A Summary of Ecological Values and Pressures Associated with Cottage Lot Tenure in Rondeau Provincial Park

Ministry of Natural Resources and Forestry

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Ontario

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Executive Summary

Rondeau Provincial Park is an area of extremely high biodiversity in a region of Ontario where the majority of the terrestrial landscape has been cleared for agriculture and development. It has been recognized as an Important Bird Area, an Area of Natural Scientific Interest, and houses the largest diversity of species at risk of any park in Ontario. It also protects over a dozen imperilled ecosystems and contributes to provincially significant life science representation targets in Ontario.

Rondeau is a cuspate sandspit formation supporting Carolinian forest, freshwater dunes, prairie, savannah and a provincially significant wetland. It is a provincially significant earth science feature found nowhere else in Canada.

Rondeau provides nationally and provincially significant protection to a wide suite of natural heritage values and is used recreationally by over 160,000 people per year. Identified ecological values within the park include but are not limited to: species at risk, provincially significant species, natural cover, water quality and quantity, earth and life science representation, wildlife habitat, natural disturbance patterns, ecological processes, rare ecosystems, habitat connectivity and biodiversity.

Recreational uses within the park include camping, bird watching, angling, photography, hiking, cycling and private cottaging. All of these uses and the infrastructure developed to support them contribute to the cumulative pressures exerted on the park's values. A wide suite of impacts on natural heritage values result from any development and human activities. With regard to Rondeau specifically, three topics are of particular concern; species at risk, critically imperilled ecosystems, and invasive species.

Private cottage lots and their associated recreational activities have existed for over a century in Rondeau Provincial Park. Many of the cottages in Rondeau are within species at risk habitat. Populations of species at risk are located both on cottage lots and throughout the rest of the park. Some of the threats to species at risk in Rondeau are associated with recreational use and access by both public and cottagers. Some species are put at increased risk in Rondeau because of cottages and associated recreational activities.

Many of the cottages also are located within or adjacent to fragile ecosystems ranked as imperilled in the province of Ontario. Recreational use of these ecosystems by cottagers and the public has degraded them relative to their natural state and threatens their ecological integrity.

The cottage lots are a continuing source of invasive plant species that spread into the rest of the park, harming species at risk populations, ecological communities, and endangered ecosystems. Every year, Rondeau Park staff and volunteers spend time and resources removing invasive plant species, some of which originated on cottage lots.

The existing state of the cottage infrastructure and associated uses presents substantial challenges to the maintenance and restoration of ecological integrity as defined by the *Provincial Parks and Conservation Reserves Act, 2006*. Addressing these ecological issues is necessary to prevent further degradation of nationally and provincially significant ecosystems and to ensure the sustainability of populations and habitats of species at risk.

Several of the public and private recreational uses of Rondeau Provincial Park affect natural heritage values. This report is focused on ecological values and pressures associated with cottaging and related uses to help inform the policy review process on this specific topic.

Résumé

Le parc provincial Rondeau est le haut lieu de la biodiversité dans une région de l'Ontario où la plupart des terres ont été déboisées à des fins agricoles et de développement. Cette région est considérée comme une zone importante pour la conservation des oiseaux et une zone d'intérêt naturel et scientifique où l'on trouve la plus grande diversité d'espèces en péril de tout parc en Ontario. Le parc protège aussi plus d'une douzaine d'écosystèmes en péril. De plus, il contribue aux cibles de représentation d'importance provinciale des sciences de la vie en Ontario.

Le parc Rondeau est une formation sablonneuse cuspidée soutenant la forêt carolinienne, des dunes d'eau douce, une prairie, une savane et une terre humide d'importance provinciale. Ses caractéristiques liées aux sciences de la terre ont une importance provinciale et sont uniques au Canada.

Le parc Rondeau protège une vaste gamme de valeurs du patrimoine naturel d'importance nationale et provinciale. En outre, plus de 160 000 personnes s'y rendent chaque année pour se livrer à des activités récréatives. Ses valeurs écologiques comprennent des espèces en péril, des espèces d'importance provinciale, une couverture naturelle, de l'eau de qualité en grande quantité, une représentation scientifique de la terre et de la vie, un habitat faunique, des modèles de perturbation naturelle, des processus écologiques, des écosystèmes rares, la connectivité des habitats et la biodiversité.

Le parc est utilisé à des fins récréatives comme le camping, l'observation d'oiseaux, la pêche sportive, la photographie, la randonnée pédestre, le vélo et les chalets privés. Ces utilisations et l'infrastructure connexe exercent des pressions sur le parc. Tout aménagement et toute activité humaine ont une incidence considérable sur son patrimoine naturel. Les espèces en péril, les écosystèmes gravement en péril et les espèces envahissantes sont des enjeux importants dans le parc Rondeau.

Les lotissements pour chalets privés et les activités récréatives connexes existent depuis plus d'un siècle dans le parc provincial Rondeau. Un grand nombre de chalets aménagés dans le parc Rondeau se trouvent dans l'habitat d'espèces en péril. Il y a des espèces en péril dans les lotissements pour chalets et ailleurs dans le parc. Les activités récréatives et l'accès au parc par le public et les propriétaires de chalets

menacent les espèces en péril. En outre, les chalets et les activités récréatives qui en découlent accroissent les risques pour certaines espèces dans le parc Rondeau.

Un grand nombre de chalets sont situés à l'intérieur ou à proximité d'écosystèmes fragiles considérés comme étant en péril en Ontario. L'usage récréatif de ces écosystèmes par les propriétaires de chalet et le public a détérioré leur état naturel et menace leur intégrité écologique.

Les lotissements pour chalets sont une source constante d'espèces de plantes envahissantes qui se propagent dans le reste du parc, mettant en danger les populations d'espèces en péril, les communautés écologiques et les écosystèmes en voie de disparition. Chaque année, le personnel et les bénévoles du parc Rondeau enlèvent les espèces de plantes envahissantes, dont certaines se sont propagées à partir des lotissements pour chalets.

L'état actuel de l'infrastructure des chalets et les utilisations connexes créent des défis de taille quant au maintien et à la restauration de l'intégrité écologique, telle que définie dans la *Loi de 2006 sur les parcs provinciaux et les réserves de conservation*. Il faut régler ces questions écologiques pour éviter toute dégradation supplémentaire des écosystèmes d'importance nationale et provinciale et assurer la viabilité des populations et des habitats des espèces en péril.

Plusieurs utilisations publiques et privées du parc provincial Rondeau à des fins récréatives ont une incidence sur les valeurs du patrimoine naturel. Le présent rapport met l'accent sur les valeurs écologiques et les pressions exercées par les chalets et les utilisations connexes dans le but de faciliter l'examen des politiques portant sur cette question.

Preface

Ontario's provincial parks are governed under the *Provincial Parks and Conservation Reserves Act, 2006* (PPCRA). Under this Act, all planning and management activities within provincial parks are required to follow two guiding principles:

1. Maintenance of ecological integrity shall be the first priority and the restoration of ecological integrity shall be considered.
2. Opportunities for consultation shall be provided. 2006, c. 12, s. 3.

Ecological integrity is defined as "…a condition in which biotic and abiotic components of ecosystems and the composition and abundance of native species and biological communities are characteristic of their natural regions and rates of change and ecosystem processes are unimpeded." 2006, c. 12, s. 5 (2).

Ecological integrity includes but is not limited to:

- healthy and viable populations of native species, including species at risk, and maintenance of the habitat on which the species depend; and
- levels of air and water quality consistent with protection of biodiversity and recreational enjoyment. 2006, c. 12, s. 5 (3).

Provincial parks and conservation reserves are dedicated to the people of Ontario, with the intent that "… these areas shall be managed to maintain their ecological integrity and to leave them unimpaired for future generations." 2006, c. 12, s. 6.

Thus, planning and management decisions in provincial parks must be conducted with consideration of factors which may impair the ability to maintain or enhance ecological integrity, including species at risk and their habitat.

Many activities, both public and private, have the potential to impact the ecological integrity of Rondeau Provincial Park. The MNRF regularly reviews these activities and takes steps to address those that impact ecological integrity. Examples of these steps include road closures, habitat restoration, invasive species removal and the careful use of fire to maintain ecosystems.

This report focuses on pressures likely to be associated with cottage lots and their uses to inform the policy review process and aid the MNRF in considering mitigative measures that could be taken to reduce risks to ecological integrity.

This report provides a review, synthesis and general discussion regarding ecological values in Rondeau Provincial Park, focusing primarily on those significant values that occur in the vicinity of the cottage lots and that are likely to be affected by related activities. It is based on available published literature, park-specific studies prepared by government and consultants, and other available information. Environmental pressures associated with other recreational uses in Rondeau Provincial Park (e.g., waterfowl hunting, camping, bird watching) are out of the scope of this review, as are other values that are not specifically natural heritage values.

Context

Rondeau Provincial Park is one of the oldest protected areas in Ontario, established in 1894 (OMNR, 1991). It is an area of high biodiversity, with more recorded species at risk than any other provincial park in Ontario (Steinberg, 2012), several endangered ecosystems (Dobbyn and Pasma, 2012), and possibly the highest biodiversity of any protected area in Ontario. It includes part of a provincially significant wetland, is recognized as an Important Bird Area, a life science Area of Natural Scientific Interest (ANSI) and is a tourist destination for over 160,000 visitors a year. The importance of Rondeau in protecting biodiversity and species at risk is evident, as most of the surrounding natural forest cover has been removed for agriculture and development (Henson and Brodribb, 2005). The park also plays an important role in meeting conservation targets outlined in the Rondeau-Erie Coast Conservation Action Plan (Jalava *et al*., 2013), a collaborative, multi-agency conservation plan that focuses on the unique ecosystems and species living in this area of Ontario.

Government and academic experts have conducted significant amounts of research in Rondeau Provincial Park. Several up-to-date inventories including a comprehensive life science inventory, septic system impact survey, scores of other research papers, and a comprehensive literature review were consulted in preparing this summary report of values and pressures.

Despite its national and regional significance, Rondeau has a wide array of pressures on its natural heritage values. An over-abundance of deer has changed the structure of the forest through over-browsing of young trees and understory vegetation, limiting recruitment of new trees into the canopy (Ontario Parks, 2001). Invasive plant species threaten to out-compete endangered plants and alter wetlands within the park. Rapid erosion is occurring on the south tip of the park due to the installation of break walls at Erieau immediately to the west. Cottages, roads and other infrastructure within the park fragment natural ecosystems, occupy significant areas of imperilled dune and savannah communities, and provide a pathway for invading species (Dobbyn and Pasma, 2012).

Cottages have existed in Rondeau since the 1890s (OMNR 1991). The establishment of cottages was encouraged at the time by the provincial government in an effort to stimulate tourism. By the mid 1950s approximately 449 private cottages existed in Rondeau Provincial Park. In 1954 the provincial government reversed its policy that supported private cottages in provincial parks, and ceased making private tenure available. A new policy to restore provincial parks to as near as possible to their natural state for the benefit, enjoyment and advantage of the people of Ontario was adopted. Phase out of cottage tenure was intended to occur gradually as the last tenure agreement issued for each cottage lot expired. In 1978 and in 1996 cottage lot tenure were extended for 21 years, respectively. Currently 283 private cottage lots exist in Rondeau Provincial Park. The size and use of these structures varies by cottage. Some cottages are small and consist of the original building structure. Others have been rebuilt and now resemble modern day houses. Use of these cottages also varies, with some used as year round residences (Brad Connor, pers. comm).

The Ministry of Natural Resources and Forestry is continuing to work to reduce the pressures on the park's natural heritage values. For example, controlled reductions of deer, invasive plant removal programs, and the re-introduction of fire into the park landscape are helping to preserve and restore some of these values. Directed research and monitoring helps to guide Ontario Parks staff in managing the park.

Area Description

Rondeau Provincial Park is a tear-drop-shaped peninsula that extends south into Lake Erie. It is located in southwestern Ontario in Harwich Township of Kent County, in the

amalgamated municipality of Chatham-Kent. The park is approximately 4 kilometres wide, 8 kilometres long with approximately 25% of the park being terrestrial, 50% water and 25% wetland. The western side of the park is comprised mainly of water and wetland, and the eastern side of the park is terrestrial, with much of the park infrastructure and cottage lots occurring there, particularly in the north-eastern part of the park (Figure 1).

The cottage lots in Rondeau Provincial Park are located in three distinct areas. The majority (approximately 75%) of the cottages form a row that stretches over 7 km parallel to the eastern lakeshore. These cottage lots are found primarily within dune and savannah ecosystems. The remainder of the cottage lots occur on the northwestern side of the park and in a subdivision near the northern boundary of the park. Cottage lots occupy approximately 0.62% (approximately 20 hectares) of the total park area (which includes open water and wetland) or about 2.2% of the terrestrial portion of the park.

Table 1. Select area calculations for Rondeau Provincial Park

Value	Area (hectares)	% of Park
Total Regulated Area	3254.0	N/A
Wetland	775.4	23.8
Water	1669.2	51.3
Terrestrial Area	857.6	26.4
Campground and picnic areas	34.2	13.5
Roads/utilities	19.4	0.6
Tenured Cottage Area	20.54	0.6
Area Modified by Cottages	41.7	1.3
Park infrastructure	3.2	9.8

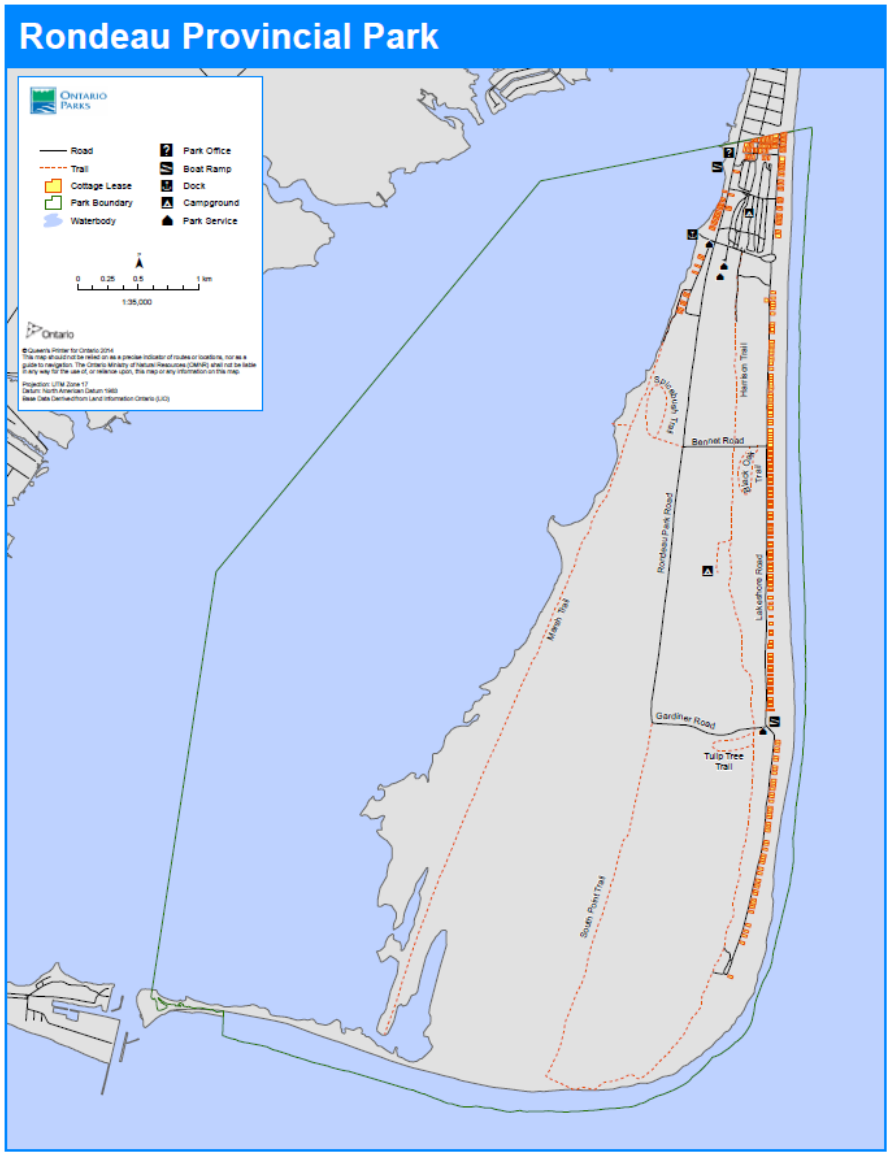

Figure 1. Map of Rondeau Provincial Park

Values

Natural heritage features or processes that are important enough to warrant special attention are often referred to as ‘values’ (OMNR, 2014a). Environmental or natural

heritage values in Rondeau Provincial Park are listed in Table 1. Those that are relevant to this summary are provided with an asterisk.

Table 2. Natural heritage values in Rondeau Provincial Park (*denotes relevance to this summary)

Ecological Value	Ecological Value
Mammal communities	Hydrological function
Reptile communities*	Natural disturbance patterns
Amphibian communities*	Soils
Bird communities	Connectivity (landscape scale)
Insect communities*	Connectivity (local scale)*
Fish communities	Nutrient cycling
Plant communities*	Air quality
Species at risk*	Cuspate Sandspit formation
Rare vegetation communities*	Carbon sequestration
Biodiversity*	Ground water quality/quantity*
Plant regeneration*	Surface water quality/quantity
Carolinian forest*	Bird migration
Sand dunes*	Wetlands
Core area	

Many of the natural heritage values in Rondeau Provincial Park are unlikely to be affected by cottages or related uses. However, some natural heritage values do have the potential to be affected. The following sections provide a more detailed review of several of the natural heritage values that have the potential to be affected by cottages and associated activities (Values Section) and associated pressures (Pressures Section) derived from a review of literature, reports and park planning documents.

Species at Risk

Rondeau has the highest recorded diversity of species at risk of any provincial park in Ontario (Steinberg, 2012). This includes over 75 plants and animals identified on the Species at Risk in Ontario (SARO) list. Some of these species at risk have not been seen in recent years and may now be extirpated from Rondeau (Dobbyn and Pasma, 2012).

Plants

Over 300 species of plants in Rondeau are considered to be nationally, provincially, or locally, significant (Savanta, Inc., 2009). Some of these species warrant highlighting, below because their habitat is located near or on some of the cottage lots or there is the potential for them to be directly or indirectly affected by associated activities.

Nodding Pogonia (*Triphora trianthophora*): The provincial stronghold for this endangered orchid is within Rondeau Provincial Park, as it is found only in one other location (a small woodlot) in Canada (Dobbyn and Pasma, 2012).

Common Hoptree (*Ptelea trifoliata*) is a threatened small tree species which grows on sandy and well drained shorelines and dunes. It is estimated that 38 native trees occur in the park, with an additional 92 trees having been planted through recovery efforts (Dobbyn and Pasma, 2012).

Snakes and Lizards

Rondeau Provincial Park is well known as an important area for reptile diversity. Snakes at risk in Rondeau include the endangered Eastern Foxsnake (*Pantherophis gloydi*), the threatened Eastern Hog-nosed Snake (*Heterodon platyrhinos*). The Eastern Ribbonsnake (*Thamnophis sauritus*) and Milksnake (*Lampropeltis triangulum*) are ranked as Special Concern. The endangered Butler's Gartersnake (*Thamnophis buterli*) is extirpated from Rondeau Provincial Park (COSEWIC, 2010c).

The endangered Common Five-lined Skink (*Plestiodon fasciatus*) is found throughout Rondeau and is known to use buildings and other human – made structures for basking (Dobbyn and Pasma, 2012). Lack of available microhabitat such as logs and driftwood can limit population persistence of Five-lined Skinks (Hecnar and M'Closkey, 1998).

Turtles

Several species of turtles that are at risk in Ontario are found in Rondeau Provincial Park. These include the threatened Blanding's Turtle (*Emydoidea blandingii*), and the Special Concern Map Turtle (*Graptemys geographica*) and Snapping Turtle (*Chelydra serpentina),* among others. These three species are discussed more fully in the Pressures section of this report.

Fowler's Toad

The endangered Fowler's Toad (*Anaxyrus fowleri*) is found in only three locations in Ontario, Rondeau Provincial Park being the most westerly population (COSEWIC, 2010a). These animals live on the beach and dunes of the eastern shore of Rondeau. Fowler's Toads burrow in the sand during the day and are vulnerable to sand compaction.

Due to the natural process of sand accumulating on the eastern beach and being blown inland, the beach/dune area of Rondeau has increased in size over the years. This has increased the amount of dune habitat that can be used by Fowler's toads by over 50 hectares (OMNR, 2013e).

Birds

About half of the endangered Prothonotary Warblers (*Protonotaria citrea*) in Canada breed in Rondeau Provincial Park (COSEWIC, 2007c; McCracken and Somple, 2008). These warblers nest in cavities in dead trees over standing water.

Other Rare Species – Insects and Plants

It is important to note that the list of recognized species at risk in Ontario includes only those species that have been evaluated as being at risk by the Committee on the Status of Species at Risk in Ontario (COSSARO). There are many other species within Rondeau that are rare and of conservation concern, but have not been evaluated by COSSARO and are not formally classified as species at risk. Over 300 plant species in Rondeau Provincial Park are considered to be nationally, provincially, or locally significant (Savanta, 2009). For example, Green Milkweed (*Asclepias viridiflora*) is a rare milkweed found in open dune areas in Rondeau (Dobbyn and Pasma, 2012).

Over 1,700 insect species have been identified in Rondeau Provincial Park, primarily by the University of Guelph insect lab (see Dobbyn and Pasma, 2012). Of these, many insects are found only in prairies, dunes or savannahs and as such, are found in only a few places in Ontario (Marshall *et al*., 2005b) including Rondeau Provincial Park. Others are even more rare, having only been recorded in Rondeau Provincial Park within Canada (Paiero and Buck, 2004; Paiero and Marshall, 2003; Marshall *et al*., 2005a, 2005b). Disruptions to the integrity of the habitats upon which these insects rely may pose a conservation concern.

Rare Ecosystems

Extensive classification and mapping of the ecosystems within Rondeau Provincial Park has been completed (Dobbyn and Pasma, 2012). A total of 102 vegetation types have been identified, of which 12 are critically imperilled and another 7 are provincially significant (Dobbyn and Pasma, 2012). These rare ecosystems are associated primarily with dune, prairie, and savannah areas in Rondeau.

National Context

Rondeau is a cuspate sand spit formation covered in a Carolinian forest. This landform/vegetation feature is not found anywhere else in Canada (OMNR, 1991). This sand spit formation is an excellent example of this type of geologic feature in Canada (Trenhaile, 1998).

Provincial Context

The Province of Ontario has a target to protect a minimum of 50 hectares or 1% of every naturally occurring ecosystem in a representative system of protected areas (OMNR, 2011). Much of the natural vegetation in southwestern Ontario, where Rondeau is located, has been removed for other land uses. As a result, Rondeau Provincial Park is critical to meeting Ontario's protection targets. At least 23 rare ecosystems are found within the park including freshwater dunes, savannahs and prairies.

Regional Context

The natural heritage features in Rondeau are regionally important because much of southwestern Ontario has been cleared for agriculture and development. Environment

Canada recommends retaining 50% forest cover in an area to support healthy aquatic systems and species (Environment Canada, 2013). The Municipality of Chatham-Kent has less natural cover than any other upper tier municipality in Ontario, with 4% forest cover (Lawrence and Associates, 2014). Rondeau is the largest and most significant natural area remaining in the Chatham-Kent area. Currently, many of the remaining woodlots in the area are being cleared, apparently due to high land values and lack of a tree-cutting bylaw (Gilbert and Gilbert, 2013), making the natural heritage values of Rondeau even more important at the regional level.

Vulnerable Ecological Processes

Natural processes such as succession (for example, on dunes, where sand is trapped by plants, ultimately leading to areas with stable vegetation and other areas where the process is in earlier stages) and natural disturbance (such as fire and wind) are ecologically important (OMNR, 2011). These processes are essential to the conservation of biodiversity and the maintenance of ecological integrity (OMNR, 2011).

Fire is an important tool in the maintenance of several ecosystems that are found in Rondeau, including prairies and savannahs (OMNR, 2011). The Ministry of Natural Resources and Forestry has been using fire to restore and maintain some areas of these ecosystems in the park (Dobbyn and Pasma, 2012; OMNR, 2001; Berkers, 2014).

Pressures

The following discussion summarizes the main ecological pressures that are associated with the cottage lots and associated activities in Rondeau Provincial Park, and is based on published literature, reports, and other sources of information.

Habitat Loss and Alteration

Habitat loss and degradation is one of the leading threats to biodiversity worldwide and in Ontario (OMNR, 2012a). Cottage lots and their associated footprint (off-lot areas being occupied or managed by cottagers) have been measured using geographical information system (GIS) technology.

Rondeau cottages directly occupy and impact upon provincially significant habitats (Dobbyn and Pasma, 2012). Some of this loss was historic and occurred at the time the cottage lots were cleared and cottages were erected, while some of the impacts are ongoing, such as on and off lot vegetation clearing, trail use and invasive species spread.

A total of 11.5% (99 hectares) of the terrestrial portion of Rondeau Provincial Park is occupied and directly affected by human infrastructure such as cottage lots, roads, campgrounds and buildings. Approximately one fifth of this (20%) is cottage lots. Most of these areas historically would have been dune, savannah, or woodland communities, all of which are important representative ecosystems within Rondeau Provincial Park (Dobbyn and Pasma, 2012).

Cottage lots in Rondeau occupy approximately 0.62% of the entire provincial park (which includes a large portion of Rondeau Bay) or 2.2% of the terrestrial portion of the park. The lots themselves are highly altered from their natural state. Some cottage-related activities (such as mowing and vegetation clearing) extend beyond the limits of the cottage lots, effectively doubling the size of the area directly affected (Dobbyn and Pasma, 2012). These off lot activities affect plant regeneration in these ecosystems.

Some of these dune, savannah and woodland ecosystems require active management in the absence of natural disturbance regimes, such as the use of fire, to maintain them. The presence of cottages and other infrastructure adds complexity to the use of fire as a management tool in Rondeau, and areas containing cottages are largely excluded from fire management planning (Berkers, 2014).

Trails through sand dunes facilitate the spread of invasive species, kill sensitive and in some cases rare vegetation, and impair the integrity of the dune ecosystem (Callahan, 2008). Human traffic and invasive species are recognized threats to coastal dunes in provincial parks (Bakowsky and Henson, 2014). In Rondeau, there are 15 public beach access trails totalling 1.7 km in length which allow all park users recreational access to the beach. There are also over 200 trails that lead from the edges of individual cottage lots through the dunes to the beach totalling 19.3 km in length. This total length of these trails is ten times longer than that of the public trails (OMNR, 2014b).

The dune area of Rondeau Provincial Park has actually grown in size over time, through the natural accumulation of sand on the beach (OMNR, 2013e). This has had the effect

of gradually increasing the distance between the edges of the cottage lots and the beach. As a result, access trails across the dunes (both authorized public trails and trails running from individual cottage lots to the beach) have lengthened. Most cottage lots do not share trails, but rather, have their own separate access trails leading from the edges of their lots across the dunes (OMNR, 2012e).

The total area of habitat disturbed by cottage structures and activities has decreased since the 1950s, which is attributed to the cessation of certain cottage-related activities such as bulldozing of dunes (OMNR, 2013e). The extensive network of beach access trails from cottage lots remains a concern (OMNR 2014b), as does continued disturbance to dunes adjacent to certain cottage lots (OMNR 2013e).

Most of the area surrounding Rondeau cottage lots, and some of the area on the cottage lots, is regulated habitat for species at risk and receives protection under the *Endangered Species Act, 2007* (OMNR, 2013b; 2013c). Restoration or naturalization of habitat on and near cottage lots would benefit some species at risk and correspond with recovery actions and the restoration of ecological integrity (Parks Canada, 2008).

Several of the species at risk in Rondeau are, or have been, affected by habitat loss or impairment. For example, Common Hoptree (*Ptelea trifoliata*) occurs in habitats that have been cleared for cottages and other infrastructure (trails, etc.), where fire has been suppressed, where vegetation trampling occurs, and where invasive species have been documented (e.g., White Sweet Clover, *Melilotus alba*) (OMNR, 2013d).

Research has found that there is a lack of natural woody debris (such as logs and other driftwood) near campgrounds and along the beach in the vicinity of cottages and other buildings in Rondeau Provincial Park (Hecnar and Brazeau, 2014). This reduction in habitat components is likely to have effects on species at risk that rely on woody debris for shelter such as the Common Five-lined Skink and Fowler's Toad. Some debris originating from human use (for example, compost or brush piles) and human structures may also provide habitat components for Common Five-lined Skinks (i.e., for basking and shelter).

Other provincially rare species, such as the tiger beetle *Cicindela hirticollis*, are susceptible to beach trampling and have disappeared from many sites on the Great Lakes (Brust *et al*., 2006). As many rare insect species are found only within dune

communities, recreation, development or vegetation clearing in these areas is likely to damage habitats that are important to these species.

Fragmentation

Animals, and the plants that rely on them for dispersal, need to move throughout their habitat to eat, find shelter, reproduce, and complete the rest of their life processes. Things that interrupt or alter the ability of an organism to move through its habitat can have varying levels of harm. These impacts to the connectivity of the landscape are referred to as fragmentation. Fragmentation is a common threat to the conservation of biodiversity in protected areas in Canada (Parks Canada, 2008).

Although the core area of Rondeau Provincial Park has minimal internal fragmentation, a long strip of cottages is located on the eastern shore of the park. These cottage lots and the Lakeshore Road are located at a key transition area between two ecosystems. While specific studies on fragmentation have not occurred at Rondeau, there are some species that live in Rondeau Provincial Park and have been shown to be affected elsewhere by barriers comparable to the Lakeshore Road, and similar affects are likely at Rondeau. For example, some species in the park rarely cross roads, such as the White-footed Mouse (*Peromyscus leucopus*) (Merriam *et al*., 1989) and the Red-backed Salamander (*Plethodon cinereus*) (Marsh *et al*., 2005). Some species exhibit road avoidance regardless of whether there is traffic, like the Blanding's Turtle (Proulx *et al*., 2013). Other species such as Raccoon (*Procyon lotor*) and White-tailed Deer (*Odocoileus virginianus*) are less likely to find a road or cottage lots as barriers to movement.

Roads

Roads in Rondeau Provincial Park are used by park staff, the public, and by cottagers. The presence and use of these roads has several ecological impacts. These include road mortality (Farmer *et al*., 2007; Hecnar and Brazeau, 2014), creating barriers to wildlife movement (Forman *et al*., 2003), facilitating the spread of invasive species (Forman *et al*., 2003), and reducing the quality of adjacent habitats for some species of wildlife, such as salamanders (Marsh and Beckman, 2004). The environmental consequences of roads in Rondeau cannot be linked solely to any one user group as all park users have access to park roads. However, the primary purpose of some roads (e.g., Lakeshore Road) is to provide access to cottage lots. The presence of cottage lots

and associated roads and vehicle use can magnify the risks to some of the park's natural heritage values, such as certain species at risk (COSEWIC, 2010a).

Road Mortality

Hundreds, if not thousands, of animals are killed on roads in Rondeau Provincial Park every year (Farmer, 2007), including species at risk (Hecnar and Brazeau, 2014). The effects of roads on some animal populations can be detected as far away as two kilometres (Findlay and Houlahan, 1997). Road mortality is of particular concern for those animals that are already rare or at risk.

Cottages in Rondeau magnify this risk for some species (COSEWIC, 2010a) since some roads are maintained to allow for access to the cottage lots, and additional traffic associated with these roads increases the risk of collisions with animals. Studies quantifying the use of roads in Rondeau by user (e.g., public, cottager) have not been conducted, and thus road mortality cannot be attributed to or compared between users at this time.

Rondeau has 17.2 km of public access roads (Farmer and Brooks, 2012), of which approximately 9.9 km are necessary to provide access to cottages.

A 2007 study identified factors associated with road kill in Rondeau Provincial Park and Point Pelee National Park (Farmer, 2007). This study noted numerous species at risk being killed on roads in Rondeau, including Blanding's, Map, and Snapping turtles, Eastern Foxsnake, Hognose Snake, and Eastern Ribbonsnake, Common Five-lined Skinks and Fowler's Toad. A total of over 60 individual road killed species at risk were documented in Rondeau during this study.

For all species analyzed, buildings (including cottages) were positively associated with road kill numbers for birds, but not for snakes, mammals or amphibians. Other factors such as vehicle speed, distance to water or wetlands, and seasons were important predictors of mortality for these species groups (Farmer, 2007).

Hot spots of mortality for certain groups of vertebrates were mapped as part of this project.

For frogs, mortality was recorded on all roads, but two hot spots were noted on Rondeau Park Road. Fewer road killed frogs were recorded on the Lakeshore Road,

adjacent to the cottages (Farmer 2007). Parts of the Rondeau Park Road have since been closed to traffic for most of the year to address mortality concerns. No road killed toads were reported from the Lakeshore road (adjacent to cottages).

For birds, more dead birds were found on the Lakeshore Road in the vicinity of cottages than on the Rondeau Park road, including Barn Swallow, a species at risk. The author hypothesized that bird feeding attractants at cottages may contribute to birds being vulnerable to road mortality in this area (Farmer, 2007).

Snakes in Rondeau are particularly at risk from being killed on roads while moving or basking (COSEWIC, 2007a; Farmer, 2007; Eastern Foxsnake Recovery Team, 2010; COSEWIC, 2002; Gillingwater and Brooks, 2002). The use of roads in Rondeau by the public, cottagers, and park staff is a threat to snakes, as pavement is attractive to snakes for basking in the sun. Furthermore, these roads bisect snake habitat, and crossing these roads may be necessary for these species to access resources such as hibernation sites.

Snakes were found dead at a higher proportion on the Rondeau Park Road than on the Lakeshore Road (adjacent to the cottages) (Farmer 2007). The author hypothesized that lower road kill numbers for snakes may be a result of snakes preferring less developed habitats (Farmer 2007). Parts of the Rondeau Park road have since been closed to traffic for most of the year to address mortality concerns. A more recent survey recorded over 30 dead snakes on the Lakeshore road, including 2 species at risk (Hecnar and Brazeau, 2013).

Mammal road kills were found on most of the roads within the park, with hotspots near the campground and on the Lakeshore road (Farmer, 2007). Some of the mammal mortality concerns have also been addressed by seasonally closing parts of the Rondeau Park Road.

Although not mapped, road mortality is considered a risk to Common Five-lined Skink (COSEWIC, 2007b), and there is evidence of skinks being killed on roads in Rondeau (Gillingwater and Brooks, 2002; Farmer, 2007). However, recent surveys indicate that the Lakeshore Road seems to create only a low risk for skink mortality (Hecnar and Brazeau, 2014).

Turtles are also threatened by roads in Rondeau (COSEWIC, 2002; Farmer, 2007; Gillingwater and Brooks, 2002). Turtle species particularly threatened by road mortality include the threatened Blanding's Turtle, and the 'special concern' Map Turtle and Snapping Turtle (COSEWIC, 2002; Farmer, 2007; Gillingwater and Brooks, 2002). A total of 22 dead turtles were reported as part of the road mortality study, including all three species mentioned above (Farmer 2007). Turtle mortality areas were not mapped as part of this exercise due to a low sample size.

This study concluded that roads in parks are as, if not more, likely to cause road kill of reptiles and amphibians than municipal or provincial roads outside parks, and should be managed more aggressively to reduce this phenomenon (Farmer 2007).

Temporary (seasonal) road closures have been used by park staff in some locations (Hecnar and Brazeau, 2014; E. Slavik, pers. comm.) to reduce road kill, but this technique cannot be used in all locations because of the need to maintain access to cottage lots and park facilities year-round. Another approach used in Rondeau, the conversion of certain roads into walking trails, also is presently impractical on some of the roads where road kills have been documented because of the need to maintain access for public and cottagers.

Road density has been used as an indicator of ecological integrity, with higher densities resulting in lower integrity (Rivard and Seaby, 2003). Rondeau Provincial Park has a total of 29.3 km of road, of which 9.9 km provide access to cottage lots (OMNR, 2014b). The total road density in Rondeau Provincial Park is 1.82 km of road per square km of forest (OMNR, 2014b). A road density target has not been set for Rondeau Provincial Park, but the removal of non-essential roads is a recommended tactic to improve the ecological integrity of protected areas (Parks Canada, 2008). Techniques such as temporary road closure, conversion to walking trails or road removal to reduce risks from roads are constrained along Lakeshore Road as access must be maintained to cottage lots. Other measures to reduce snake mortality such as education, signage and speed control have been implemented by Rondeau Park staff.

Road Edge Effect

The environmental impact of a road extends beyond its physical footprint into areas adjacent to the road. This impacted 'buffer' area is often referred to as an 'edge effect'. The road edge effect can have varying impacts on wildlife, from decreased abundance

through avoidance of edges (Summers *et al*., 2011) to reduced biodiversity (Findlay and Houlahan, 1997). As such, the ecological impact of the roads within Rondeau Provincial Park likely extends beyond the physical footprint of the roads.

Depredation

Roads can also increase the number of generalist predators like Raccoons, Foxes and Virginia Opossum, which may be attracted to roads because of opportunities to find and eat road kill. In turn, this increases predation on prey species within the park, including species at risk. Other factors such as bird feeders, wildlife feeding and garbage also contribute to the subsidization of predators, however the relative impacts of each of these sources has not been evaluated. The effects subsidized predators are discussed more fully in Subsidized Pressures Section.

Trails

Trails in Rondeau include public hiking trails, public beach access trails, and beach access trails from individual cottage lots. Beach access trails from individual cottage lots comprise almost half the trail length in Rondeau, and are over ten times the length of public beach access trails (OMNR, 2014b). These trails vary in size and condition. Cottage beach access trails are generally slightly smaller in size and slightly better in condition than public beach access trails. Cumulatively, the 202 cottage beach access trails and the 15 public beach access trails directly occupy just over 4.2 hectares of the terrestrial landscape (OMNR, 2014d), most of which is dune ecosystem.

Invasive Species

Invasive species are among the leading causes of biodiversity loss on earth (IUCN, 2013) and in Ontario (OMNR, 2012a, b). They threaten the ecological integrity of protected areas by out-competing native species and degrading the ecosystems on which they depend (Meunier and Lavoie, 2012). Invasive species are a serious threat in Rondeau Provincial Park, where approximately 24.5% of the known plant species are alien or invasive (Dobbyn and Pasma, 2012).

Invasive species can spread in a number of ways, including along roadways and trails (OMNR, 2012b). Park visitors and staff may inadvertently spread invasive species that ‘hitch-hike’ on equipment, footwear, or vehicles.

Historically, the planting of non-native plants was a common practice by staff in provincial parks in Ontario, and some of the invasive plant species in Rondeau are likely of this origin. Non-native plants are no longer planted by park staff, and staff now actively remove invasive species that threaten biodiversity, as time and resources permit. Planting of ornamental plants on cottage lots in Rondeau has also contributed to the spread of invasive species, through suckering, seed dispersal, and dumping of leaves and other plant material that can contain invasive seeds in the forest (Ontario Parks, 2001). A higher proportion of non-native plants (ornamental species, lawn grasses, fruiting shrubs, etc.) is maintained on cottage lots than elsewhere in the park. Those non-native plants can spread beyond the cottage lots to natural areas of the park (OMNR, 2013b) and hamper efforts by park staff and volunteers to remove invasive species. Furthermore, new invasive species originating from ornamental plantings on cottage lots continue to be discovered in Rondeau (Dobbyn and Pasma, 2012).

An example of a harmful invasive species escaping from cottages and threatening ecosystem health is the shrub, Japanese Barberry (*Berberis thunbergii*). Planted in the park, including many cottage lots, because of its resistance to browsing by White-tailed Deer, it has spread widely and can now be found throughout the park (OMNR, 2014), where it competes with rare and endangered species and alters the understory of several ecosystem types, including Carolinian forest. This invasive shrub can also alter the environment to favour the survival of the Black-legged Tick (*Ixodes scapularis*), leading to higher risk of human exposure to Lyme Disease (Elias *et al*., 2006).

The Lakeshore Road has more alien and invasive species than the Rondeau Park Road, the latter of which has no cottage lots along most of its length (Savanta, 2009). Invasive species are particularly common between dune areas and the backs of the cottage lots (Savanta, 2009). In addition, many invasive species have been identified a long beach access trails (OMNR, 2014b), which is a concern in dune ecosystems (Bakowsky and Henson, 2014). A comparison of public beach access trails and individual cottage lot beach access trails revealed the presence of 54 alien and invasive plant species along trails from cottage lots compared with 24 such species documented along public trails (OMNR, 2014b). This study did not explore whether invasive species were spreading off trails into dunes, but this risk has been noted as a threat to dunes in Ontario Parks (Bakowsky and Henson, 2014). In total, over 100 non-native species have been documented between the cottage lots and the beach (Savanta, 2009). Park

staff and volunteers, including some cottagers, spend time every year removing invasive species that have spread directly from cottage lots.

Other invasive species management approaches, such as tree removal and herbicide spraying, have also taken place (Dobbyn and Pasma, 2012). Invasive species in Rondeau also spread through the dumping of leaves and yard waste off of cottage lots in the park (Ontario Parks, 2001) which can contain the seeds of invasive species. A composting program for yard waste has been established to reduce this practice (OMNR, 2001).

The effectiveness of invasive species removal efforts by park staff and volunteers is hampered by the constant influx of invasive species propagules from multiple sources, including the cottage lots.

Dunes and Invasive Species

Sand dunes are particularly fragile ecosystems (Bowles and Maun, 1982) and can be severely impacted by human activities (Bakowsky and Henson, 2014). Rondeau sand dunes comprise critical ecosystem representation components in Ontario's system of protected areas (Dobbyn and Pasma, 2012). In Ontario, cottage development and invasive species are among the threats to this ecosystem (Bakowsky and Henson, 2014).

As described in the Invasive Species Section, the sand dunes in Rondeau are susceptible to invasive plant species because of the proximity of many of the cottage lots to the dunes and the associated unauthorized trails that lead from the edges of the cottage lots through the dunes to the beach.

The impact of invasive species on these dunes is important because these ecosystems are imperilled in Ontario. All beach access trails (public and cottage) have increased in length over the last 30 years as the entire dune area has increased in size due to the natural accumulation of sand (OMNR, 2013e). The trails leading from individual cottage lots to the beach cumulatively have twice as many invasive plant species as the public beach access trails (OMNR, 2014b), as discussed in the Invasive Species Section. The spatial distribution of this network of trails increases the potential for species invasion by providing hundreds of additional pathways into the dunes along which invasive species can move (OMNR, 2014b; OMNR, 2012b).

Invasive Species and other Ecosystems

Invasive species located on cottage lots contribute to the threats on other ecosystems within the park, because these species can spread from the cottage lots to the rest of the park through seed dispersal or disposal of garden refuse (Dobbyn and Pasma, 2012; OMNR, 2014.) Existing occurrences of invasive plant species on cottage lots continue to contribute to the threats on the integrity of other park areas (OMNR, 2013e; Meloche and Murphy, 2002).

Cottage lot lease conditions prohibit the planting of non-native vegetation (Ontario Parks, 2001). However, new invasive plant species continue to be discovered (Dobbyn and Pasma, 2012; OMNR, 2014b). The most recent invasive species to be discovered in the park, a plant called Jetbead (*Rhodotypos scandens*), has spread from a cottage lot into other natural areas within the park (Dobbyn and Pasma, 2012).

One of the most pervasive invasive species in the park, Japanese Barberry, has been planted as a hedgerow species and ornamental shrub in the past, before it was known how much of a problem this species could become. In addition to its ornamental properties, it was used to discourage deer from browsing on other garden plants (OMNR, 2014). Eradication efforts to control Japanese Barberry have taken place on many cottage lots, and in areas of the park near populations of the endangered Nodding Pogonia, which does not occur near any of the cottage lots (Dobbyn and Pasma, 2012). Japanese Barberry competes with Nodding Pogonia for resources such as light and nutrients (Woodliffe, 2009; COSEWIC, 2010b). Japanese Barberry is now so widespread in the park that anything other than localized control is unlikely to be feasible (OMNR, 2014).

Wildlife Mortality and Disturbance

Subsidized Predators

Human development and use often is associated with conditions that lead to higher than natural numbers of predators (Rodewald *et al*., 2011), which are referred to as ‘subsidized’ predators. Higher than natural populations of Raccoons have been noted as a conservation concern in other protected areas, such as Point Pelee National Park (Phillips, 2008) because they may have greater impacts on prey species, including species at risk, than what would be expected under natural conditions. Garbage, bird

feeders, road kill, pet food, and supplemental feeding all can subsidize predators and increase their density (Strickland and Janzen, 2010). Cottagers, campers, and other park users contribute to subsidizing predators in Rondeau; however, the relative contribution of each of these groups towards this pressure has not been established.

Subsidized predators can impact turtles (Phillips, 2008) and breeding birds (Rodewald *et al*., 2011) because high numbers of predators means a higher chance of nests being found and eaten. Higher than natural rates of turtle nest predation have been observed in Rondeau (Gillingwater and Brooks, 2002).

Domestic and feral cats also can be classified as subsidized predators that have an impact on wildlife (Hawkings, 1998; Hanson *et al*., 2005), because they will hunt wildlife regardless of whether they are hungry. Both feral and domestic house cats have been observed in cottage areas in Rondeau Provincial Park (S. Dobbyn, pers. comm). Domestic dogs can act as predators in some ecosystems (Hanson *et al*., 2005), but there is also evidence that dogs can deter other subsidized predators like Raccoons, reducing nest predation of turtles (Marchand and Litvaitis, 2004).

Subsidized predators are a conservation concern in many areas of North America, including the Rondeau-Erie Coast (Jalava *et al*., 2013). However, they are of particular concern in protected areas like Rondeau Provincial Park, where the PPCRA establishes an objective to permanently protect representative ecosystems, biodiversity and provincially significant elements of Ontario's natural and cultural heritage and to manage these areas to ensure that ecological integrity is maintained.

Snake species at risk in Rondeau are also threatened by subsidized predators and domestic pets (COSEWIC 2002; 2007a; 2008). Cats and dogs may kill and eat snakes, and the presence of garbage and bird feeders may increase the abundance of predators such as Raccoons, which also eat snakes. Recreational uses such as cottaging, camping and day-uses contribute to the increase in subsidized predators within the park.

Turtle populations in Rondeau are at risk from subsidized predators which dig up and eat the majority of eggs laid in nests every year (Gillingwater and Brooks, 2002). Development such as cottages can boost the population of predators like Raccoon and Virginia Opossum (Didelphis virginiana) by increasing their food supply through garbage and bird feeders, and by displacing larger predators. The ability of turtles to

successfully reproduce is diminished when these predators dig up nests and eat the eggs, in addition to eating adult turtles.

Subsidized Competitors

Competition between species is also influenced by cottaging activities at Rondeau. The relationship between House Wrens and the endangered Prothonotary Warbler is such an example, where the placement of nest boxes on cottage lots has led to increased populations of House Wrens (Dobbyn and Pasma, 2012) which compete with Prothonotary Warblers (Dobbyn and McCracken, 2005). House Wrens compete for nest cavities with Prothonotary Warblers and will also actively destroy eggs and build 'dummy nests' by filling up nest cavities with debris, making them unusable by other birds (Environment Canada, 2011). The population of House Wrens at Rondeau and nest boxes on cottage lots are linked (J. McCracken, pers. comm). Other factors, such as habitat change from wind events and invasive plant species (unrelated to cottages) are also threats to Prothonotary warblers (Environment Canada, 2011). It should be noted that the topic of artificial nest boxes is complex, as some next boxes on cottage lots likely provide habitat for species at risk birds such as Tree Swallow and Purple Martin, and nest boxes have been erected in wetlands in Rondeau by park staff to provide predator-proof nesting opportunities for Prothonotary warbler (Dobbyn and Pasma, 2012).

Persecution

Five species of at-risk snakes live in Rondeau Provincial Park (Dobbyn and Pasma, 2012). Direct human persecution (killing) is a threat for snakes in Ontario and elsewhere. Rondeau cottagers have been reported as killing at-risk snakes (specifically, Eastern Hog-nosed Snakes), with two cottagers stating that they would continue to do so (COSEWIC, 2007a).

Disturbance

The recreational use of dune and beach areas by all users also affects species that live there. The density and arrangement of the cottage beach access trails increases the disturbance area associated with beach access (OMNR, 2014b). Another recreational use of the beach and sand dunes involves the movement and storage of boats and trailers (Dobbyn and Pasma, 2012).

The destruction of dune habitat through trails, blowouts (when vegetation is killed and a portion of the dune blows away) and mowing is also a threat to Fowler's Toads (Dobbyn and Pasma, 2012). Another example involves the provincially rare Green Milkweed (*Asclepias viridiflora*), which is also found in open dune areas in Rondeau (Dobbyn and Pasma, 2012). Disturbance, along with invasive species in the sand dunes, threaten this species.

Bird Feeders

Bird feeding, although a popular activity, contributes to the subsidization of predators (Strickland and Janzen, 2010), which can impact several species at risk, as discussed earlier. It may also reduce survival rates of birds when feeders are unavailable (Brittingham and Temple, 1992) and can attract and subsidize predators, spread disease, and function as an ecological trap by providing inaccurate cues about habitat quality (Robb *et al*., 2008). They may also expose birds to greater risk of road mortality (Farmer, 2007). Approximately 60% of the cottages in Rondeau (over 160 cottages) have bird feeders (E. Slavik, pers. comm.). The Rondeau Park Visitor Centre also has two bird feeders operating at certain times of the year.

Water Quality

Recent studies have shown that nitrogen contamination of groundwater as a result of septic systems from the Rondeau cottages is minor and mostly within Ontario standards (Genivar, 2012). However, phosphorous (a nutrient found in detergents and human waste) levels are being elevated by septic systems in Rondeau Provincial Park as these systems do not remove phosphorous (Genivar, 2012). Phosphorous is a concern because it can impair water quality at much lower concentrations than nitrogen (Lusk *et al*., 2011).

Groundwater in Rondeau flows toward both Lake Erie and Rondeau Bay, and has the potential to negatively impact those water bodies (Genivar, 2012) with phosphorous. Phosphorous is a nutrient essential for plant growth. Recent blue-green algal blooms in Lake Erie, including areas adjacent to Rondeau, have been linked to excess phosphorous. A report published jointly by Canada and the US recommends the identification and upgrading of failing septic systems (International Joint Commission, 2014) as a means to reduce phosphorous inputs into Lake Erie. Upgrading faulty and obsolete septic systems is a strategic action in the Rondeau – Erie Coast Conservation

Action Plan (Jalava *et al*., 2013). Septic systems designed to remove phosphorous do exist, but are not likely practical or feasible in a low density, residential context such as that associated with cottages in Rondeau Provincial Park.

Summary

In summary, there are many environmental pressures on park values at Rondeau. Cottages and associated activities and infrastructure contribute to these pressures and create challenges for maintaining or enhancing the ecological integrity of some ecosystems. While cottage lots collectively occupy approximately 20 hectares of land in Rondeau, some of the impacts from cottaging activities on park values (many of which are provincially or nationally significant) are evident in other areas of the park.

Although cottaging infrastructure and activities contribute to a number of ecological pressures, their contribution to three pressures are particularly noteworthy: impacts on species at risk, impacts on nationally and provincially significant ecosystems, and the spread of invasive species.

Impacts on species at risk are particularly significant because some of these species have a large portion of their Canadian population within Rondeau. Little alternative habitat exists because little natural cover remains in the Municipality of Chatham-Kent and elsewhere in southwestern Ontario Also, cottage lots and associated activities overlap terrestrial area that is utilized by multiple species at risk.

Pressure on critically imperilled dune and savannah ecosystems is a concern because the resilience of these habitats has already been impacted by past use, they are highly fragmented, and they continue to be degraded by invasive species.

Cottage lots in Rondeau are a significant and ongoing source of invasive species, which then spread to other areas of the park. In addition to impacts on natural heritage values, this also creates an ongoing workload for park staff in trying to manage invasive species which can re-establish from cottage lots.

This report was compiled using a wide suite of available information, including reviews of relevant published literature, park-specific studies prepared by government agencies and consultants, and other available information. While it is recognized that other uses

and associated ecological pressures exist in Rondeau (for example, hyper-abundant White-tailed Deer), this report focuses on those ecological values and pressures that are linked, at least in part, to cottages and associated infrastructure and activities to inform the policy review process. Similarly, social, recreational, and cultural values and pressures are not within the scope of this report.

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