golden-Plover

Semipalmated Plover

Piping Plover* END

Killdeer*

STILTS & AVOCETS

Black-necked Stilt(NP)

American Avocet

SANDPIPERS & PHALAROPES

Spotted Sandpiper*

Solitary Sandpiper

Greater Yellowlegs

Willet

Lesser Yellowlegs

Upland Sandpiper*(NB)

Eskimo Curlew EXP

Whimbrel

Hudsonian Godwit

Marbled Godwit

Ruddy Turnstone

Red Knot

Sanderling

Semipalmated Sandpiper

Western Sandpiper

Least Sandpiper

White-rumped Sandpiper

Magnolia Warbler

Cape May Warbler

Black-throated Blue Warbler

Yellow-rumped Warbler

Black-throated Gray Warbler

Black-throated Green Warbler (*)

Townsend's Warbler

Blackburnian Warbler

Yellow-throated Warbler

Pine Warbler*

Kirtland's Warbler END

Prairie Warbler

Palm Warbler

Bay-breasted Warbler

Blackpoll Warbler

Cerulean Warbler* THR

Black-and-white Warbler

American Redstart*

Prothonotary Warbler* END

Worm-eating Warbler

Swainson's Warbler

Ovenbird*

Northern Waterthrush*

Louisiana Waterthrush* SC

Kentucky Warbler (*)

Connecticut Warbler

Mourning Warbler*

Baird's Sandpiper
Pectoral Sandpiper
Purple Sandpiper
Dunlin
Curlew Sandpiper(NP)
Stilt Sandpiper
Buff-breasted Sandpiper
Ruff
Short-billed Dowitcher
Long-billed Dowitcher
Wilson's Snipe*
American Woodcock*
Wilson's Phalarope*
Red-necked Phalarope
Red Phalarope

GULLS & TERNS

Laughing Gull
Franklin's Gull
Little Gull*
Black-headed Gull
Bonaparte's Gull
Mew Gull
Ring-billed Gull*
California Gull
Herring Gull*
Thayer's Gull
Iceland Gull
Common Yellowthroat*
Hooded Warbler (*) SC
Wilson's Warbler
Canada Warbler (*) SC
Yellow-breasted Chat* SC

TANAGERS

Summer Tanager (*)
Scarlet Tanager*
Western Tanager

SPARROWS

Spotted Towhee
Eastern Towhee*
American Tree Sparrow
Chipping Sparrow*
Clay-coloured Sparrow (*)
Field Sparrow*
Vesper Sparrow*
Lark Sparrow
Lark Bunting
Savannah Sparrow*
Grasshopper Sparrow*
Henslow's Sparrow END
Le Conte's Sparrow
Nelson's Sharp-tailed Sparrow
Fox Sparrow
Song Sparrow*
Lincoln's Sparrow

Lesser Black-backed Gull
Glaucous Gull
Great Black-backed Gull
Black-legged Kittiwake
Caspian Tern
Black Tern* SC
Common Tern*
Forster's Tern*
Black Skimmer

SKUAS & JAEGERS

Pomarine Jaeger
Parasitic Jaeger
Long-tailed Jaeger

ALCIDS

Thick-billed Murre

PIGEONS & DOVES

Rock Pigeon*
Band-tailed Pigeon
Eurasian Collared-Dove
Mourning Dove*
Passenger Pigeon (extinct)

CUCKOOS

Yellow-billed Cuckoo*
Black-billed Cuckoo*

OWLS

Barn Owl*(NB) END
Eastern Screech-Owl*
Swamp Sparrow*
White-throated Sparrow
Harris's Sparrow
White-crowned Sparrow
Dark-eyed Junco
Lapland Longspur
Snow Bunting

CARDINALS & GROSBEAKS

Northern Cardinal*
Rose-breasted Grosbeak*
Blue Grosbeak (*)
Indigo Bunting*
Painted Bunting(NP)
Dickcissel*(NB)

BLACKBIRDS & ORIOLES

Bobolink* THR
Red-winged Blackbird*
Eastern Meadowlark* THR
Western Meadowlark*
Yellow-headed Blackbird
Rusty Blackbird
Brewer's Blackbird*
Common Grackle*
Brown-headed Cowbird*
Orchard Oriole*
Baltimore Oriole*

FINCHES

Great Horned Owl*

Snowy Owl

Northern Hawk Owl(NP)

Burrowing Owl(NP)

Barred Owl

Long-eared Owl*

Short-eared Owl SC

Northern Saw-whet Owl (*)

GOATSUCKERS

Common Nighthawk* SC

Chuck-will's-widow (*)

Whip-poor-will* THR

SWIFTS

White-collared Swift

Chimney Swift* THR

Pine Grosbeak

Purple Finch

House Finch*

Red Crossbill

White-winged Crossbill

Common Redpoll

Hoary Redpoll

Pine Siskin

American Goldfinch*

Evening Grosbeak

OLD WORLD SPARROWS

House Sparrow*

Appendix 5. Checklist of the Amphibians and Reptiles of Rondeau Provincial Park

S-Ranks refer to Ontario subnational conservation status ranks as defined by the NHIC (see Appendix 1). S-Ranks are current as of May 2012. SARO status (SC, THR, END) represent species status as identified on the *Species at Risk in Ontario* (SARO) list (see Appendix 1).

AMPHIBIANS (13)		**SRANK/SARO**
Salamanders		
Mudpuppy	*Necturus maculosus*	S4
Blue-spotted Salamander	*Ambystoma laterale*	S4
Red-spotted Newt	*Notophthalmus viridescens viridescens*	S5
Eastern Red-backed Salamander	*Plethodon cinereus*	S5
Toads and Frogs		
American Toad	*Anaxyrus americanus*	S5
Fowler's Toad	*Anaxyrus fowleri*	S2/END
Tetraploid Gray Treefrog	*Hyla versicolor*	S5
Spring Peeper	*Pseudacris crucifer*	S5
Western Chorus Frog (Carolinian)	*P. triseriata*	S4
Bullfrog	*Lithobates catesbeianus*	S4
Green Frog	*L. clamitans*	S5
Wood Frog	*L. sylvaticus*	S5
Northern Leopard Frog	*L. pipiens*	S5
REPTILES: (18)		
Turtles		
Snapping Turtle	*Chelydra serpentina*	S3/SC
Eastern Musk Turtle	*Sternotherus odoratus*	S3/THR
Spotted Turtle	*Clemmys guttata*	S3/END
Blanding's Turtle	*Emydoidea blandingi*	S3/THR
Northern Map Turtle	*Graptemys geographica*	S3/SC
Midland Painted Turtle	*Chrysemys picta marginata*	S5
Spiny Softshell	*Apalone spinifera*	S3/THR

Lizards		
Common Five-lined Skink (Carolinian)	*Plestiodon fasciatus*	S2/END
Snakes		
Northern Watersnake	*Nerodia sipedon sipedon*	S5
DeKay's Brownsnake	*Storeria dekayi*	S5
Butler's Gartersnake	*Thamnophis butleri*	S2/THR
Eastern Ribbonsnake	*T. sauritus*	S3/SC
Eastern Gartersnake	*T. sirtalis sirtalis*	S5
Eastern Hog-nosed Snake	*Heterodon platirhinos*	S3/THR
Ring-necked Snake	*Diadophis punctatus*	S4
Eastern Foxsnake (Carolinian)	*Pantherophis gloydi*	S2/END
Milksnake	*Lampropeltis triangulum*	S3/SC
Smooth Greensnake	*Opheodrys vernalis*	S4

Appendix 6. Checklist of the Fishes of Rondeau Provincial Park

81 taxa

Taxonomic order by Mandrak and Crossman 1992

S-Ranks refer to Ontario subnational conservation status ranks as defined by the NHIC (see Appendix 1). S-Ranks are current as of May 2012. SARO status (SC, THR, END) represent species status as identified on the *Species at Risk in Ontario* (SARO) list (see Appendix 1). COSEWIC status codes as per the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2012b).

Lampreys	Petromyzontidae	**SRANK/COSEWIC/SARO**
Silver Lamprey	*Ichthyomyzon unicuspis*	S3
Sea Lamprey	*Petromyzon marinus*	SNA
Sturgeons	Acipenseridae	
Lake Sturgeon	*Acipenser fulvescens*	S3/THR/THR
Gars	Lepisosteidae	
Longnose Gar	*Lepisosteus oculatus*	S1/THR/THR
Spotted Gar	*L. osseus*	S4
Bowfins	Amiidae	
Bowfin	*Amia calva*	S4
Mooneyes	Hiodonitidae	
Mooneye	*Hiodon tergisus*	S4
Freshwater Eels	Anguillidae	
American Eel	*Anguilla rostrata*	S1?/THR/END
Herrings	Clupeidae	
Alewife	*Alosa pseudoharengus*	SNA
Gizzard Shad	*Dorosoma cepedianum*	S4
Minnows	Cyprinidae	
Goldfish	*Carassius auratus*	SNA
Spotfin Shiner	*Cyprinella spiloptera*	S4
Common Carp	*Cyprinus carpio*	SNA
Common Shiner	*Luxilus cornutus*	S5
Silver Chub	*Macrhybopsis storeriana*	S2/END/SC
Golden Shiner	*Notemigonus crysoleucas*	S5
Pugnose Shiner	*Notropis anogenus*	S2/END/END
Emerald Shiner	*N. atherinoides*	S5
Blackchin Shiner	*N. heterodon*	S4

Blacknose Shiner	*N. heterolepis*	S5
Spottail Shiner	*N. hudsonius*	S5
Sand Shiner	*N. stramineus*	S4
Mimic Shiner	*N. volucellus*	S5
Bluntnose Minnow	*Pimephales notatus*	S5
Fathead Minnow	*P. promelas*	S5
Longnose Dace	*Rhinichthys catatactae*	S5
Creek Chub	*Semotilus atromaculatus*	S5
Suckers	Catostomidae	
Quillback	*Carpiodes cyprinus*	S4
White Sucker	*Catostomus commersonni*	S5
Lake Chubsucker	*Erimyzon sucetta*	S2/END/THR
Black Redhorse	*Moxostoma duquesnei*	S2/THR/THR
Shorthead Redhorse	*M. macrolepidotum*	S5
Greater Redhorse	*M. valenciennesi*	S3
Catfishes	Ictaluridae	
Black Bullhead	*Ameiurus melas*	S4
Yellow Bullhead	*A. natalis*	S4
Brown Bullhead	*A. nebulosus*	S5
Channel Catfish	*Ictalurus punctatus*	S4
Stonecat	*Noturus flavus*	S4
Tadpole Madtom	*N. gyrinus*	S4
Pikes	Esocidae	
Northern Pike	*Esox lucius*	S5
Muskellunge	*E. masquinongy*	S4
Mudminnows	Umbridae	
Central Mudminnow	*Umbra limi*	S5

Smelts	Osmeridae	
Rainbow Smelt	*Osmerus mordax*	S5
Salmon, Trout, Char and Whitefish	Salmonidae	
Cisco	*Coregonus artedi*	S5
Pink Salmon	*Oncorhynchus gorbuscha*	SNA
Coho Salmon	*O. kisutch*	SNA
Rainbow Trout	*O. mykiss*	SNA
Chinook Salmon	*O. tshawytscha*	SNA
Brown Trout	*Salmo trutta*	SNA
Lake Trout	*Salvelinus namaycush*	S5
Trout-Perches	Percopsidae	
Trout-perch	*Percopsis omiscomaycus*	S5
Cods	Gadidae	
Burbot	*Lota lota*	S5
Killfishes	Cyprinodontidae	
Banded Killfish	*Fundulus diaphanus*	S5
Silversides	Atherinidae	
Brook Silverside	*Lapidesthes sicculus*	S4
Sticklebacks	Gasterosteidae	
Brook Stickleback	*Culaea inconstans*	S5
Threespine Stickleback	*Gasterosteus aculeatus*	S4
Sculpins	Cottidae	
Mottled Sculpin	*Cottus bairdi*	S5
Temperate Basses	Percichthyidae	
White Perch	*Morone americana*	SNA
White Bass	*M. chrysops*	S4
Sunfishes	Centrarchidae	

Rock Bass	*Ambloplites rupestris*	S5
Green Sunfish	*Lepomis cyanellus*	S4
Pumpkinseed	*L. gibbosus*	S5
Warmouth	*L. gulosus*	S1/SC/SC
Bluegill	*L. macrochirus*	S5
Longear Sunfish	*L. megalotis*	S3
Smallmouth Bass	*Micropterus dolomieu*	S5
Largemouth Bass	*M. salmoides*	S5
White Crappie	*Pomoxis annularis*	S4
Black Crappie	*P. nigromaculatus*	S4
Perches	Percidae	
Eastern Sand Darter	*Ammocrypta pellucida*	S2/THR/END
Iowa Darter	*Etheostoma exile*	S5
Least Darter	*E. microperca*	S4
Johnny Darter	*E. nigrum*	S5
Yellow Perch	*Perca flavescens*	S5
Logperch	*Percina caprodes*	S5
Channel Darter	*P. copelandi*	S2/THR/THR
Sauger	*Sander canadensis*	S4
Blue Walleye	*S. vitreus glaucus*	SX/EXT/EXT
Walleye	*S. vitreus vitreus*	S5
Drums	Sciaenidae	
Freshwater Drum	*Aplodinotus grunniens*	S5
Gobies	Gobiidae	
Round Goby	*Neogobius melanostomus*	SNA

Appendix 7. Checklist of the Odonata and Lepidoptera of Rondeau Provincial Park

This list is restricted to the Odonata (Dragonflies and Damselflies) and Lepidoptera (Skippers, Butterflies and Moths). For a list of other insect orders, see the University of Guelph Insect Collection species list for Rondeau Provincial Park (Marshall and Paiero 2011).

This list is organized taxonomically by family and alphabetically by Scientific Name within each family, with the Odonata (29 species) first, followed by the Lepidoptera broken into two groups – the skippers and butterflies (78 species) and moths (371 species).

Family	Scientific name	Common Name	S-rank
Odonata - Dragonflies and Damselflies			
Calopterygidae	*Calopteryx maculata*	Ebony Jewelwing	S5
Lestidae	*Lestes disjunctus*	Common Spreadwing	S5
Lestidae	*Lestes dryas*	Emerald Spreadwing	S5
Lestidae	*Lestes rectangularis*	Slender Spreadwing	S5
Coenagrionidae	*Ischnura verticalis*	Eastern Forktail	S5
Aeshnidae	*Aeshna canadensis*	Canada Darner	S5
Aeshnidae	*Aeshna constricta*	Lance-tipped Darner	S5
Aeshnidae	*Anax junius*	Common Green Darner	S5
Aeshnidae	*Epiaeshna heros*	Swamp Darner	S2S3
Aeshnidae	*Nasiaeschna pentacantha*	Cyrano Darner	S3
Corduliidae	*Dorocordulia libera*	Racket-tailed Emerald	S5
Corduliidae	*Epitheca cynosura*	Common Baskettail	S5
Gomphidae	*Arigomphus furcifer*	Lilypad Clubtail	S3
Gomphidae	*Gomphus vastus*	Cobra Clubtail	S1
Libellulidae	*Celithemis elisa*	Calico Pennant	S5
Libellulidae	*Celithemis eponina*	Halloween Pennant	S4
Libellulidae	*Erythemis simplicicollis*	Eastern Pondhawk	S5
Libellulidae	*Leucorrhinia intacta*	Dot-tailed Whiteface	S5
Libellulidae	*Libellula luctuosa*	Widow Skimmer	S5
Libellulidae	*Libellula pulchella*	Twelve-spotted Skimmer	S5
Libellulidae	*Libellula quadrimaculata*	Four-spot Skimmer	S5
Libellulidae	*Libellula semifasciata*	Painted Skimmer	S2
Libellulidae	*Libellula vibrans*	Great Blue Skimmer	S1

Family	Scientific name	Common Name	S-rank
Libellulidae	*Pachydiplax longipennis*	Blue Dasher	S5
Libellulidae	*Pantala hymenea*	Spot-winged Glider	S4
Libellulidae	*Plathemis* (Libellula) *lydia*	Common Whitetail	S5
Libellulidae	*Sympetrum corruptum*	Variegated Meadowhawk	S3
Libellulidae	*Tramea lacerata*	Black Saddlebags	S4
Libellulidae	*Tramea onusta*	Red Saddlebags	SNA
Lepidoptera - Skippers and Butterflies			
Hesperiidae	*Anatrytone logan*	Delaware Skipper	S4
Hesperiidae	*Ancyloxypha numitor*	Least Skipper	S5
Hesperiidae	*Erynnis horatius*	Horace's Duskywing	SNA
Hesperiidae	*Erynnis icelus*	Dreamy Duskywing	S5
Hesperiidae	*Erynnis juvenalis*	Juvenal's Duskywing	S5
Hesperiidae	*Erynnis lucilius*	Columbine Duskywing	S4
Hesperiidae	*Erynnis martialis*	Mottled Duskywing	S2
Hesperiidae	*Epargyreus clarus*	Silver-spotted Skipper	S4
Hesperiidae	*Euphyes conspicua*	Black Dash	S3
Hesperiidae	*Euphyes dion*	Dion Skipper	S3
Hesperiidae	*Euphyes vestris*	Dun Skipper	S5
Hesperiidae	*Hylephila phyleus*	Fiery Skipper	SNA
Hesperiidae	*Pholisora catullus*	Common Sootywing	S3
Hesperiidae	*Poanes hobomok*	Hobomok Skipper	S5
Hesperiidae	*Poanes massasoit*	Mulberry Wing	S3
Hesperiidae	*Poanes viator*	Broad-winged Skipper	S4
Hesperiidae	*Polites mystic*	Long Dash Skipper	S5

Family	Scientific name	Common Name	S-rank
Hesperiidae	*Polites origines*	Crossline Skipper	S4
Hesperiidae	*Polites peckius*	Peck's Skipper	S5
Hesperiidae	*Polites themistocles*	Tawny-edged Skipper	S5
Hesperiidae	*Pompeius verna*	Little Glassywing	S4
Hesperiidae	*Thorybes pylades*	Northern Cloudywing	S5
Hesperiidae	*Thymelicus lineola*	European Skipper	SNA
Hesperiidae	*Wallengrenia egeremet*	Northern Broken-Dash	S5
Papilionidae	*Battus philenor*	Pipevine Swallowtail	SNA
Papilionidae	*Papilio cresphontes*	Giant Swallowtail	S3
Papilionidae	*Papilio glaucus*	Eastern Tiger Swallowtail	S5
Papilionidae	*Papilio polyxenes*	Black Swallowtail	S5
Papilionidae	*Papilio troilus*	Spicebush Swallowtail	S4
Pieridae	*Colias eurytheme*	Orange Sulphur	S5
Pieridae	*Colias philodice*	Clouded Sulphur	S5
Pieridae	*Eurema lisa*	Little Yellow	SNA
Pieridae	*Pieris rapae*	Cabbage White	SNA
Pieridae	*Phoebis sennae*	Cloudless Sulphur	SNA
Lycaenidae	*Celastrina ladon*	Spring Azure	S5
Lycaenidae	*Celastrina neglecta*	Summer Azure	S5
Lycaenidae	*Everes comyntas*	Eastern Tailed Blue	S5
Lycaenidae	*Feniseca tarquinius*	Harvester	S4
Lycaenidae	*Lycaena helloides*	Purplish Copper	S3
Lycaenidae	*Lycaena hyllus*	Bronze Copper	S5
Lycaenidae	*Lycaena phlaeas*	American Copper	S5
Lycaenidae	*Satyrium calanus*	Banded Hairstreak	S4
Lycaenidae	*Satyrium caryaevorum*	Hickory Hairstreak	S3

Family	Scientific name	Common Name	S-rank
Lycaenidae	*Satyrium edwardsii*	Edwards' Hairstreak	S4
Lycaenidae	*Satyrium liparops*	Striped Hairstreak	S5
Lycaenidae	*Satyrium titus*	Coral Hairstreak	S5
Lycaenidae	*Strymon melinus*	Grey Hairstreak	S4
Nymphalidae	*Agraulis vanillae*	Gulf Fritillary	SNA
Nymphalidae	*Asterocampa clyton*	Tawny Emperor	S2S3
Nymphalidae	*Boloria bellona*	Meadow Fritillary	S5
Nymphalidae	*Cercyonis pegala*	Common Wood-Nymph	S5
Nymphalidae	*Chlosyne nycteis*	Silvery Checkerspot	S5
Nymphalidae	*Coenonympha tullia*	Common Ringlet	S5
Nymphalidae	*Danaus plexippus*	Monarch	S2N, S4B SC/SC
Nymphalidae	*Enodia anthedon*	Northern Pearly-Eye	S5
Nymphalidae	*Euphydryas phaeton*	Baltimore Checkerspot	S4
Nymphalidae	*Junonia coenia*	Common Buckeye	SNA
Nymphalidae	*Libytheana carinenta*	American Snout	SNA
Nymphalidae	*Limenitis archippus*	Viceroy	S5
Nymphalidae	*Limenitis arthemis arthemis*	White Admiral	S5
Nymphalidae	*Limenitis arthemis astyanax*	Red-spotted Purple	S5
Nymphalidae	*Megisto cymela*	Little Wood-Satyr	S5
Nymphalidae	*Nymphalis antiopa*	Mourning Cloak	S5
Nymphalidae	*Nymphalis milberti*	Milbert's Tortoiseshell	S5
Nymphalidae	*Nymphalis vaualbum*	Compton Tortoiseshell	S5
Nymphalidae	*Phyciodes cocyta*	Northern Crescent	S5
Nymphalidae	*Phyciodes tharos*	Pearl Crescent	S4

Family	Scientific name	Common Name	S-rank
Nymphalidae	*Polygonia comma*	Eastern Comma	S5
Nymphalidae	*Polygonia interrogationis*	Question Mark	S5
Nymphalidae	*Polygonia progne*	Grey Comma	S5
Nymphalidae	*Speyeria aphrodite*	Aphrodite Fritillary	S5
Nymphalidae	*Speyeria cybele*	Great Spangled Fritillary	S5
Nymphalidae	*Speyria idalia*	Regal Fritillary	SNA
Nymphalidae	*Vanessa atalanta*	Red Admiral	S5
Nymphalidae	*Vanessa cardui*	Painted Lady	S5
Nymphalidae	*Vanessa virginiensis*	American Lady	S5
Nymphalidae	*Satyrodes eurydice*	Eyed Brown	S5
Nymphalidae	*Satyrodes appalachia*	Appalachian Brown	S4
Lepidoptera - Moths			
Hepialidae	*Sthenopsis argenteomaculatus*		
Opostegidae	*Opostega quadristrigella*		
Tineidae	*Monopis pavlovski*		
Tineidae	*Niditinea orleansella*		
Tineidae	*Tinea apimaculella*		
Tineidae	*Xylesthia pruniramiella*	Speckled Xylesthia Moth	
Bucculatricidae	*Bucculatrix ainsella*		
Bucculatricidae	*Bucculatrix coronatella*		
Gracillariidae	*Caloptilia bimaculatella*		
Gracillariidae	*Caloptilia blandella*		
Gracillariidae	*Plagodis sp.*		
Elachistidae	*Acronicta sp.*		

Family	Scientific name	Common Name	S-rank
Elachistidae	*Agonopterix curviineela*	Curvelined Agonopterix Moth	
Elachistidae	*Agonopterix pulvipennella*		
Elachistidae	*Antaeotricha leucillana*	Pale Gray Bird-dropping Moth	
Elachistidae	*Ethmia zelleriella*	Zeller's Ethmia Moth	
Oecophoridae	*Epicallima argenticinctella*	Orange-headed Epicallima Moth	
Coleophoridae	*Oegoconia quadripuncta*	Four-spotted yellowneck	
Autostichidae	*Gerdana caritella*		
Blastobasidae	*Asaphocrita sp.*		
Cosmopterigidae	*Stilbosis tesquela*		
Cosmopterigidae	*Walshia miscecolorella*	Sweetclover Root Borer Moth	
Plutellidae	*Plutella xylostella*	Diamond-back Moth	
Yponomeutidae	*Argyresthia goedartella*		
Yponomeutidae	*Atteva punctella*	Ailanthus Webworm Moth	
Yponomeutidae	*Swammerdamia pyrella*		
Sesiidae	*Synathedon acerni*	Maple Callus Borer Moth	
Gelechiidae	*Aroga argutiola*		
Gelechiidae	*Arogalea cristifasciella*	Striped-backed Moth	
Gelechiidae	*Chionodes bicostomaculella*		
Gelechiidae	*Dichomeria ochripalpella*	Shining Dichomeris Moth	
Gelechiidae	*Dichomeris bilobella*		
Gelechiidae	*Dichomeris flavocostella*	Cream-edged Dochomeris Moth	
Gelechiidae	*Dichomeris kimballi/inversella*		
Gelechiidae	*Metzneria lappella*	Burdock Seedhead Moth	

Family	Scientific name	Common Name	S-rank
Gelechiidae	*Pseaudotelphusa basifasciella*		
Acrolepiidae	*Acrolepiopsis sp.*		
Tortricidae	*Acleris forskaleana*		
Tortricidae	*Aethes angulatana*		
Tortricidae	*Aethes mymara*		
Tortricidae	*Aethes sexdentata*		
Tortricidae	*Ancylis diminutana*		
Tortricidae	*Archips cerasivorana*		
Tortricidae	*Archips fervidana*		
Tortricidae	*Argyrotaenia pinatubana*		
Tortricidae	*Argyrotaenia quercifoliana*	Oak Leafroller Moth	
Tortricidae	*Argyrotaenia velutinana*	Red Banded Leafroller Moth	
Tortricidae	*Choristoneura rosaceana*	Oblique-banded Leafroller moth	
Tortricidae	*Cydia largo*		
Tortricidae	*Cydia latiferreanus*	Filbertwork Moth	
Tortricidae	*Cydia pomonella*	Codling Moth	
Tortricidae	*Ecdytolopha insiticiana*	Locust Twig Borer Moth	
Tortricidae	*Ecdytolopha punctidiscana*	Dotted Ecdytolopha Moth	
Tortricidae	*Endothenia montana*		
Tortricidae	*Epiblema obfuscana*		
Tortricidae	*Epiblema scudderiana*	Scudder's Epiblema Moth	
Tortricidae	*Eumazoria malachitana*	Sculptered Moth	
Tortricidae	*Gretchena amatana*		
Tortricidae	*Olethreutes lacunana*	Lacuna Moth	

Family	Scientific name	Common Name	S-rank
Tortricidae	*Olethreutes versicolorana*		
Tortricidae	*Paralobesia vermoniana*		
Tortricidae	*Paralobesia viteana*		
Tortricidae	*Phaneta awemeana*		
Tortricidae	*Phaneta umbrastriana*		
Tortricidae	*Platynota exasperatana*		
Tortricidae	*Proteoteras aesculana*	Maple Twig Borer Moth	
Tortricidae	*Proteoteras moffatiana*	Maple Shoot Borer Moth	
Tortricidae	*Sparganothis sulphureana*	Aparganothis Fruitworm Moth	
Zygaenidae	*Harrisina americana*	Grapeleaf Skeletonizer Moth	
Limacodidae	*Isa textula*	Crowned Slug Moth	
Limacodidae	*Lithacodes fasciola*	Yellow-shouldered Slug Moth	
Limacodidae	*Tortricidia flexuosa*	Abbreviated Button Slug Moth	
Crambidae	*Achyra rantalis*	Garden Webworm	
Crambidae	*Aethiophysa lentifualis*		
Crambidae	*Anania funebris*		
Crambidae	*Chalcoela iphitalis*		
Crambidae	*Chrysoteuchia topiaria*	Topiary Grass-veneer Moth	
Crambidae	*Crambus agitatellus*	Double-banded Grass-veneer Moth	
Crambidae	*Crambus albellus*	Small White Grass-veneer Moth	
Crambidae	*Crambus girardellus*	Girard's Grass-veneer Moth	
Crambidae	*Crambus hamellus*		
Crambidae	*Crambus laqueatellus*	Eastern Grass-veneer Moth	
Crambidae	*Crambus praefectellus*	Common Grass Veneer Moth	

Family	Scientific name	Common Name	S-rank
Crambidae	*Crocidophora tuberculalis*	Pale-winged Crocidiphora Moth	
Crambidae	*Desmia funeralis*	Grapevine Leafroller	
Crambidae	*Donacaula roscidella*		
Crambidae	*Eudonia strigalis*		
Crambidae	*Eustixia pupula*	Spotted Peppergrass Moth	
Crambidae	*Glaphyria fulminalis*		
Crambidae	*Glaphyria glaphyralis*		
Crambidae	*Hahncappsia neobliteralis*		
Crambidae	*Hahncappsia sp.*		
Crambidae	*Herpetogramma pertextalis*	Bold-feathered Grass Moth	
Crambidae	*Hymenia perspectalis*	Spotted Beet Webworm	
Crambidae	*Lygropia rivulalis*	Bog Lygropia Moth	
Crambidae	*Microcrambus biguttellus*		
Crambidae	*Microcrambus elegans*	Elegant Grass-veneer Moth	
Crambidae	*Munroessa gyralis*	Waterlily Borer Moth	
Crambidae	*Munroessa icciusalis*		
Crambidae	*Nascia acutella*	Streaked Orange Moth	
Crambidae	*Neodactria caliginosella*	Black Grass-veneer Moth	
Crambidae	*Neodactria luteolella*	Mottled Grass-veneer moth	
Crambidae	*Neodactria zeellus*		
Crambidae	*Nomophila nearctica*	Alfalfa Moth	
Crambidae	*Ostrinia nubialis*	European Corn Borer	
Crambidae	*Palpita magniferalis*	Splendid Palpita Moth	
Crambidae	*Pantographa limata*	Basswood Leafroller	
Crambidae	*Paraponyx allionealis*		

Family	Scientific name	Common Name	S-rank
Crambidae	*Paraponyx badiusalis*	Chestnut-marked Pondweed Moth	
Crambidae	*Perispasta caeculalis*	Titian Peale's Pyralid Moth	
Crambidae	*Phlyctaenia coronata*		
Crambidae	*Polygrammodes flavidalis*	Ironweed Root Moth	
Crambidae	*Pyrausta bicoloralis*	Bicolored Pyrausta Moth	
Crambidae	*Saucrobotys futilalis*	Dogbane Saucrobotys Moth	
Crambidae	*Scoparia biplagialis*	Double-striped Scoparia Moth	
Crambidae	*Sitochroa palealis*		
Crambidae	*Synclita obliteralis*	Waterlily Leafcutter Moth	
Crambidae	*Udea rubrigalis*	Celery Leaftier	
Crambidae	*Urola nivalis*	Snowy Urola Moth	
Crambidae	*Vaxi critica*		
Pyralidae	*Acrobasis caryae*	Hickory Shoot Borer Moth	
Pyralidae	*Acrobasis juglandis*	Pecanleaf Caseborer Moth	
Pyralidae	*Acrobasis kaerfottela*		
Pyralidae	*Acrobasis palliolella*	Mantled Acrobasis Moth	
Pyralidae	*Aglossa cuprina*	Grease Moth	
Pyralidae	*Aphomia terrenella*		
Pyralidae	*Dolichomia olinalis*	Yellow-fringed Dolichomia Moth	
Pyralidae	*Erelieva parvulella*		
Pyralidae	*Euzophera semifuneralis*	American Plum Borer Moth	
Pyralidae	*Galasa nigrinodes*	Boxwood Leaftier Moth	
Pyralidae	*Hypsopygia costalis*	Clover Hayworm Moth	
Pyralidae	*Immyrla nigrovittella*		

Family	Scientific name	Common Name	S-rank
Pyralidae	*Moodna ostrinella*	Darker Moodna Moth	
Pyralidae	*Peoria gemmatella*		
Pyralidae	*Pococera expandens*	Striped Oak Webworm Moth	
Pyralidae	*Salebriaria engeli*	Engel's Salebriaria moth	
Pyralidae	*Sciota subcaesiella*	Locust Leafroller Moth	
Pyralidae	*Tosale oviplagalis*	Dimorphic Tosale Moth	
Pyralidae	*Vitula edmondsi*	Dried Fruit Moth	
Drepanidae	*Deprana arcuata*	Arched Hooktip	
Drepanidae	*Eudeilinia herminiata*	Northern Eudilenia	
Geometridae	*Anavitrinelia pampinaria*	Common Grey	
Geometridae	*Biston betularius*	Pepper-and-salt Geometer	
Geometridae	*Cabera erythemaria*	Yellow-dusted Cream Moth	
Geometridae	*Cabera variolaria*	Pink-striped Willow Spanworm	
Geometridae	*Chlorochlamys chloroleuca*	Blackberry Looper Moth	
Geometridae	*Coryphista meadii*	Barberry Geometer	
Geometridae	*Cyclophora packardi*	Packard's Wave	
Geometridae	*Dyspteris abortivaria*	The Bad Wing	
Geometridae	*Ennomos subsignaria*	Elm Spanworm	
Geometridae	*Epimecis hortaria*	Tulip-tree Beauty	
Geometridae	*Euchlaena effecta*		
Geometridae	*Eugonobapta nivosaria*	Snowy Geometer	
Geometridae	*Eulithis diversilineata*	Lesser Grapevine Looper	
Geometridae	*Euphyia unangulata*	Sharp-angled Carpet	
Geometridae	*Eupithecia miserulata*	Common Pug	
Geometridae	*Eutrapela clemataria*	Curve-toothed Geometer	
Geometridae	*Haematopis grataria*	Chickweed Geometer	

Family	Scientific name	Common Name	S-rank
Geometridae	*Heterophleps triguttaria*	Three-spotted Fillip	
Geometridae	*Hethemia pistaciaria*	Pistachio Emerald	
Geometridae	*Hydrelia albifera*	Fragile White Carpet	
Geometridae	*Idea dimidiata*	Single-dotted Wave	
Geometridae	*Itame pustularia*	Lesser Maple Spanworm	
Geometridae	*Lomographa vestaliata*	White Spring Moth	
Geometridae	*Macaria bisignata*	Red-headed Inchworm	
Geometridae	*Macaria gnophosaria*	Hollow-spotted Angle	
Geometridae	*Macaria minorata*	Minor Angle	
Geometridae	*Macaria ocellinata*	Feint-spotted Angle	
Geometridae	*Melanolophia canadaria*	Canadian Melanolophia	
Geometridae	*Mesoleuca ruficillata*	White-ribboned Carpet	
Geometridae	*Nemoria bistriaria*	Red-fringed Emerald	
Geometridae	*Nemoria mimosaria*	White-fringed Emerald	
Geometridae	*Orthonama centrostrigaria*	Bent-line Carpet	
Geometridae	*Orthonama obstipata*	The Gem	
Geometridae	*Pero honestaria*	Honest Pero	
Geometridae	*Plagodis kuetzingi*	Purple Plagodis	
Geometridae	*Prochoerodes transversata*	Large Maple Spanworm	
Geometridae	*Protoboarmia porcelaria*	Porcelain Grey	
Geometridae	*Scopula inductana*	Soft-lined Wave	
Geometridae	*Scopula limboundata*	Large Lace Border	
Geometridae	*Synchlora aerata*	Wavy-lined Emerald	
Geometridae	*Tetracis cachexiata*	White Slant-line	
Geometridae	*Xanthorhoe ferrugata*	Red Twin Spot	
Geometridae	*Xanthorhoe lacustrata*	Toothed Brown Carpet	

Family	Scientific name	Common Name	S-rank
Uraniidae	*Calledapteryx dryopterata*	Brown Scoopwing	
Mimallonidae	*Cicinnus melsheimeri*	Melsheimer's Sack-bearer	
Mimallonidae	*Lacosoma chiridota*	Scalloped Sack-Bearer	
Bombycidae	*Apatelodes torrefacta*	Spotted Apatelodes Moth	
Saturniidae	*Automeris io*	Io Moth	
Saturniidae	*Callosamia angulifera*	Tulip-tree Silk Moth	
Saturniidae	*Dryocampa rubicunda*	Rosy Maple Moth	
Saturniidae	*Hyalophora cecropia*	Cecropia Moth	
Sphingidae	*Aelloopos titan*		
Sphingidae	*Amphion floridensis*	Nessus Sphinx Moth	
Sphingidae	*Ceratomia amynfor*	Elm Sphinx Moth	
Sphingidae	*Ceratomia undulosa*	Waved Sphinx	
Sphingidae	*Darapsa myron*	Virginia Creeper Sphinx Moth	
Sphingidae	*Darapsa versicolor*		
Sphingidae	*Deidamia inscripta*	Lettered Sphinx Moth	
Sphingidae	*Dolba hyloeus*	Pawpaw Sphinx	
Sphingidae	*Eumorpha pandorus*	Pandorus Sphinx Moth	
Sphingidae	*Hemaris thysbe*	Hummingbird Clearwing Moth	
Sphingidae	*Laothoe juglandis*	Walnut Sphinx Moth	
Sphingidae	*Pachyspinx modesta*	Big Poplar Sphinx Moth	
Sphingidae	*Paonias exaecatus*	Blinded Sphinx	
Sphingidae	*Paonias myops*	Small-eyed Sphinx	
Sphingidae	*Smerinthus jamaicensis*	Twin-spotted Sphinx	
Sphingidae	*Sphinx chersis*	Great Ash Sphinx	
Sphingidae	*Sphinx eremitus*	Hermit Sphinx Moth	
Sphingidae	*Sphinx gordius*	Apple Sphinx Moth	

Family	Scientific name	Common Name	S-rank
Notodontidae	*Clostera inclusa*	Many-lined Prominent Moth	
Notodontidae	*Dasylophia thyatiroides*	Gray-patched Prominent	
Notodontidae	*Datana contracta*	Contracted Datana	
Notodontidae	*Datana integerrima*	Walnut Caterpillar Moth	
Notodontidae	*Ellida caniplaga*	Linden Prominent	
Notodontidae	*Gluphisia septentrionis*	Common Gluphisia Moth	
Notodontidae	*Heterocampa biundata*	Wavy-lined Heterocampa	
Notodontidae	*Heterocampa guttivitta*	Maple Prominent	
Notodontidae	*Hyparpax aurora*	Pink Prominent	
Notodontidae	*Lochmaeus bilineatus*	Double-lined Prominent	
Notodontidae	*Nadata gibbosa*	White-dotted Prominent	
Notodontidae	*Nerice bidentata*	Double-toothed Prominent	
Notodontidae	*Peridea angulosa*	Angulose Prominent	
Notodontidae	*Peridea basitriens*	Oval-based Prominent	
Notodontidae	*Schizura leptinoides*	Black-blotched Schizura	
Notodontidae	*Schizura unicornis*	Unicorn Caterpillar Moth	
Notodontidae	*Symmerista leucitys*	Orange-humped Mapleworm Moth	
Erebidae	*Apantesis nais*	Nais Tiger Moth	
Erebidae	*Caenurgina erechtea*	Forage Looper Moth	
Erebidae	*Caenurgina sp*	Clover Looper Moth	
Erebidae	*Catocala briseis*		
Erebidae	*Catocala cara*	Darling Underwing	
Erebidae	*Catocala concumbens*		
Erebidae	*Catocala ilia*	Ilia Underwing	
Erebidae	*Catocala minuta*	Little Underwing	

Family	Scientific name	Common Name	S-rank
Erebidae	*Catocala retecta*	The Yellow-gray Underwing	
Erebidae	*Catocala subnata*	Youthful Underwing Moth	
Erebidae	*Catocala ultronia*	Ultronia Underwing	
Erebidae	*Catocala unijuga*	Once-married Underwing	
Erebidae	*Celiptera frustulum*	Black Bit Moth	
Erebidae	*Cisseps fulvicollis*	Yellow-collared Scape Moth	
Erebidae	*Crambidia pallida*	Pale Lichen Moth	
Erebidae	*Ctenucha virginica*	Virginia Ctenucha Moth	
Erebidae	*Cycnia oregonensis*	Oregon Cycnia	
Erebidae	*Cycnia tenera*	Delicate Cycnia Moth	
Erebidae	*Dasychira sp.*		
Erebidae	*Drasteria adumbrata alleni*		
Erebidae	*Estigmene acrea*	Salt Marsh Moth	
Erebidae	*Euchaetes egle*	Milkweed Tussock Moth	
Erebidae	*Euparthenos nubilis*	Locust Underwing	
Erebidae	*Grammia phyllira*	Phyllira Tiger Moth	
Erebidae	*Grammia virgo*	Virgin Tiger Moth	
Erebidae	*Halsydota tessellaria*	Banded Tussock Moth	
Erebidae	*Haploa clymene*	Clymene Moth	
Erebidae	*Haploa colona*		
Erebidae	*Haploa militaris*		
Erebidae	*Hyoprepia miniata*	Scarlet-winged Lichen Moth	
Erebidae	*Hypena baltimoralis*	Baltimore Bomolocha	
Erebidae	*Hypena bijugalis*	Dimorphic Bomolocha	
Erebidae	*Hypena deceptalis*	Deceptive Bomolocha	
Erebidae	*Hypena madefactalis*	Grey-edged Bomolocha	

Family	Scientific name	Common Name	S-rank
Erebidae	*Hypena manalis*	Flowing-line Bomolocha	
Erebidae	*Hypena palparia*	Mottled Bomolocha	
Erebidae	*Hypena scabra*	Green Cloverworm Moth	
Erebidae	*Hypena sordidula*	Sordid Bomolocha	
Erebidae	*Hyphantria cunea*	Fall Webworm	
Erebidae	*Hypoprepia fucosa*	Painted Lichen Moth	
Erebidae	*Idia aemula*	Common Idia	
Erebidae	*Idia americalis*	American Idia	
Erebidae	*Idia lubricalis*	Glossy Black Idia	
Erebidae	*Idia scobialis*	Smoky Idia	
Erebidae	*Lascoria ambigualis*	Ambiguous Moth	
Erebidae	*Ledaea perditalis*	Lost Owlet	
Erebidae	*Lophocampa caryae*	Hickory Tussock Moth	
Erebidae	*Lymantria dispar*	Gypsy Moth	
Erebidae	*Macrochilo absorptalis*	Slant-lined Owlet	
Erebidae	*Macrochilo orciferalis*	Bronzy Macrochilo Moth	
Erebidae	*Metalectra discalis*	Common Fungus Moth	
Erebidae	*Metalectra quadrisignata*	Four-spotted Fungus Moth	
Erebidae	*Nigetia formosalis*	Thin-winged Owlet	
Erebidae	*Orgyia leucosigma*	White-marked Tussock Moth	
Erebidae	*Parallelia bistriaris*	Maple Looper Moth	
Erebidae	*Phalaenophana pyramusalis*	Dark-banded Owlet	
Erebidae	*Phalaenostola larentioides*	Black-banded Owlet	
Erebidae	*Phragmatobia fuliginosa*	Ruby Tiger Moth	
Erebidae	*Platarctia parthernos*		

Family	Scientific name	Common Name	S-rank
Erebidae	*Plusiodonta compressipalpa*	Moonseed Moth	
Erebidae	*Pyrrharctia isabella*	Isabella Tiger Moth	
Erebidae	*Renia*		
Erebidae	*Rivula propinqualis*	Spotted Grass Moth	
Erebidae	*Scoliocampa libatrix*	Dead Wood Borer Moth	
Erebidae	*Spargaloma sexpuncta*	Six-spotted Grey	
Erebidae	*Spilosoma congrua*	Agreeable Tiger Moth	
Erebidae	*Spilosoma latipennis*	Pink-legged Tiger Moth	
Erebidae	*Spilosoma virginicum*	Virginian Tiger Moth	
Erebidae	*Zale galbanata*	Maple Zale Moth	
Erebidae	*Zale helata*	Brown-spotted Zale	
Erebidae	*Zale lunata*	Lunate Zale	
Erebidae	*Zale minerea*	Colorful Zale	
Erebidae	*Zanclognatha lituralis*	Lettered Zanclognatha	
Noctuidae	*Acronicta afflicta*	Afflicted Dagger Moth	
Noctuidae	*Acronicta haesitata*	Hesitant Dagger Moth	
Noctuidae	*Acronicta noctivaga*	Night-wandering Dagger Moth	
Noctuidae	*Acronicta spinigera*	Nondescript Dagger Moth	
Noctuidae	*Agripodes fallax*	The Green Marvel	
Noctuidae	*Agrotis ipsilon*	Ipsilon Dart	
Noctuidae	*Agrotis volubilis*	Voluble Dart	
Noctuidae	*Aletia oxygala*	Lesser Wainscot	
Noctuidae	*Alypia octomaculata*	Eight-spotted Forester Moth	
Noctuidae	*Amphipyra pyramidoides*		
Noctuidae	*Amphipyra pyramidoides*	Copper Underwing	

Family	Scientific name	Common Name	S-rank
Noctuidae	*Anagrapha falcifera*	Celery Looper Moth	
Noctuidae	*Autographa precationis*	Common Looper	
Noctuidae	*Callopistria mollissima*	Pink-shaded Fern Moth	
Noctuidae	*Charadra deridens*	The Laugher	
Noctuidae	*Chytonix palliatricula*	Cloaked Marvel	
Noctuidae	*Cirrophanus triangulifer*	Goldenroad Stowaway	
Noctuidae	*Colocasia propinquilinea*	Close-banded Yellowhorn	
Noctuidae	*Crambodes talidiformis*	Verbina Moth	
Noctuidae	*Crocigrapha normani*	Norman's Quaker	
Noctuidae	*Elaphria grata*	Grateful Midget	
Noctuidae	*Eudryas grata*	Beautiful Wood Numph	
Noctuidae	*Eudryas unio*	Pearly Wood Nymph	
Noctuidae	*Euplexia benesimilis*	American Angle Shades	
Noctuidae	*Eutelia pulcherrima*	Beautiful Eutelia	
Noctuidae	*Euxoa tessellata*	Tessellate Dart	
Noctuidae	*Faronta diffusa*	Wheat Head Armyworm Moth	
Noctuidae	*Faronta rubripennis*	The Pink Streak	
Noctuidae	*Feltia subgothica*	Subgothic Dart	
Noctuidae	*Galgula partitia*	The Wedgling	
Noctuidae	*Homorthodes furfurata*	Scurfy Quaker	
Noctuidae	*Hyppa xylinoides*	Common Hyppa	
Noctuidae	*Leucania linita*		
Noctuidae	*Leucania multilinea*	Many-lined Wainscot	
Noctuidae	*Leucania ursula*	Ursula Wainscot	
Noctuidae	*Leuconycta diphteroides*	Green Leuconycta	
Noctuidae	*Leuconycta lepidula*	Marbled-green Leuconycta	

Family	Scientific name	Common Name	S-rank
		Moth	
Noctuidae	*Lithacodia carneola*	Pink-barred Lithacodia	
Noctuidae	*Lithacodia muscosula*	Large Mossy Lithacodia	
Noctuidae	*Lithacodia synochitis*	Black-dotted Lithacodia	
Noctuidae	*Marathyssa basalis*	Light Marathyssa	
Noctuidae	*Marathyssa inficita*	Dark Marathyssa	
Noctuidae	*Melanchra sp.*		
Noctuidae	*Noctua pronuba*	Large Yellow Underwing	
Noctuidae	*Oclopleura plecta*	Flame-shoulder Dart	
Noctuidae	*Ogdoconta cinereola*	Common Pinkband	
Noctuidae	*Orthodes crenulata*	Rustic Quaker	
Noctuidae	*Palthis angulalis*	Dark-spotted Palthis	
Noctuidae	*Palthis asopialis*	Feint-spotted Palthis	
Noctuidae	*Panthea furcilla*	Eastern Panthea	
Noctuidae	*Platysenta vecors*	Dusky Groundling	
Noctuidae	*Platysenta videns*	White-dotted Groundling	
Noctuidae	*Polia goodelli*	Goodell's Arches	
Noctuidae	*Protorthodes oviduca*	Ruddy Quaker	
Noctuidae	*Proxenus miranda*	Miranda Moth	
Noctuidae	*Pseudaletia unipuncta*	Armyworm Moth	
Noctuidae	*Pseudeva purpurigera*	Straight-lined Looper	
Noctuidae	*Pseudorthodes vecors*	Small Brown Quaker	
Noctuidae	*Raphia frater*	The Brother	
Noctuidae	*Schinia arcigera*	Arcigera Flower Moth	
Noctuidae	*Schinia lynx*	Lynx Flower Moth	
Noctuidae	*Simyra henrici*	Henry's Marsh Moth	

Family	Scientific name	Common Name	S-rank
Noctuidae	*Stiriodes obtusa*	Obtuse Yellow	
Noctuidae	*Tarachidia candefacta*	Olive-shaded Bird-dropping Moth	
Noctuidae	*Tarachidia erastrioides*	Small Bird-dropping Moth	
Noctuidae	*Tricholita signata*	Signate Quaker	
Noctuidae	*Ulolonche modesta*		
Nolidae	*Baileya australis*	Small Baileya	
Nolidae	*Baileya levitans*	Pale Baileya	
Nolidae	*Nola cilicoides*	Blurry-patched Nola	
Nolidae	*Nola triquetrana*	Three-spotted Nola	

Appendix 8. Checklist of the Freshwater Mussels of Rondeau Provincial Park

This checklist contains all mussels known to occur or have occurred within Rondeau Bay and adjacent Lake Erie. The list contains 22 unionids and three other mussel species. The checklist was derived from the Department of Fisheries and Ocean's Lower Great Lakes Unionid Database, and supplemented by park records.

S-Ranks refer to Ontario subnational conservation status ranks as defined by the NHIC (see Appendix 1). S-Ranks are current as of May 2012. SARO status (SC, THR, END) represent species status as identified on the Species at Risk in Ontario (SARO) list (see Appendix 1). COSEWIC status codes as per the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2012b).

Family	Genus	Common Name	S-Rank	COSEWIC/ SARO
Unionidae	*Amblema plicata*	Three-ridge	S4	
Unionidae	*Anodontoides ferussacianus*	Cylindrical Papershell	S4	
Unionidae	*Elliptio dilatata*	Spike	S5	
Unionidae	*Epioblasma triquetra*	Snuffbox	S1	END/END
Unionidae	*Fusconaia flava*	Wabash Pigtoe	S2S3	
Unionidae	*Lampsilis cardium*	Plain Pocketbook		
Unionidae	*Lampsilis radiata*	Eastern Lampmussel	S4	
Unionidae	*Lampsilis siliquoidea*	Fatmucket	S5	
Unionidae	*Lasmigona costata*	Fluted-shell	S5	
Unionidae	*Leptodea fragilis*	Fragile Papershell	S4	
Unionidae	*Ligumia nasuta*	Eastern Pondmussel	S1	END/END
Unionidae	*Ligumia recta*	Black Sandshell	S3	
Unionidae	*Obliquaria reflexa*	Threehorn Wartyback	S1	
Unionidae	*Pleurobema sintoxia*	Round Pigtoe	S1	END/END
Unionidae	*Potamilus alatus*	Pink Heelsplitter	S3	
Unionidae	*Ptychobranchus fasciolaris*	Kidneyshell	S1	END/END
Unionidae	*Pyganodon grandis*	Giant Floater	S5	
Unionidae	*Quadrula pustulosa*	Pimpleback	S3	
Unionidae	*Quadrula quadrula*	Mapleleaf Mussel	S2	THR/THR
Unionidae	*Truncilla donaciformis*	Fawnsfoot	S2	END/END
Unionidae	*Truncilla truncata*	Deertoe	S3	
Unionidae	*Villosa iris*	Rainbow Mussel	S2S3	END/THR
Dreissenidae	*Dreissena polymorpha*	Zebra Mussel	SNA	
Sphaeiidae	*Pisidium sp.*	Peaclam spp.		

Corbiculidae	*Corbicula fluminea*	Asian Clam	SNA	