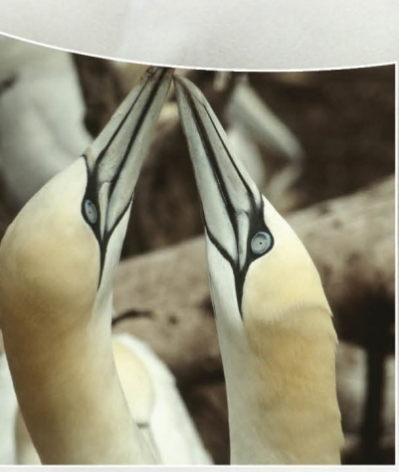
Environment Canada Environnement Canada

Bird Conservation Strategy for Bird Conservation Region 13 in Ontario Region: Lower Great Lakes/St. Lawrence Plain

July 2014



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Preface

Environment Canada led the development of all-bird conservation strategies in each of Canada's Bird Conservation Regions (BCRs) by drafting new strategies and integrating new and existing strategies into an all-bird framework. These integrated all-bird conservation strategies will serve as a basis for implementing bird conservation across Canada, and will also guide Canadian support for conservation work in other countries important to Canada's migratory birds. Input to the strategies from Environment Canada's conservation partners is as essential as their collaboration in implementing their recommendations.

Environment Canada has developed national standards for strategies to ensure consistency of approach across BCR. BCR strategies will provide the context from which specific implementation plans can be developed for each BCR, building on the programs currently in place through Joint Ventures or other partnerships. Landowners including Aboriginal peoples will be consulted prior to implementation.

Conservation objectives and recommended actions from the conservation strategies will be used as the biological basis to develop guidelines and Beneficial Management Practices that support compliance with regulations under the *Migratory Birds Convention Act, 1994*. Furthermore, these strategies will guide conservation action in support of *The State of Canada's Birds 2012* (North American Bird Conservation Initiative 2012), which points to the strong influence of human activity on bird populations, both positive and negative, and presents solutions towards keeping common birds common and restoring populations that are in decline.

Acknowledgements

Brigitte Collins and Paul Smith were the main authors of this document that follows templates developed by Alaine Camfield, Judith Kennedy and Elsie Krebs with the help of the BCR planners in each of the Canadian Wildlife Service regions throughout Canada. However, work of this scope cannot be accomplished without the contribution of others who provided or validated technical information, commented on draft versions of the strategy, produced maps and supported the overall planning process. We would like to thank the following for their contributions to this strategy: Gregor Beck, Graham Bryan, Mike Cadman, Alaine Camfield, Lesley Carpenter, Britt Dupuis, Christian Friis, Krista Holmes, Jack Hughes, Judith Kennedy, Sarah Mainguy, Shawn Meyer, Dave Moore, Jocelyn Neysmith, Marie-France Noel, Michele Rodrick, Daniel Rokitnicki-Wojcik, Paul Watton, Chris Wedeles and D.V. Weseloh.

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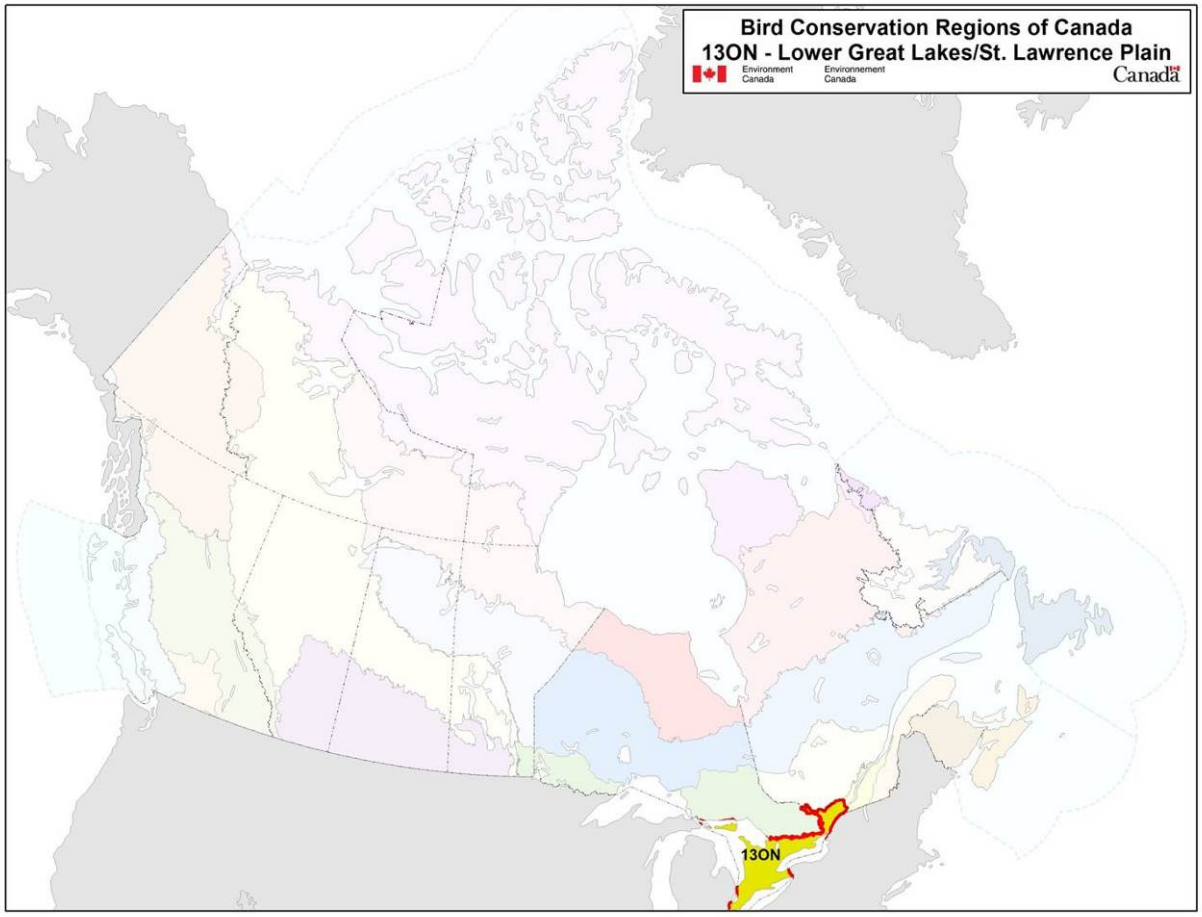

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Executive Summary

The Lower Great Lakes/St. Lawrence Plain Bird Conservation Region 13 (BCR 13) covers an area of 201,300 km^2 across Ontario, Quebec and the United States (Ontario Partners in Flight 2008). In Ontario, the region includes those areas lying between the Canadian Shield and the shores of the Great Lakes. This conservation strategy for Ontario's portion of BCR 13 (BCR 13 ON) builds on existing bird conservation plans and complements those created for the other BCRs across Canada. These strategies serve as a framework for implementing bird conservation nationally and also identify international conservation issues for Canada's priority bird species. This strategy is not intended to be highly prescriptive, but rather is intended to guide future implementation efforts undertaken by various partners and stakeholders.

Southern Ontario is the most populous region of Canada. Approximately one in three Canadians lives here, and population growth continues to outpace that of the rest of the country. Humans have had a profound and irreversible effect on the landscape in this region. Dense, old-growth deciduous and mixed forests once covered 90% of the landscape but were reduced to only 10% by 1920 as lands were cleared for agriculture. Wetlands and natural grasslands also suffered substantial losses. Although agricultural lands still dominate BCR 13 ON, a trend towards reforestation has benefitted some species, and efforts to restore and protect wetlands and other habitat types are ongoing. Moreover, a number of unique natural habitats remain, including Carolinian forests, alvars and the Frontenac Arch. Each of these habitats supports an atypically high proportion of birds as well as species at risk. The coastal wetlands of the Great Lakes also support a rich diversity of birds and offer critical staging habitat for shorebirds and waterfowl en route to breeding and non-breeding areas scattered widely across the western hemisphere.

Within BCR 13 ON, 280 species of birds regularly breed, overwinter, reside year-round or routinely migrate through the region.[1] Of these, 97 were identified as priority species in this BCR. All bird groups are represented on the priority species list, although the list is dominated by landbirds (47%). This list also includes waterbirds (25%), waterfowl (17%) and shorebirds (11%). More than two thirds of the waterbirds (77%) and almost half of the waterfowl (48%) occurring in BCR 13 ON are identified as priority species, compared to 34% of the shorebirds and only 25% of landbirds. Among the 97 priority species, 33 are assessed by the Committee on the Status of Endangered Wildlife in Canada as "at risk," 25 of which are listed under the federal *Species at Risk Act* and 30 under Ontario's *Endangered Species Act 2007* at the time of writing this strategy. In addition, 2 species are identified as being of management interest: the Eastern Temperate-breeding population of Canada Goose and the Mute Swan.

Identifying the broad habitat requirements for each priority species within the BCR allows species to be grouped by shared habitat-based conservation issues and actions. Priority species

[1] Species occurrence was determined using Ontario's Breeding Bird Atlas (Cadman et al. 2007), Birds of North America online (Cornell Lab of Ornithology 2013) and expert opinion.

are associated with 10 habitat types in BCR 13 ON. Wetlands are used by the greatest number of priority species (40%), while forest (deciduous 12% and mixed 13%) and urban areas (6%) are preferred habitat types for a smaller proportion of priority species. Herbaceous habitats (e.g., tallgrass prairie, savannah, alvar) are used by 23% of species, despite accounting for less than 1% of the region's land cover and, by contrast, cultivated and managed areas are used by a similar fraction of species (32%), though these habitat types dominate the landscape. The large number of priority species using cultivated and managed habitats reflects the adaptation to these human-influenced habitats and subsequent population increases by species that were restricted to native herbaceous habitats prior to European settlement. The Great Lakes are a prominent feature of the region, and the beaches, mudflats and other coastal "bare areas" are used by 18% of priority species, while 21% use the waterbodies themselves.

The population objectives in this strategy are categorical and are based on a quantitative or qualitative assessment of species' population trends. Much of BCR 13 ON is well covered by large-scale bird surveys, and in comparison to some other BCRs in Canada, the status of birds in southern Ontario is relatively well known. For 24% of priority species, monitoring data suggest declines with sufficient certainty to support an objective of increasing population size. In contrast, populations are sufficiently elevated to warrant a reduction in population size for two priority species: the Canada Goose, Eastern Temperate-breeding population and the Mute Swan. Maintaining populations at current levels is the objective for 23% of the priority species in BCR 13 ON (including most migrant waterfowl). Only 12% of priority species are assigned a population objective of Assess/Maintain because monitoring data are insufficient to propose an objective. A recovery objective is assigned to 30% of priority species, which are all species at risk whose breeding range occurs within this BCR. Nine percent (9 %) of priority species are identified as migrating through BCR 13 ON, including the federally and provincially endangered Red Knot (*rufa*), and are not assigned an objective, as those are set in other BCR strategies covering the breeding range of these species.

An assessment of threats identified a large number and diversity of conservation issues facing priority species in the various habitats of BCR 13 ON. Major threats to priority species relate to habitat loss and degradation from a variety of sources including urban development, biological resource use, pollution and human disturbance. Given the presence of many species at risk in this BCR, threats are both more numerous and of a greater magnitude than for other BCRs in the province. Wide-ranging conservation issues such as climate change were considered separately as widespread threats, given their effects on multiple species and habitats. The lack of biological or demographic data for some priority species is also considered an important conservation issue in this strategy.

Conservation objectives have been designed to address threats and information gaps facing priority birds in the region. For BCR 13 ON, the majority of conservation objectives identified relate to ensuring an adequate quantity and quality of habitat, such as ensuring that resource and land use policies and practices maintain or improve bird habitat. Objectives seeking to improve understanding of population declines as well as management of specific species are also among those most frequently identified in BCR 13 ON. These objectives address the lack of

information on the ecology and demographics of some priority species and the continued effort to establish recovery strategies and management plans for species at risk.

Recommended actions identify activities that will help to achieve the conservation objectives and thus mitigate threats to priority species. Actions are strategic rather than highly detailed and prescriptive. Whenever possible, recommended actions benefit multiple species and/or respond to more than one threat. Recognizing that a large majority of lands in the region are privately owned, only a small proportion of the actions relate to the direct protection of land. Instead, a majority of actions focus on habitat restoration and management for priority species by engaging land owners and other stakeholders in conservation. Developing and implementing effective policies and regulations, the development, use and promotion of Beneficial Management Practices (BMPs), increasing awareness about conservation issues, developing partnerships, determining factors causing population declines, and improving the scientific knowledge that underlies management decisions all figure prominently in the suite of conservation actions proposed for this region. Engaging stakeholders in actions that restore the function and resilience of ecosystems in this highly impacted region ensures that conservation successes can be maintained over the long term.

Introduction: Bird Conservation Strategies

Context

This document is one of a suite of Bird Conservation Region (BCR) Strategies that have been drafted by Environment Canada for all regions of Canada. These strategies respond to Environment Canada's need for integrated and clearly articulated bird conservation priorities for birds in Canada to support the implementation of Canada's migratory birds program, both domestically and internationally. This suite of strategies builds on existing conservation plans for the four "bird groups" (waterfowl,[2] waterbirds,[3] shorebirds[4] and landbirds[5]) in most regions of Canada, as well as on national and continental plans, and includes birds under provincial/territorial jurisdiction. These new strategies also establish standard conservation planning methods across Canada and fill gaps, as previous regional plans do not cover all areas of Canada or all bird groups.

These strategies present a compendium of required actions based on the general philosophy of achieving scientifically based desired population levels as promoted by the four pillar initiatives of bird conservation. Desired population levels are not necessarily the same as minimum viable or sustainable populations, but represent the state of the habitat/landscape at a time prior to recent dramatic population declines in many species from threats known and unknown. The threats identified in these strategies were compiled using currently available scientific information and expert opinion. The corresponding conservation objectives and actions will contribute to stabilizing populations at desired levels.

The BCR strategies are not highly prescriptive. In most cases, practitioners will need to consult additional information sources at local scales to provide sufficient detail to implement the recommendations of the strategies. Tools such as Beneficial Management Practices (BMPs) will also be helpful in guiding implementation. Partners interested in participating in the implementation of these strategies, such as those involved in the habitat Joint Ventures established under the North American Waterfowl Management Plan (NAWMP), are familiar with the type of detailed implementation planning required to coordinate and undertake on-the-ground activities.

[2] NAWMP Plan Committee 2004
[3] Milko et al. 2003
[4] Donaldson et al. 2000
[5] Rich et al. 2004

Strategy Structure

Section 1 of this strategy presents general information about the BCR and the sub-region (i.e., Ontario's portion of the BCR), with an overview of the six elements[6] that provide a summary of the state of bird conservation at the sub-regional level. Section 2 provides more detail on the threats, objectives and actions for priority species grouped by each of the broad habitat types in the sub-region. Section 3 presents additional widespread conservation issues that are not specific to a particular habitat or were not captured by the threat assessment for individual species, as well as research and monitoring needs, and threats to migratory birds while they are outside of Canada. The approach and methodology are summarized in the appendices, but details are available in a separate document (Kennedy et al. 2012). A national database houses all the underlying information summarized in this strategy and is available from Environment Canada.

[6] The six elements are: Element 1 – priority species assessment; Element 2 – habitats important to priority species; Element 3 – population objectives; Element 4 – threat assessment; Element 5 – conservation objectives; Element 6 – recommended actions.

Characteristics of Bird Conservation Region 13: Lower Great Lakes/St. Lawrence Plain

The Lower Great Lakes/St. Lawrence Plain Bird Conservation Region, BCR 13, extends across southern Ontario and southwestern Quebec, as well as the northern United States from Ohio to Vermont. The region encompasses a total area of 201,300 km^2, with the largest portion in Ontario (84,500 km^2 or 42%; Ontario Partners In Flight 2008; Fig. 1). Located in the southernmost portion of the province, and of Canada, BCR 13 Ontario (BCR 13 ON) is unique both in terms of physiography and biodiversity. The habitats along the northern boundary of the BCR reflect the transition between the sedimentary rocks and glacial till in the south of the province and the igneous bedrock of the Canadian Shield to the north (Fig. 2). Mixed forest dominates the transitional landscape, and agriculture is limited in comparison to elsewhere in the region. Farther south, glacial till and plains of limestone, clay or sand predominate. Glacial features such as drumlins and moraines occur throughout the region, and because they have poorer soils or challenging topography, they are often less intensively farmed and support more natural habitats. However, much of BCR 13 ON has deep, fertile soil, and intensive farming is a dominant feature of the landscape. Indeed, nearly 60% of the region is classified as cultivated or managed land (Table 1). Still, despite this heavily altered state, BCR 13 ON continues to offer a variety of unique natural habitats.

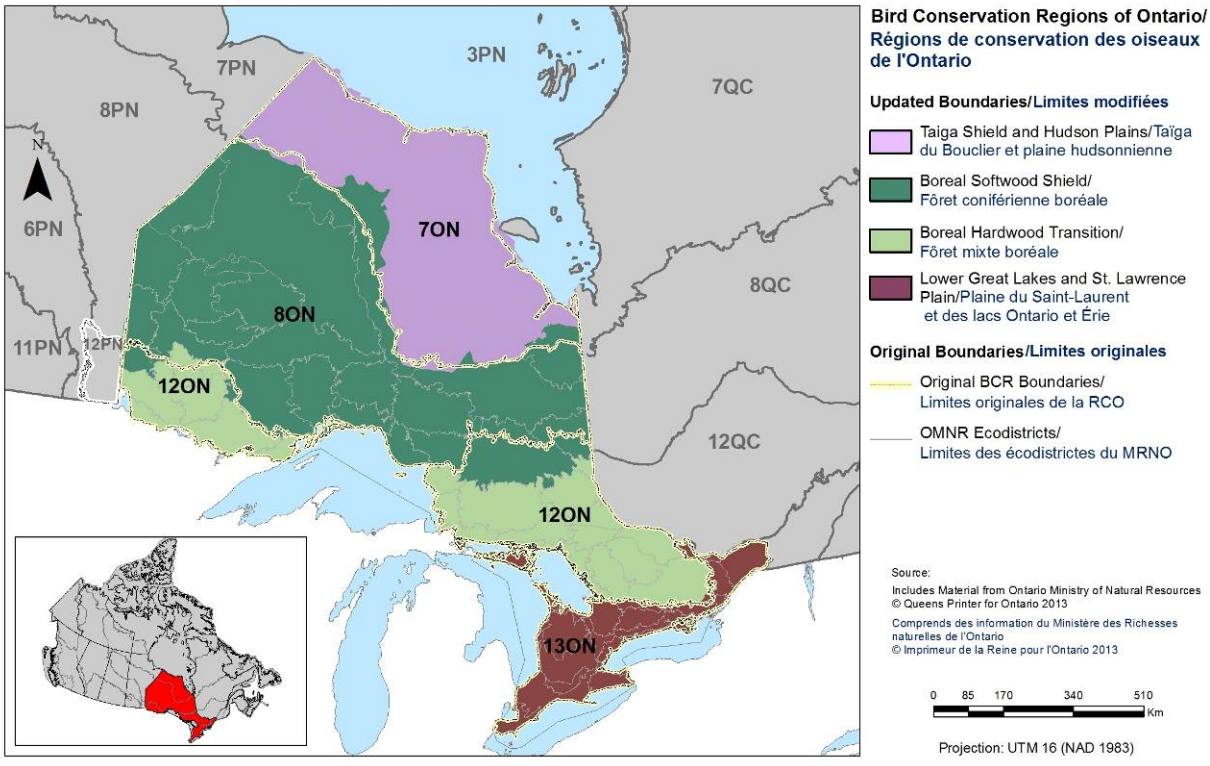

Figure 1. Map of Boundary Changes to BCR 13 ON: Lower Great Lakes/St. Lawrence Plain.

For conservation planning purposes, the original Ontario BCR boundaries (as defined by the North American Bird Conservation Initiative) have been slightly modified to align with the Ontario Ministry of Natural Resources Ecodistrict boundaries[7].

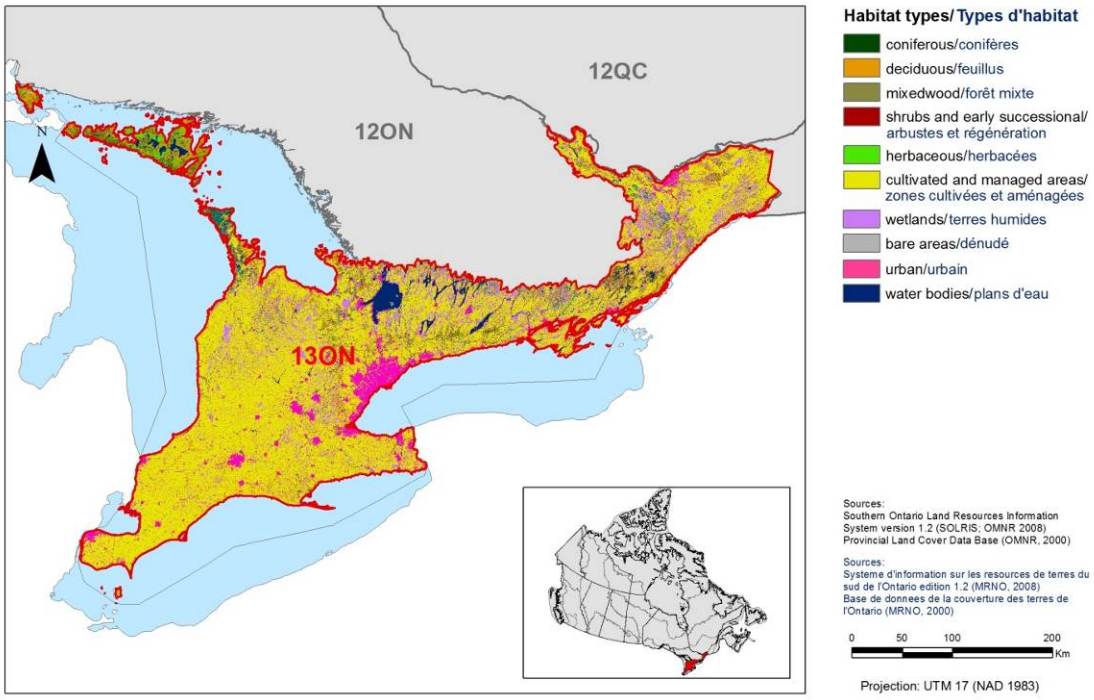

Figure 2. Map of habitat types in BCR 13 ON.

Note: Riparian habitat areas are not depicted on this map because they represent a "zone" and are not a true land cover/land use class. A map depicting the extent of derived riparian areas for illustration purposes can be found in the Riparian section of this strategy.

[7] Ecodistrict 6E-17 has been moved from BCR 12 and included in BCR 13, which results in Cockburn and St. Joseph Islands being included in BCR 13.

Table 1. Major categories of land cover in BCR 13 ON and their proportions on the landscape.

BCR Habitat Class[1]	Provincial Land Cover (PLC 27) Class(es)	SOLRIS v1.2 Land Cover/Land Use Class(es)	Area (ha)	Percent of Total Area
Coniferous Forest	Forest – Dense Coniferous	Coniferous Forest Plantations – Tree Cultivation	322,782	3.79%
Deciduous Forest	Forest – Dense Deciduous Forest – Sparse	Deciduous Forest Forest	730,085	8.59%
Mixed Wood Forest	Forest – Dense Mixed	Mixed Forest	378,203	4.45%
Shrub/Early Successional	Forest Depletion – Cuts Forest Depletion – Burns Forest – Regenerating Depletion	Tallgrass Woodland, Treed Sand Barren and Dune, > 25% vegetated Shoreline	1,839	0.02%
Herbaceous	Agriculture – Pasture/Abandoned fields	Open Tallgrass Prairie, Tallgrass Savannah Alvar	58,271	0.68%
Cultivated/Managed Areas	Agriculture - Cropland	Hedge Rows, Undifferentiated	4,974,029	58.53%
Bare Areas	Sand/Gravel/Mine Tailings, Bedrock	Open Shoreline, Open Sand Barren and Dune, Extraction, Open Cliff and Talus	45,528	0.54%
Urban	Settlement/Infrastructure	Transportation, Built-up area pervious, Built-up area impervious	668,898	7.87%
Wetlands[2]	Marsh – Inland, Swamp – Deciduous, Swamp – Coniferous, Fen – Open, Fen – Treed, Bog – Open, Bog – Treed	Swamp, Fen, Bog, Marsh	1,069,538	12.59%
Waterbodies[3]	Water – Deep clear, Water – Shallow/Sedimented	Open Water	246,932	2.91%
Riparian[4]	30 m inland from shoreline		77,614	N/A

[1] BCR Habitat Classes are based on the United Nations international Land Cover Classification System (LCCS).
[2] Coastal wetlands are not differentiated at the resolution of Provincial Land Cover data.
[3] The area of waterbodies does not include the open waters of the Great Lakes. The area includes inland waterbodies only.
[4] Riparian areas are not included in the total area, as they are "zones" and do not represent a true provincial land cover class.

Table 1 continued

BCR Habitat Class[1]	Provincial Land Cover (PLC 27) Class(es)	SOLRIS v1.2 Land Cover/Land Use Class(es)	Area (ha)	Percent of Total Area
Unknown	Unknown, Cloud/shadow		2,175	0.03%
		Total Area	**8,498,280**	**100%**

Data Source: Lower Great Lakes/St. Lawrence Plain – SOLRIS v1.2 (2000–2002 image data)
Manitoulin and North Channel Islands – Provincial Land Cover 27 (Spectranalysis Inc. 2004)

In several areas of the BCR, including Napanee, Manitoulin Island and the Carden Plain, thin soils over limestone support a sparsely vegetated habitat known as alvar, a globally rare ecosystem (Brownell and Riley 2000). In the southern extent of the region, Canada's most southerly area, unique Carolinian forests support a high diversity of bird species including an atypically high proportion of species at risk (Ontario Partners in Flight 2008). The eastern portion of BCR 13 ON holds a unique landscape that is recognized as 1 of only 13 UNESCO World Biosphere Reserves in Canada: the Frontenac Axis (or Frontenac Arch) is a ridge of Precambrian rock that connects the Canadian Shield of the Algonquin Highlands to the Adirondack Mountains of New York. This 50 km long ridge is home to a unique assemblage of species, including highly diverse herpetofauna and uncommon birds such as the Least Bittern and Cerulean Warbler.

However, high species richness is not limited to these unique habitats. BCR 13 ON as a whole supports among the greatest diversity of breeding landbirds of any region in Canada (Rich et al. 2004) and offers important breeding habitat for a wide diversity of waterfowl, shorebirds and waterbirds. Species richness is greatest where there is a mixture of forest, wetlands and grasslands, found near the edge of the Canadian Shield in this region (Mike Cadman, pers. comm. 2012). The region is also of critical importance to birds during migration. The coastal wetlands, beaches and near-shore waters of the Great Lakes are key migratory stopovers for many waterfowl, shorebirds and waterbirds, and many landbirds congregate at locations such as Presqu'ile, Long Point and Point Pelee before continuing over the Great Lakes on their way south to complete their migration. There is also an atypically high proportion of species at risk, due in part to BCR 13 ON's position at Canada's most southerly latitudes, thus at the northern edge of some species' ranges. However, it also reflects the profound influence that humans have had, and continue to have, on the landscape in this region.

The land cover of BCR 13 ON prior to European settlement bears little resemblance to that which we see today. In the early 19th century, as much as 90% of southern Ontario was covered with deciduous forest and mixed woodlands, perhaps 5% was open habitats such as natural tallgrass prairie, alvar, marsh and savannah (Larson et al. 1999), and perhaps 25% of the region was wetlands (including forested swamps; Snell 1987). Clearing of land and drainage of wetlands for agriculture was widespread and intensive, and estimates suggest a maximum loss of 94% of the region's original upland forest (Larson et al. 1999), 97% of the native prairie and savannah habitats (Rodger 1998), and 68% of wetlands (Snell 1987) at various points in the 20th

century. Although still radically different from the historic land cover, current conditions reflect a recent trend towards reforestation. In 2000, 17% of the land cover was forested, wetlands comprised 13% of the region's area and less than 1% of the region supports natural open habitats (Fig. 2, Table 1). At that time, more than half of the region's land cover supported agriculture, and a majority of the other habitats were either human-made or managed for a variety of uses.

Not surprisingly, these massive changes in habitats in BCR 13 ON have had drastic impacts on the region's avifauna. Grassland birds benefitted significantly from the widespread clearing of forest in the 19th century, but many have since declined due to changing land management practices, reforestation and a variety of other threats discussed in this strategy. In contrast, forest bird population show increasing population trends in the region, as evidenced by a 31% increase in counts of many but not all forest birds in the Breeding Bird Survey, 1968–1977 vs. 2001–2003, presumably in response to increases in forest cover in parts of the BCR sub-region (Ontario Partners In Flight 2008). Other trends in bird abundance, such as a decline of up to 75% in counts of migrant shorebirds at stopover sites throughout southern Ontario (Ross et al. 2012), may have little to do with habitat change in BCR 13 ON (many of the key stopovers are protected areas) and instead could relate to changing conditions on the breeding grounds or elsewhere in the non-breeding range. Still other trends in bird abundance in the region, such as a general decline in aerial insectivores, remain poorly understood (Ontario Partners In Flight 2008).

BCR 13 ON features a number of areas that are protected, including 9 National Wildlife Areas and 6 Migratory Bird Sanctuaries totalling 9,985 hectares (Protected Areas Network 2013) that are maintained by Environment Canada's Canadian Wildlife Service (Fig. 3). A network of national and provincial parks, provincial wildlife areas, conservation reserves, and locally managed working forests (e.g., Conservation Authority and county forests) also contributes to the conservation of birds and wildlife in the BCR. As of 2013, 48 Important Bird Areas (IBA Canada 2013) have been identified in BCR 13 ON, as well as 6 Wetlands of International Importance under the 1981 Ramsar Convention.

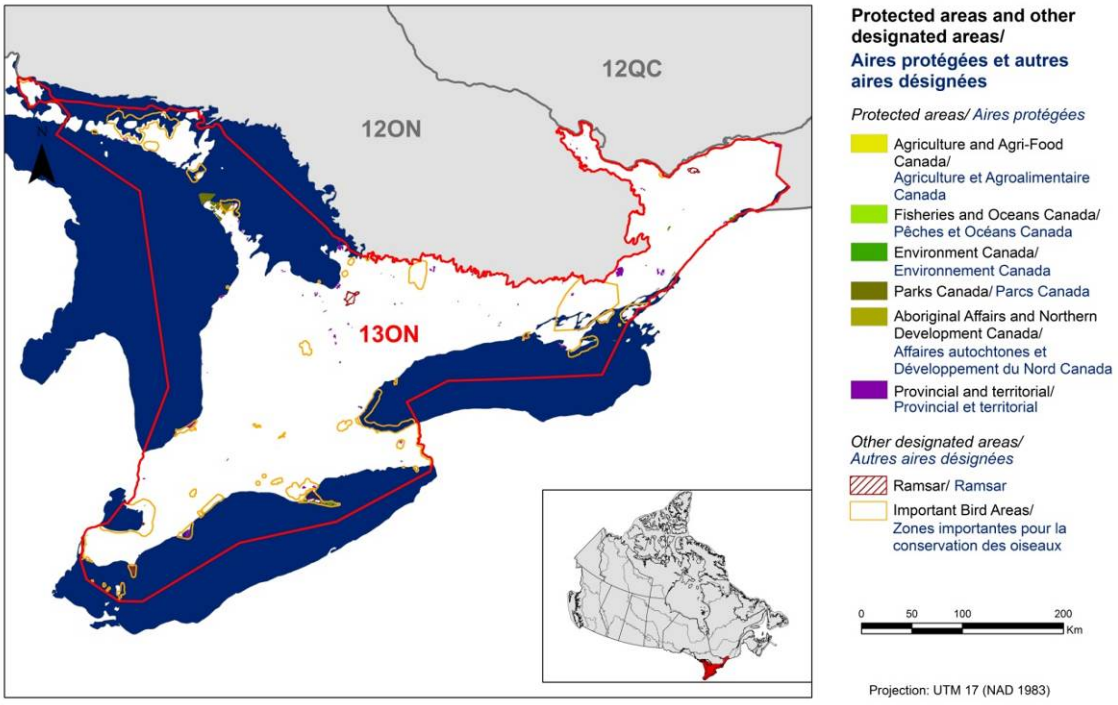

Figure 3. Map of protected areas BCR 13 ON.

Conservation efforts in BCR 13 ON must recognize that a landscape dominated by humans is the reality for this region. Despite its small size, roughly a third of the Canadian population inhabits the region, and population growth here continues to outpace that elsewhere in the province (Ontario Ministry of Finance 2010). Growth has been, and continues to be, accommodated through urban development, which has often resulted in loss of habitats and ecological functions. The ecological functions found in intact or restored migratory bird habitats, such as forests and wetlands, provide ecological goods and services to the growing human population. The economic value of these ecosystem services, from natural purification of water to control of erosion or insect pests, is increasingly recognized by both governments and the public. The concept of maintaining ecosystem services through sustainable development is widely promoted, and this increased awareness may offer new opportunities for conservation of birds and their habitats.

Approximately 90 % of all lands in Southern Ontario are privately owned (Ontario Partners In Flight 2008). Thus, implementation of conservation actions depends heavily on the involvement of private landowners. Conservation of birds on private lands, and in particular lands that are in most cases managed for a variety of human uses, is a substantial challenge involving numerous stakeholders. Yet, significant progress has been made through stewardship programs, adoption of BMPs, municipal and provincial land use plans, strategic protection of lands by environmental non-governmental organizations, the contribution of conservation authorities working with local communities, and the efforts of partnerships such as the Eastern Habitat Joint Venture. Accordingly, implementation of the actions suggested in this strategy could only

be accomplished through a broad partnership of governments and stakeholders pursuing a common goal of biodiversity conservation in BCR 13 ON.

Section 1: Summary of Results – All Birds, All Habitats

Element 1: Priority Species Assessment

These Bird Conservation Strategies identify "priority species" from all regularly occurring bird species in each BCR sub-region (see Appendix 1). Species that are vulnerable due to population size, distribution, population trend, abundance and threats are included as priorities because of their "conservation concern." Some widely distributed and abundant "stewardship" species are also included. Stewardship species are included because they typify the national or regional avifauna and/or because they have a large proportion of their range and/or continental population in the sub-region; many of these species have some conservation concern, while others may not require specific conservation effort at this time. Species of management concern are also included as priority species when they are at (or above) their desired population objectives and require ongoing management because of their socio-economic importance as game species or because of their impacts on other species or habitats (see Appendix 2).

In Ontario, significant efforts to define priority species have already been undertaken for shorebirds, waterbirds, waterfowl and landbirds. The results of these bird group-specific planning efforts form the foundation of this integrated bird priority species list for BCR 13 ON. Birds identified as priority species in previous BCR 13 conservation plans were in general included as priority species. These priority species lists were drawn from Ontario Partners in Flight (2008) for landbirds, the North American Waterfowl Management Plan (NAWMP Plan Committee 2004) and the Ontario Eastern Habitat Joint Venture Implementation Plan (2007) for waterfowl, the Ontario Waterbird Conservation Plan (Zeran et al. unpubl.) for waterbirds and from the Ontario Shorebird Conservation Plan (Ross et al. 2003) for shorebirds. In addition, species that occur regularly within the BCR and have been assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), listed on Schedule 1 of the federal *Species at Risk Act* (SARA) or included on the Species at Risk in Ontario list (SARO; Ontario Ministry of Natural Resources 2013a) in the categories of Endangered, Threatened or Special Concern were added, current to November 2013. Further details on priority species assessment are found in Appendix 2.

The purpose of the prioritization exercise is to focus implementation efforts on the species and issues of greatest significance to Ontario's avifauna. As with any priority-setting exercise, some important species may be excluded; however, the issues of importance to any excluded species are usually captured by addressing the threats identified for species that are included on the priority list. With this in mind, species present in the region only as migrants were included as priority species only when their inclusion introduced new regional conservation issues, such as

for the protection of migratory staging sites. Otherwise, the BCR 13 ON strategy relies on conservation actions arising from threats to other priority species to address more general conservation concerns for migrants.

In all, 280 species of birds occur regularly in BCR 13 ON, 97 of which were assessed as priority species (Table 2) with representatives from all four bird groups. Landbirds show the greatest diversity in BCR 13 ON, representing nearly 66% of the candidate species list (Table 3). Many landbird species are uncommon or non-breeders in the region, and only 25% of them were assigned priority status. Still, landbirds contributed the greatest number of species to the priority list (46 species or 47%; Table 3). In contrast, more than two-thirds of the waterbirds present within the region were assigned priority status, contributing 24 species (25%) to the priority list. The diversity of breeding shorebirds and waterfowl in the region is low in comparison to landbirds. These groups contribute 11 and 16 species, respectively, to the priority species list, including a number present only as migrants (Table 2). Among the 97 priority species, 33 are assessed as "at risk" by COSEWIC; 25 are listed on Schedule 1 of the federal SARA, and 30 are included on the SARO list (Table 4).

Table 2. Priority species in BCR 13 ON, population objective and reasons for priority status.
Note: All assessments, listings and designations are current to November 2013. A species can be on the priority list for more than one reason.

Priority Species	Population Objective	COSEWIC[1]	SARA[2]	SARO[3]	Regional/Sub-regional Concern[4]	Regional/Sub-regional Stewardship[5]	National/Continental Concern	National/Continental Stewardship
Landbirds								
Acadian Flycatcher	Recovery objective	E	E	E	Y		Y	Y
American Kestrel	Maintain current				Y			
Bald Eagle	Recovery objective[6]			SC	Y			Y
Baltimore Oriole	Maintain current				Y			
Bank Swallow	Increase	T				Y		

[1] Assessed by COSEWIC as E, Endangered; T, Threatened; SC, Special Concern.
[2] Species listed on Schedule 1 of SARA as E, Endangered; T, Threatened; SC, Special Concern (Species at Risk Public Registry 2013).
[3] Species listed as E, Endangered; T, Threatened; SC, Special Concern on the SARO List.
[4] Regional refers to BCR-wide (i.e., all jurisdictional data were used for the entire BCR) while sub-regional refers to the Ontario portion of the BCR only (i.e., Ontario BCR data were used).
[5] Only the landbird group distinguishes stewardship species from other priority species (see Panjabi et al. 2005)
[6] This species is listed under the federal SARA and/or the provincial *Endangered Species Act 2007*, but its federal and/or provincial recovery documents have not yet been finalized.

Table 2 continued

Priority Species	Population Objective	COSEWIC[1]	SARA[2]	SARO[3]	Regional/Sub-regional Concern[4]	Regional/Sub-regional Stewardship[5]	National/Continental Concern	National/Continental Stewardship
Barn Owl	Recovery objective	E	E	E	Y		Y	
Barn Swallow	Recovery objective	T		T	Y			
Belted Kingfisher	Increase				Y			
Black-billed Cuckoo	Increase				Y	Y		
Blue-winged Warbler	Maintain current				Y		Y	
Bobolink	Recovery objective	T		T	Y	Y	Y	
Brown Thrasher	Increase				Y			Y
Canada Warbler	Recovery objective[6]	T	T	SC	Y		Y	
Cerulean Warbler	Recovery objective	E	SC	T	Y		Y	
Chimney Swift	Recovery objective[6]	T	T	T	Y		Y	
Common Nighthawk	Recovery objective[6]	T	T	SC	Y		Y	
Eastern Kingbird	Increase				Y			
Eastern Meadowlark	Recovery objective	T		T	Y			
Eastern Towhee	Increase				Y		Y	Y
Eastern Whip-poor-will	Recovery objective[6]	T	T	T	Y		Y	
Eastern Wood-Pewee	Increase	SC			Y			
Field Sparrow	Increase				Y			
Golden-winged Warbler	Recovery objective[6]	T	T	SC	Y		Y	
Grasshopper Sparrow	Increase	SC			Y		Y	Y
Henslow's Sparrow	Recovery objective	E	E	E	Y		Y	
Hooded Warbler	Recovery objective		T		Y		Y	Y
Kirtland's Warbler	Recovery objective	E	E	E	Y		Y	
Loggerhead Shrike *(migrans)*	Recovery objective	E	E	E	Y		Y	
Louisiana Waterthrush	Recovery objective	SC	SC	SC	Y		Y	Y

Table 2 continued

Priority Species	Population Objective	COSEWIC[1]	SARA[2]	SARO[3]	Regional/Sub-regional Concern[4]	Regional/Sub-regional Stewardship[5]	National/Continental Concern	National/Continental Stewardship
Northern Bobwhite	Recovery objective[6]	E	E	E	Y		Y	
Northern Flicker	Increase				Y			
Northern Harrier	Maintain current				Y			
Northern Rough-winged Swallow	Increase				Y			
Olive-sided Flycatcher	Recovery objective [6]	T	T	SC	Y		Y	
Peregrine Falcon (*anatum/tundrius*)	Recovery objective	SC	SC	SC	Y		Y	
Prairie Warbler	Assess/Maintain				Y		Y	
Prothonotary Warbler	Recovery objective	E	E	E	Y		Y	
Purple Martin	Increase				Y			
Red-headed Woodpecker	Recovery objective[6]	T	T	SC	Y		Y	
Red-shouldered Hawk	Assess/Maintain				Y			Y
Rose-breasted Grosbeak	Maintain current					Y		
Savannah Sparrow	Increase				Y			
Short-eared Owl	Recovery objective[6]	SC	SC	SC	Y		Y	
Vesper Sparrow	Increase				Y			
Wood Thrush	Maintain current	T			Y		Y	
Yellow-breasted Chat (*virens*)	Recovery objective	E	SC	E	Y		Y	
Shorebirds								
American Golden-Plover	Migrant (no BCR 13-ON population objective)				Y		Y	
American Woodcock	Increase				Y		Y	
Black-bellied Plover	Migrant (no BCR 13-ON population objective)				Y		Y	
Buff-breasted Sandpiper	Migrant (no BCR 13-ON population objective)	SC			Y		Y	
Killdeer	Increase				Y		Y	
Piping Plover	Recovery objective	E	E	E	Y		Y	

Table 2 continued

Priority Species	Population Objective	COSEWIC[1]	SARA[2]	SARO[3]	Regional/Sub-regional Concern[4]	Regional/Sub-regional Stewardship[5]	National/Continental Concern	National/Continental Stewardship
(*circumcinctus)*								
Red Knot (*rufa*)	Migrant (no BCR 13-ON population objective)	E	E	E	Y		Y	
Semipalmated Sandpiper	Migrant (no BCR 13-ON population objective)				Y		Y	
Spotted Sandpiper	Increase				Y		Y	
Upland Sandpiper	Increase				Y			
Wilson's Snipe	Assess/Maintain				Y			
Waterbirds								
American Bittern	Assess/Maintain				Y		Y	
American Coot	Increase				Y			
Black Tern	Recovery objective			SC	Y		Y	
Black-crowned Night-Heron	Assess/Maintain				Y			
Bonaparte's Gull	Migrant (no BCR 13-ON population objective)				Y		Y	
Caspian Tern	Maintain current				Y			
Common Gallinule	Assess/Maintain				Y			
Common Loon	Maintain current				Y		Y	
Common Tern	Increase				Y		Y	
Forster's Tern	Assess/Maintain				Y		Y	
Great Black-backed Gull	Maintain current				Y			
Great Blue Heron	Maintain current				Y			
Great Egret	Maintain current				Y			
Green Heron	Increase				Y			
Horned Grebe (western population)	Migrant (no BCR 13-ON population objective)	SC		SC	Y		Y	
King Rail	Recovery objective	E	E	E	Y		Y	
Least Bittern	Recovery objective	T	T	T	Y		Y	

Table 2 continued

Priority Species	Population Objective	COSEWIC[1]	SARA[2]	SARO[3]	Regional/Sub-regional Concern[4]	Regional/Sub-regional Stewardship[5]	National/Continental Concern	National/Continental Stewardship
Little Gull	Migrant (no BCR 13-ON population objective)				Y		Y	
Pied-billed Grebe	Maintain current				Y			
Red-necked Grebe	Assess/Maintain				Y			
Sandhill Crane	Assess/Maintain				Y			
Sora	Assess/Maintain				Y		Y	
Virginia Rail	Maintain current				Y		Y	
Yellow Rail	Recovery objective	SC	SC	SC	Y		Y	
Waterfowl								
American Black Duck	Maintain current				Y		Y	
Blue-winged Teal	Increase				Y		Y	
Canada Goose (Southern James Bay)	Migrant[7] (no BCR 13-ON population objective)				Y		Y	
Canada Goose (Temperate-breeding in Eastern Canada)	Decrease[8]				Y			
Canvasback	Maintain current				Y		Y	
Common Goldeneye	Maintain current				Y		Y	
Common Merganser	Maintain current				Y			
Green-winged Teal	Maintain current				Y			
Lesser Scaup	Assess/Maintain				Y		Y	
Long-tailed Duck	Assess/Maintain				Y		Y	
Mallard	Maintain current				Y		Y	
Mute Swan	Decrease[8]				Y			
Redhead	Maintain current				Y		Y	
Ring-necked Duck	Maintain current				Y			

[7] Population objectives for migrant waterfowl are based on spring and fall staging surveys of the Great Lakes with the exception of the Southern James Bay Population of Canada Geese.
[8] A species of management interest due to its high abundance.

Table 2 continued

Priority Species	Population Objective	COSEWIC[1]	SARA[2]	SARO[3]	Regional/Sub-regional Concern[4]	Regional/Sub-regional Stewardship[5]	National/Continental Concern	National/Continental Stewardship
Tundra Swan	Maintain current				Y			
Wood Duck	Increase				Y			

Table 3. Summary of priority species, by bird group, in BCR 13 ON.

Bird Group	Number of Species	Percent of Total Number of Species	Number of Priority Species	Percent Listed as Priority by Bird Group	Percent of Total Number of Priority Species
Landbird	184	66%	46	25%	47%
Shorebird	32	11%	11	34%	11%
Waterbird	31	11%	24	77%	25%
Waterfowl	33	12%	16	48%	17%
Total	**280**	**100%**	**97**	**-**	**100%**

Table 4. Number of priority species in BCR 13 ON by reason for priority status.
Note: All assessments, listings and designations are current to November 2013.

Priority Listing[1]	Landbird	Shorebird	Waterbird	Waterfowl
COSEWIC[2]	26	3	4	0
SARA[3]	20	2	3	0
SARO[4]	23	2	5	0
National/Continental Concern	26	9	13	9
National/Continental Stewardship[5]	8	N/A	N/A	N/A

[1] A single species can be on the priority list for more than one reason.
[2] Assessed by COSEWIC as Endangered, Threatened or Special Concern.
[3] Species listed on Schedule 1 of SARA as Endangered, Threatened or Special Concern.
[4] Species listed as Endangered, Threatened or Special Concern on the SARO List.
[5] Only the landbird group distinguishes stewardship species from other priority species (see Panjabi et al. 2005).

Regional/Sub-regional Concern[6]	44	11	24	16
Regional/Sub-regional Stewardship	4	N/A	N/A	N/A
Management Interest[7]	0	0	0	2

Element 2: Habitats Important to Priority Species

Identifying the broad habitat requirements for each priority species within the BCR allowed species to be grouped by shared habitat-based conservation issues and actions (see Appendix 2 for details on how species were assigned to standard habitat categories). If many priority species associated with the same habitat face similar conservation issues, then conservation action in that habitat may support populations of several priority species. BCR strategies use a modified version of the standard land cover classes developed by the United Nations (Food and Agriculture Organization 2000) to categorize habitats, and species were often assigned to more than one habitat class. In BCR 13 ON, two data sets were used to derive the extent of available BCR habitats. The Southern Ontario Land Resource Information System (SOLRIS) version 1.2 released April 2008 provides a comprehensive land cover/land use inventory of southern Ontario's natural, rural and urban areas (OMNR 2008b). SOLRIS follows a standardized approach for ecosystem description, inventory and interpretation known as Ecological Land Classification (Lee et al. 1998) and covers the majority of the BCR. Provincial land cover (PLC) data were used to fill the information gaps for Manitoulin and North Channel Islands. PLC 27 is an Ontario land cover classification system produced wholly from satellite remote sensing data by the Ontario Ministry of Natural Resources. It provides a classification of 27 broad land cover types for the province of Ontario north of the southern border of the Canadian Shield and reflects the nature of the land surface rather than the land use (Spectranalysis Inc., 2004).

Priority species used many different habitats, with wetlands most heavily used (40% of species; Fig. 4). Although wetlands represent only 13% of land cover, prior to European settlement wetlands (greater than 10 ha) covered perhaps 25% or more of the region (Ducks Unlimited Canada 2010). The high number of wetland-associated priority species reflects the ongoing pressure on this important habitat. Similarly, herbaceous habitats (e.g., tallgrass prairie, savannah, alvar) were used by 23% of species, despite accounting for less than 1% of the region's land cover, whereas cultivated and managed areas used by a similar fraction of species (32%) dominate the landscape. The populations of many priority species that had been restricted to native herbaceous habitats prior to European settlement flourished as they adapted to the cultivated and managed land that became available. The large number of priority species using these two habitat classes is due to alarming population declines as high-quality open country such as native and managed grasslands is lost or degraded.

[6] Regional refers to BCR-wide (i.e., all jurisdictional data were used for the entire BCR) while sub-regional refers to the Ontario portion of the BCR only (i.e., Ontario BCR data were used).
[7] A species of management interest due to its high abundance.

The Great Lakes are a prominent feature of the region, and the beaches, mudflats and other coastal “bare areas” were used by 18% of species, while 21% used the waterbodies themselves (Great Lakes and inland waterbodies) (Fig. 4). The two forested habitats were used by 12% (deciduous) and 13% (mixed wood) of priority species. Although the diversity of landbirds can be high in the forests of BCR 13 ON, many of these species were not identified as priorities. Forest cover has actually increased in BCR 13 ON over the last 70 years (Riley and Mohr 1994; Ontario Partners in Flight 2008) and populations of many but not all forest bird species show stable or increasing trends over the last 40 years (Environment Canada 2014). It may be that some of these species have stabilized at lower post-European settlement population levels. However, it remains important to keep common species common, and current habitat trends must be monitored as new studies are showing a decline in forest cover in the north-eastern United States following decades of increase (Foster et al. 2008).

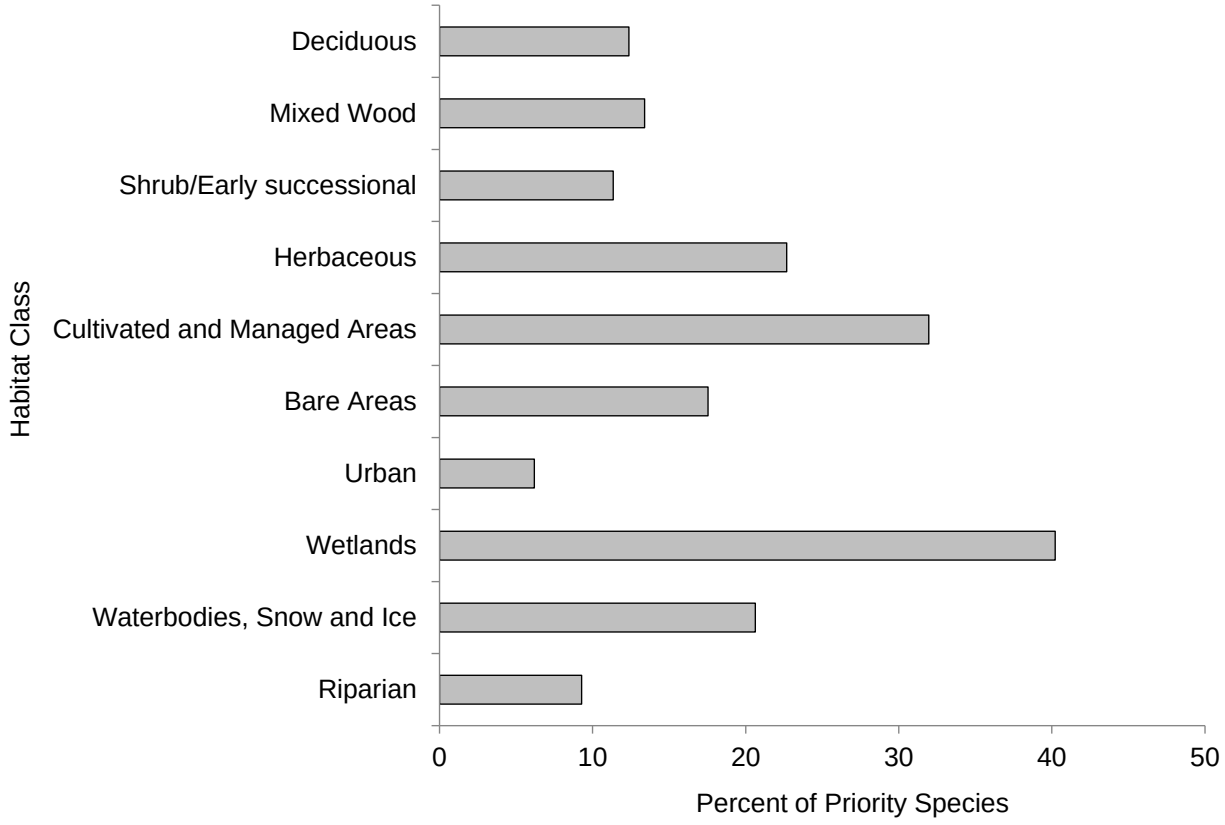

Figure 4. Percent of priority species that are associated with each habitat type in BCR 8 ON.
Note: The total exceeds 100% because each species may use more than one habitat.

Element 3: Population Objectives

Population objectives allow us to measure and evaluate conservation success. The objectives in this strategy are assigned to categories and are based on a quantitative or qualitative assessment of species' population trends. If the population trend of a species is unknown, the objective is set as "assess and maintain," and a monitoring objective is given (see Appendix 2). For any species listed under SARA or under provincial/territorial endangered species legislation, Bird Conservation Strategies defer to population objectives in available Recovery Strategies and Management Plans. If recovery documents are not yet available, interim breeding population objectives are provided by species, by habitat in Section 2. When recovery objectives are available, they will replace the interim objectives. For more details on methodology, refer to Appendix 2. The ultimate measure of conservation success will be the extent to which population objectives have been reached within the timeframes set by national and continental bird conservation plans.

The lands, habitats and ecosystems within BCR 13 ON have changed fundamentally and irreversibly over the last 200 years (Environment Canada 2013a; Ontario Partners in Flight 2008). How they will contribute to restoring North America's bird populations at natural abundances can be seen by referring to historic conditions, present-day conditions and new opportunities. Different bird species and guilds have flourished and declined with past changes to the ecosystems of BCR 13 ON. For example, forest birds were at peak abundance when BCR 13 ON was a forest biome prior to European land clearance. Subsequently, when forests in this region were converted to open country habitats for agriculture (peaking in extent in the early 20th century), populations of open country birds increased greatly (Ontario Partners In Flight 2008). Today, high-quality open country habitats are in decline and with each successive ecosystem state, the population abundance of few, if any, bird guilds have remained the same. Furthermore, new species colonized BCR 13 ON when ecosystem changes favoured them. Therefore, the BCR 13 ON priority species represent different ecological reference points. Setting population and habitat targets that contribute to North American population goals must be done in the context of the relationship of a species' status relative to these previous ecosystem states. There are, therefore, multiple reference points for setting objectives for sustainable populations and habitat that reflect population levels prior to various widespread declines associated with the different bird species and guilds.

Unlike many BCRs in Canada, much of BCR 13 ON is well covered by large-scale bird surveys such as the Breeding Bird Survey, the Christmas Bird Count, the Ontario Breeding Bird Atlas, the Ontario Shorebird Survey, the Southern Ontario Breeding Waterfowl Plot Survey, the Great Lakes Marsh Monitoring Program, the Great Lakes Colonial Waterbird Monitoring Surveys and decadal migrant waterfowl surveys of the major shorelines in southern Ontario. Consequently, the status of birds in Southern Ontario is relatively well known, which facilitates the setting of population objectives for priority species. For 24% of priority species, monitoring data suggested declines with sufficient certainty to support an objective of increasing population size (Fig. 5). In contrast, populations were sufficiently elevated to warrant a reduction in population size for two priority species: the Eastern Temperate-breeding Canada Goose and non-native

invasive Mute Swan. Both are species of management interest for Environment Canada's Canadian Wildlife Service in Ontario Region. Maintaining populations at current levels (including most migrant waterfowl) was the objective for 23% of the priority species in BCR 13 ON, while only 12% of priority species were assigned a population objective of Assess/Maintain because monitoring data were insufficient to propose an objective. Six of these species were waterbirds. Among breeding birds, waterbirds and especially marsh birds are perhaps the most difficult group to monitor in BCR 13 ON, and population size and status remain poorly known for a number of species. A recovery objective was assigned to 30% of priority species, which are all species at risk whose breeding range occurs within this BCR, though their recovery documents may not yet be finalized. Nine percent (9 %) of priority species were identified as migrating through BCR 13 ON, including the federally and provincially endangered Red Knot (*rufa*), and were not assigned an objective as those were set in other BCR strategies covering the breeding range of these species. However, population goals were established for migrant waterfowl, recognizing both the importance of migratory staging habitat to waterfowl and the importance of migrant waterfowl to society. One exception is the Southern James Bay population of Canada Geese, which is impossible to differentiate from temperate breeders during routine aerial surveys.

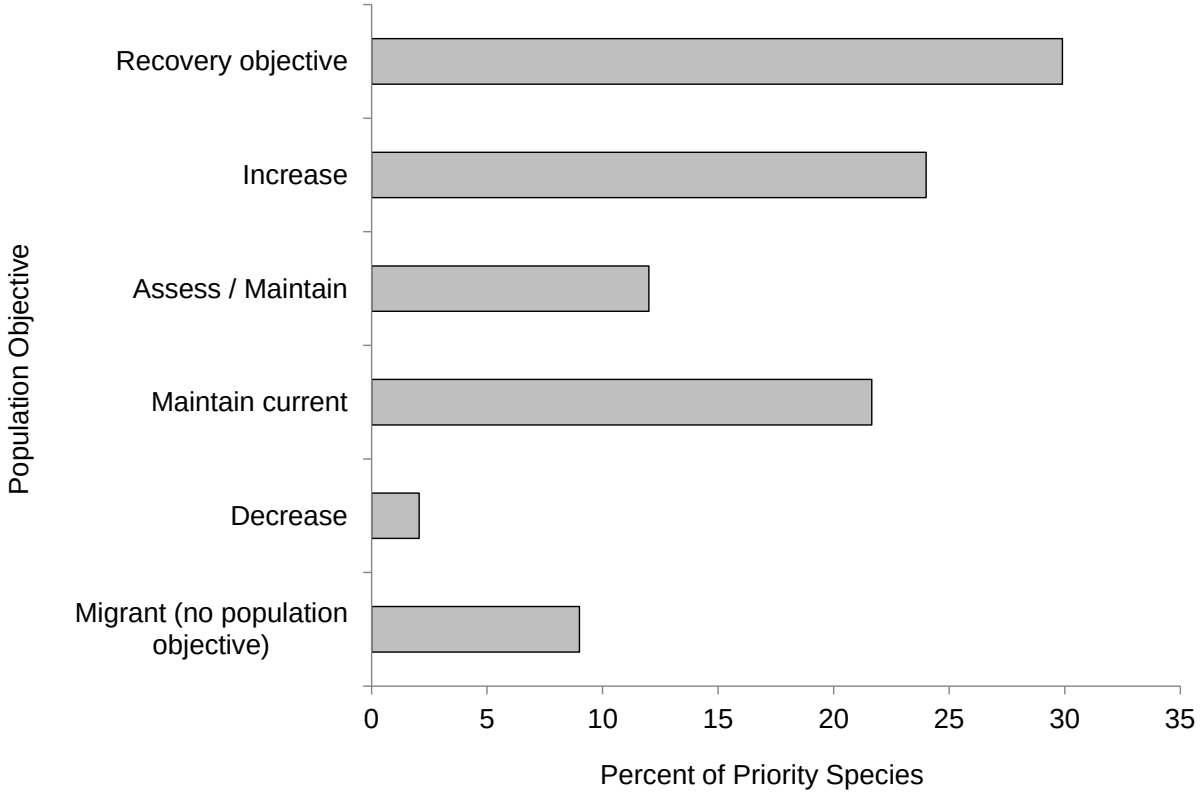

Figure 5. Percent of priority species that are associated with each population objective category in BCR 13 ON.

Element 4: Threat Assessment for Priority Species

Bird population trends may be driven by factors that negatively affect either their reproduction or survival during any point in their annual life cycle. Threats that can reduce survival include reduced food availability at migratory stopovers or exposure to toxic compounds. Examples of threats that can reduce reproductive success are high levels of nest predation or reduced quality or quantity of breeding habitat. The threats assessment process (which is based on the methods described in Salafsky et al. 2008; see Appendix 2) identifies threats believed to have a population-level effect on individual priority species. These threats are assigned a relative magnitude (Low, Medium, High, Very High) based on their scope (the proportion of the species' range within the sub-region that is impacted) and severity (the relative impact on the priority species' population). This allows us to target conservation actions towards threats with the greatest effects on suites of species or in broad habitat classes. Some well-known conservation issues may not be identified in the literature as significant threats to populations of an individual priority species and therefore may not be captured in the threat assessment. However, they merit attention in conservation strategies because of the large numbers of individual birds affected in many regions of Canada. Usually these issues transcend habitat types and are considered "widespread," and these issues are addressed in a separate section (see Section 3: Widespread Issues), but unlike other threats, they are not ranked (e.g., climate change and severe weather; threat category 11).

In BCR 13 ON, threat category 12 "other direct threats" and sub-category 12.1 "Information lacking" was used to identify priority species that lack adequate biological or demographic information required for population conservation and management. Using this category in this manner facilitated the development of targeted research and monitoring conservation actions to address knowledge gaps for these species, but unlike the other threats, they were not ranked (Fig. 6).

Because of the highly human-altered landscape, priority birds in BCR 13 ON face a significant number of anthropogenic threats, greater in both number and intensity than for birds in Ontario's more northerly BCRs (Fig. 6 and Table 5). The dominant threats relate to habitat loss and degradation from a variety of sources including residential and commercial development (threat category 1), agriculture (category 2), transportation and service corridors (category 4), biological resource use (category 5), invasive and other problematic species (category 8), pollution (category 9), natural system modifications (category 7) such as succession in grasslands in the absence of natural fire regimes, or unnatural regulation of water levels in wetlands, and also human intrusion and disturbance of breeding or foraging birds (category 6). These threats are discussed in more detail in subsequent sections, but the diversity and magnitude of threats are noteworthy (Fig. 6). Within BCR 13 ON, threats related to climate change and severe weather (category 11), collisions with vehicles (category 4), and collisions with buildings (category 1) were considered to be widespread and as such are discussed in the Widespread Issues section of this strategy.

Cumulative Effects of Threats to Priority Species

For several of the threats identified in this strategy, the long-term combined or cumulative effect may be greater than the sum of the effects of the individual threat. There is no standardized method for assessing these "cumulative effects." The threat ranking and roll-up procedures (Appendix 2) demonstrate the sum of effects for threats within and among threat categories and are useful for identifying the most important threats within a habitat class or the relative importance of individual threats across the BCR sub-region (Table 5). These procedures also identify whether a large number of low-level threats may be affecting a species. However, it is important to consider that threats might interact in unanticipated ways or that, in aggregate, threats might exceed some ecological threshold to produce cumulative effects of an unanticipated magnitude. Cumulative impact studies assessing population responses to multiple stressors are an important tool to better understand the long-term consequences of some of the threats described in this strategy.

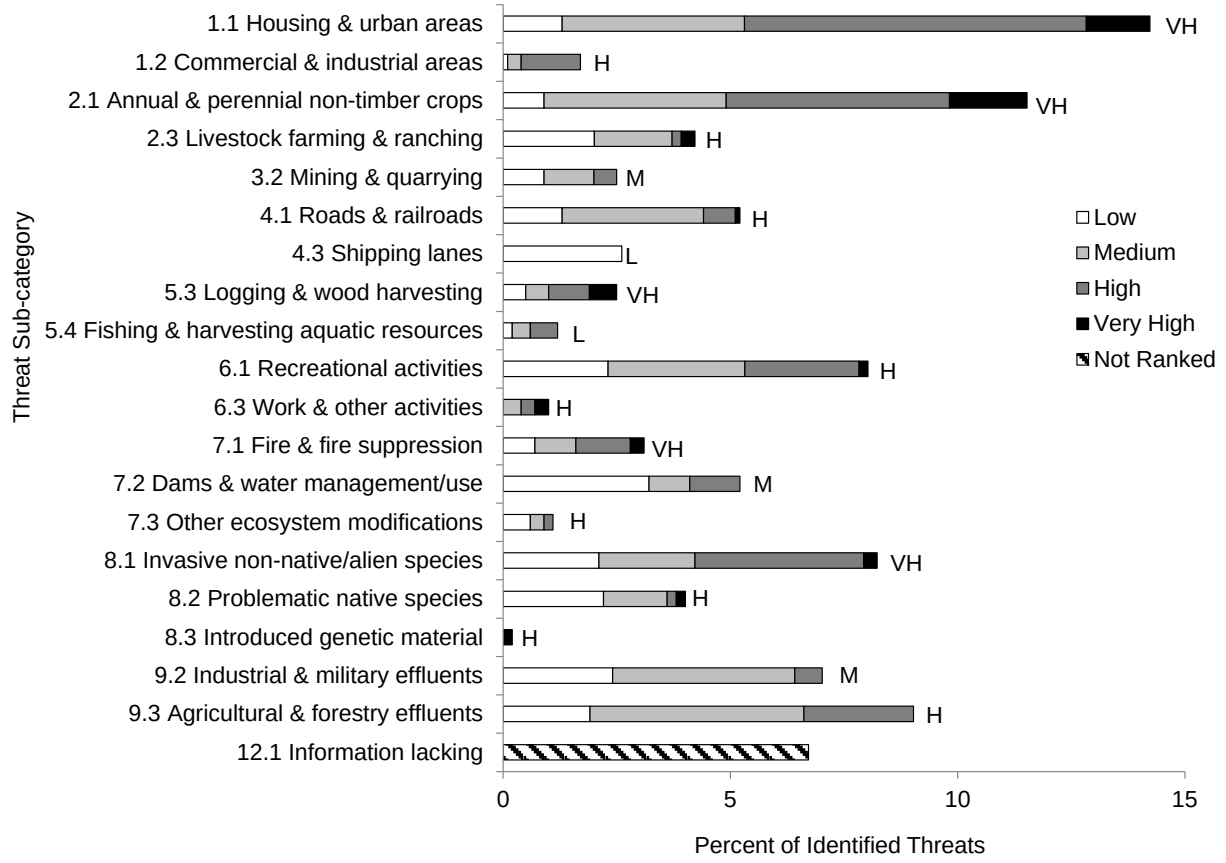

Figure 6. Percent of identified threats to priority species within BCR 13 ON by threat sub-category.
Each bar represents the percent of the total number of threats identified in each threat sub-category in BCR 13 ON (for example, if 100 threats were identified in total for all priority species in BCR 13 ON, and 10 of those threats were in the category 6.1 Recreational activities, the bar on the graph would represent this as 10%). Shading in the bars (VH = very high, H = high, M = medium and L = low) represents the magnitude of the threats in each threat sub-category in the BCR. The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another. The overall rolled-up magnitude of the threat sub-category is

shown at the end of each bar (also presented in Table 5). Threat sub-category 12.1 Information lacking was not ranked. See Element 4 in Appendix 2 for details on how magnitude was assessed.

Threats to priority species while they are outside Canada during the non-breeding season were also assessed and are presented in the section Threats Outside Canada.

Table 5. Relative magnitude of identified threats to priority species within BCR 13 ON by threat category and broad habitat class.

Only threats with a population-level effect were considered, and overall ranks were generated through a roll-up procedure described in Kennedy et al. (2012). L represents Low-magnitude threats, M: Medium, H: High, VH: Very High. Cells with hyphens indicate that no priority species had threats identified in the threat category/habitat combination.

Threat Category	Habitat Class										
	Deciduous	Mixed	Shrub/Early successional	Herbaceous	Cultivated and Managed Areas	Bare Areas	Urban	Wetlands	Waterbodies	Riparian	Overall Rank
Overall Rank	**VH**	**VH**	**H**	**VH**	**VH**	**H**	**H**	**VH**	**VH**	**H**	
1. Residential & Commercial Development	VH	VH	H	H	H	VH	H	VH	H	H	**VH**
2. Agriculture & Aquaculture	VH	VH	H	VH	VH	-	-	VH	-	H	**VH**
3. Energy Production & Mining	-	-	-	M	-	H	-	L	L	L	**M**
4. Transportation & Service Corridors	M	M	-	H	H	L	M	M	-	M	**H**
5. Biological Resource Use	VH	VH	-	-	-	-	-	H	M	M	**VH**
6. Human Intrusions & Disturbance	L	L	L	M	VH	H	H	H	VH	H	**VH**
7. Natural System Modifications	L	L	VH	VH	VH	M	-	H	L	-	**VH**
8. Invasive & Other Problematic Species & Genes	VH	H	H	H	H	H	L	VH	VH	L	**VH**
9. Pollution	M	H	L	-	VH	M	M	H	H	H	**H**

Element 5: Conservation Objectives

Conservation objectives were designed to address threats and information gaps that were identified for priority species. They describe the environmental conditions and research and monitoring that are thought to be necessary for progress towards population objectives and to understand underlying conservation issues for priority bird species. As conservation objectives are reached, they will collectively contribute to achieving population objectives. Whenever possible, conservation objectives were developed to benefit multiple species and/or respond to more than one threat (see Appendix 2).

For BCR 13 ON, the majority of conservation objectives identified relate to ensuring an adequate supply and quality of habitat (conservation objective category 1; Fig. 7). Included in these objectives are the maintenance and/or restoration of the full range and diversity of habitat types, maintaining the quality of existing habitats, and retaining important features on the landscape (e.g., standing dead snags for cavity-nesting birds). Also important is the need to manage individual species (category 3). Most of the objectives in this category relate to the prevention and control of invasive and exotic species as well as the development and/or implementation of recovery strategies and management plans for the numerous species at risk in BCR 13 ON. The third-most identified conservation objective category reflects the need to improve understanding of factors causing population declines of priority species as well as enhancing population/demographic and habitat monitoring across the BCR (category 7). Other objectives address the need to reduce human disturbance of priority species (category 4), ensure adequate food supply through the maintenance of natural food webs and prey sources (category 5), and reduce mortality (and/or sub-lethal effects) through reductions in pesticide use across the BCR (category 2).

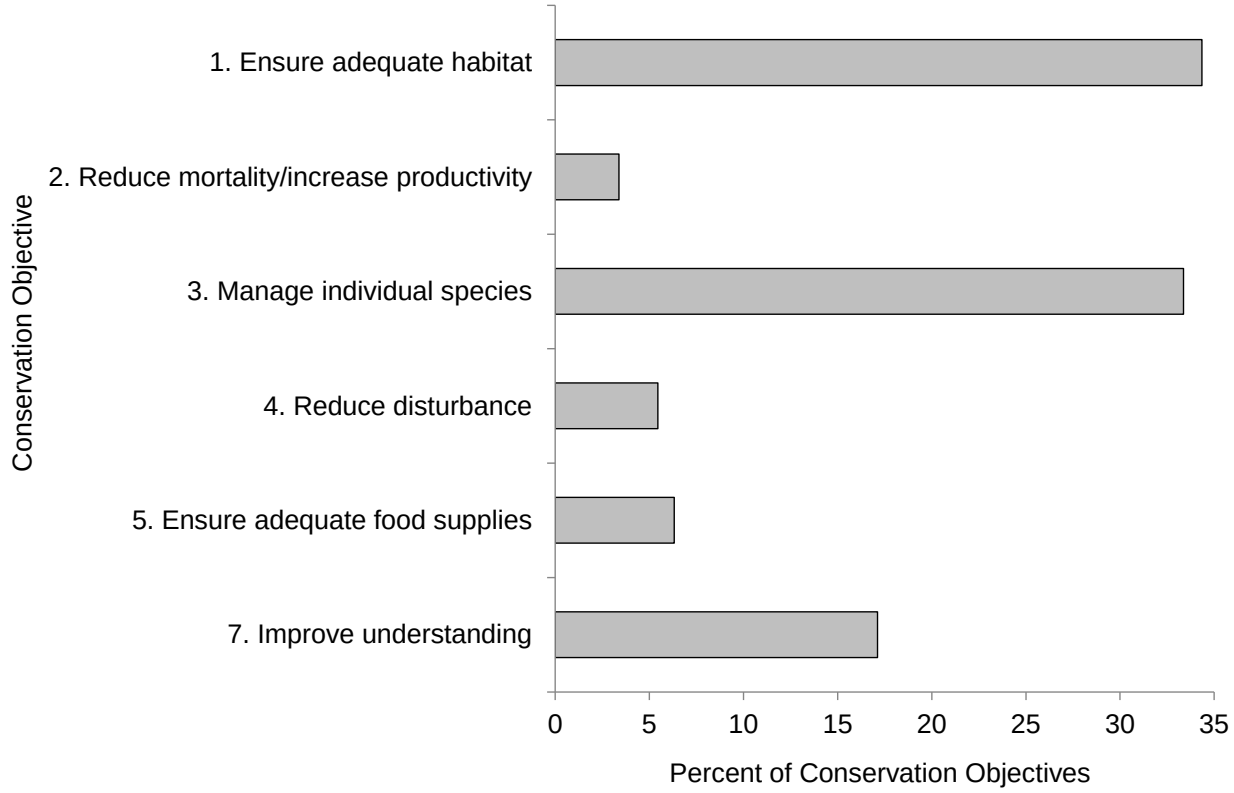

Figure 7. Percent of all conservation objectives assigned to each conservation objective category in BCR 13 ON.

Element 6: Recommended Actions

Recommended actions indicate on-the-ground activities that will help to achieve the conservation objectives (Fig. 8). Actions are strategic rather than highly detailed and prescriptive (see Appendix 2). Whenever possible, recommended actions benefit multiple species and/or respond to more than one threat. Recommended actions defer to or support those provided in recovery documents for species at risk at the federal, provincial or territorial level and will usually be more general than those developed for individual species. However, for detailed recommendations for species at risk, readers should consult published federal recovery documents (Species at Risk Public Registry 2013) or provincial recovery documents (Ontario Ministry of Natural Resources 2013b). Similarly, a number of landbird species included in this strategy are stewardship species as defined by Partners in Flight (Rich et al. 2004). These are species with stable populations or for which no specific conservation issues have been identified, but which depend on BCR 13 ON to such an extent that the region has a high responsibility for their protection. These species may not appear prominently in the threats, objectives and actions described herein, but should benefit from the implementation of actions that target multiple species.

The proposed conservation actions for BCR 13 ON are diverse in their approach (Fig. 8), demonstrating the need for a multi-faceted strategy for conservation in this highly developed region. Recognizing that a large majority of lands in the region are privately owned, only a small proportion of the actions relate to the direct protection of land (action sub-category 1.1). Instead, a majority of actions focus on habitat restoration and management (sub-categories 2.1, and 2.3) for priority species by engaging landowners and other stakeholders in conservation. Developing and implementing effective policies and regulations (sub-category 5.2), the development, use and promotion of BMPs (sub-category 5.3), increasing awareness about conservation issues (sub-category 4.3), developing partnerships (sub-category 7.2), determining factors causing population declines and improving the scientific knowledge that underlies management decisions (sub-category 8.1) all figure prominently in the suite of conservation actions proposed for this region. Engaging stakeholders in actions that restore the function and resilience of ecosystems in this highly impacted region ensures that conservation successes can be maintained over the long term.

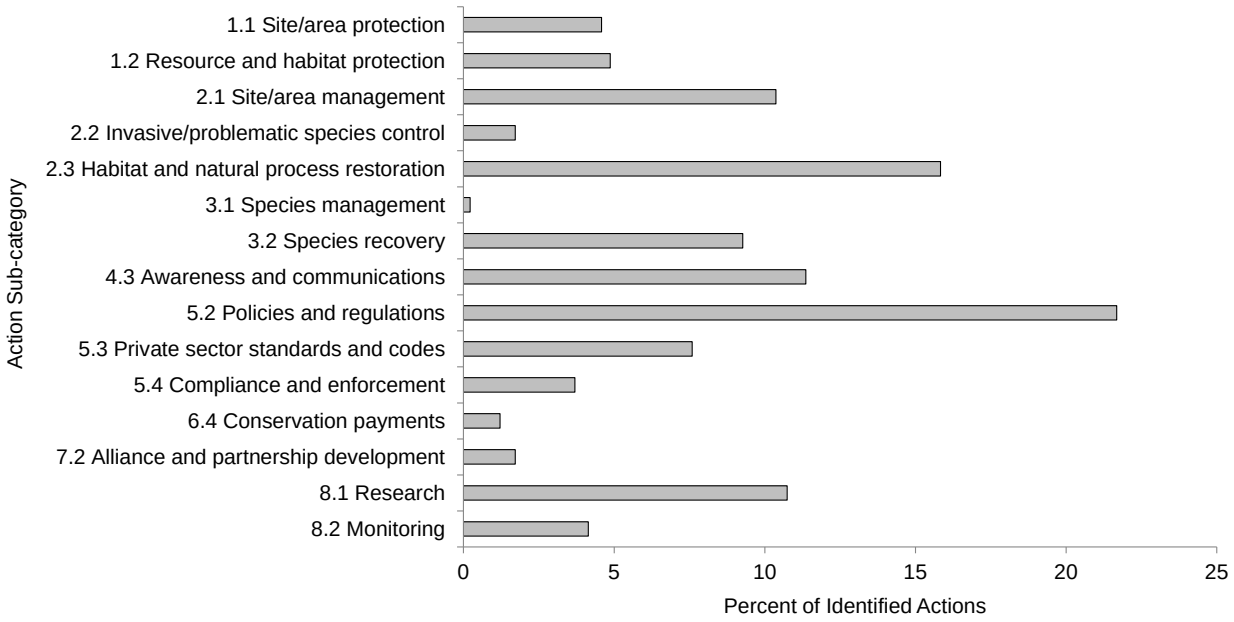

Figure 8. Percent of recommended actions assigned to each sub-category in BCR 13 ON.
”Research and monitoring” actions refer to individual species where information is required to support conservation and management. For a discussion of broad-scale research and monitoring requirements, see the section on Research and Population Monitoring Needs (Section 3).

Section 2: Conservation Needs by Habitat

The following sections provide more detailed information on priority species, their threats and objectives within each of the broad habitat classes that occur in BCR 13 ON. Where appropriate, habitat information is provided at a finer scale than the broad habitat categories in order to coincide with other land management exercises in the region. Conservation objectives and corresponding actions have been developed to address only those threats to priority species that have a magnitude of "medium" or greater. Some priority species do not appear in the threats table because their low-level threats have not been assigned objectives or actions, identified threats are addressed in the Widespread Issues section of the strategy, and/or they are migrants with no threats identified in a specific habitat in this BCR.

The priority birds of BCR 13 ON face a variety of threats, from habitat loss and fragmentation to the threats of habitat shifting and alteration due to climate change. As discussed above, some of these threats apply broadly to all habitat types and are better described as "widespread issues." These issues, including collisions with vehicles and human-made structures, predation by domestic and feral cats, some forms of pollution, and habitat alteration or other issues related to climate change are discussed separately in Section 3. It is important to note that the threats in sub-category 1.2, Commercial and industrial areas, refer mainly to collisions with vehicles, buildings and towers, which is discussed under Widespread Issues, while habitat loss due to development (commercial and residential) is included in 1.1, Housing and urban areas (urban development).

Sustainable Development, Ecosystem Services and Resilience

Predictions suggest that the human population of Ontario might increase by 37% by 2036 (Ontario Ministry of Finance 2010). Already, 90% of Ontarians inhabit BCR 13 ON, and projections for a disproportionate rate of population growth could see this percentage increase. In addition to this population growth, economic growth could bring significant new commercial and industrial development to the region, and climate change could bring further stress. These impending changes mean that conservation of birds and other wildlife cannot be achieved solely by addressing today's threats; ecosystems must also be resilient to future stressors. Conversely, sustainable economic growth and development depend on functioning ecosystems and the services they provide.

Ecosystem services, or functions provided by ecosystems that have measurable value to humans, range from the provision of clean air and clean water for drinking to the natural control of insect pests. In some cases, such as water purification, it may be possible, though perhaps not desirable, to replace ecosystem services with technology. In other cases, such as the natural build-up of fertile soil for agriculture, no viable artificial alternatives exist. Globally, this latter service alone has an estimated aggregate value of over $17 trillion/year, nearly equivalent to the global Gross National Product (Costanza et al. 1997). In BCR 13 ON, other

regionally important ecosystem services include the water purification and storm water management provided by wetlands (Troy and Bagstad 2009). For BCR 13 ON and the adjoining portions of the Great Lakes, the total aggregate value of these and other ecosystem services was estimated at over $84B annually (Troy and Bagstad 2009). Although considerable uncertainty surrounds such estimates, it is clear that the value is significant. Moreover, it is usually more cost effective and efficient to rely on existing natural ecosystem services rather than replace those functions with technology.

The stable provision of these ecosystem services in the face of future environmental changes, including the unknown effects of climate change, depends on the resilience of ecosystems. It is well established in ecology that ecosystems are better able to withstand disturbance when they possess functional redundancy and response diversity (Chapin et al. 1997, Balvanera et al. 2006), in other words, numerous species contributing in similar ways to ecosystem function (i.e., the source of ecosystem services) but responding differently to disturbance. Maintaining or improving species richness and expanding the natural habitat base to support species diversity can therefore contribute to the stable provision of valuable ecosystem services.

Increasing recognition of the value of naturally functioning ecosystems has generated a heightened interest in sustainable development and land use planning, and potentially increased opportunities for conservation. The interrelationships between sustainable development, ecosystem services and biodiversity are the context in which conservation must be delivered in BCR 13 ON. The actions suggested in this strategy seek to improve the diversity and abundance of birds in degraded habitats, restore ecological function, and contribute to the resilience of ecosystems in a variety of ways. In so doing, it is hoped that conservation successes can be maintained over the long term, despite ongoing unavoidable conservation challenges in BCR 13 ON.

Habitat-specific Issues and Actions

Coniferous

According to the Southern Ontario Land Resource Information System (SOLRIS), coniferous forest is classified as being at least 60% tree cover with upland conifer tree species comprising more than 75% of the canopy cover. Typical coniferous tree species include white pine (*Pinus strobus*) and eastern white cedar (*Thuja occidentalis*) and cover less than 4% of BCR 13 ON (Table 1; Fig. 9). All priority forest bird species in this region are affected by similar conservation issues, particularly regional forest cover and the effect of management practices on habitat quality. Given the overlap in threats and predominance of mixed and deciduous forest, conservation objectives and actions for coniferous habitats were combined into those sections.

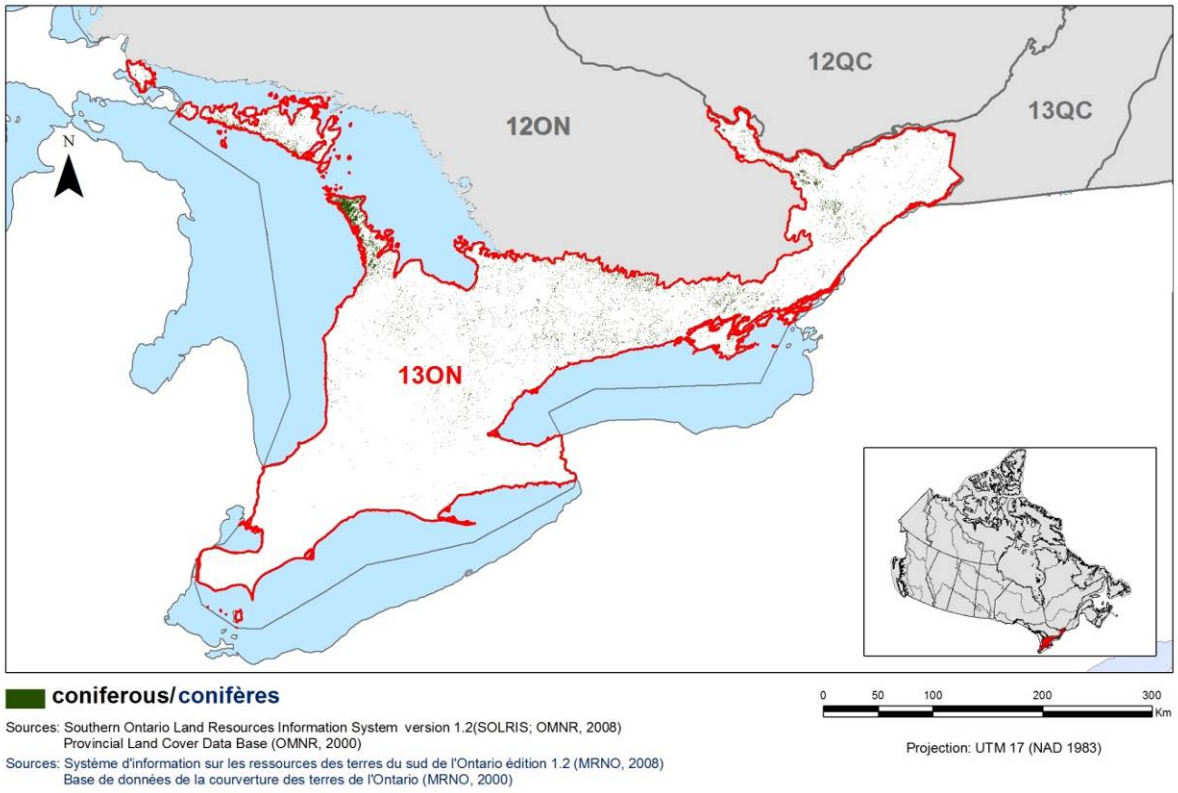

Figure 9. Map of coniferous forest in BCR 13 ON.

Conifer plantations provide important biodiversity elements to southern Ontario's landscapes. Specific direction for the long-term management of conifer plantations to provide mature forest structural elements (e.g., downed wood, canopy gaps and diverse vegetation layers) can be found in *A land manager's guide to conserving habitat for forest birds in southern Ontario* (Ontario Ministry of Natural Resources 2011).

Deciduous

In BCR 13 ON today, dense forest dominated by deciduous species accounts for approximately 9% of the land cover/land use (Table 1, Fig. 10). Deciduous forest is the predominant forest class in southern portions of the region (Ontario Partners in Flight 2008), and tolerant hardwoods such as sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), black cherry (*Prunus serotina*), red ash (*Fraxinus pennsylvanica*), white ash (*Fraxinus americana*), red oak (*Quercus rubra*), white oak (*Quercus alba*) and yellow birch (*Betula alleghaniensis*) occur regularly. The extreme southwest region also contains tree species characteristic of the Carolinian zone such as black walnut (*Julgans nigra*), shagbark hickory (*Carya ovata*) and American sycamore (*Platanus occidentalis*; Lee et al. 1998). Much of the deciduous forest in this BCR consists of isolated remnants interspersed with agricultural and urban areas.

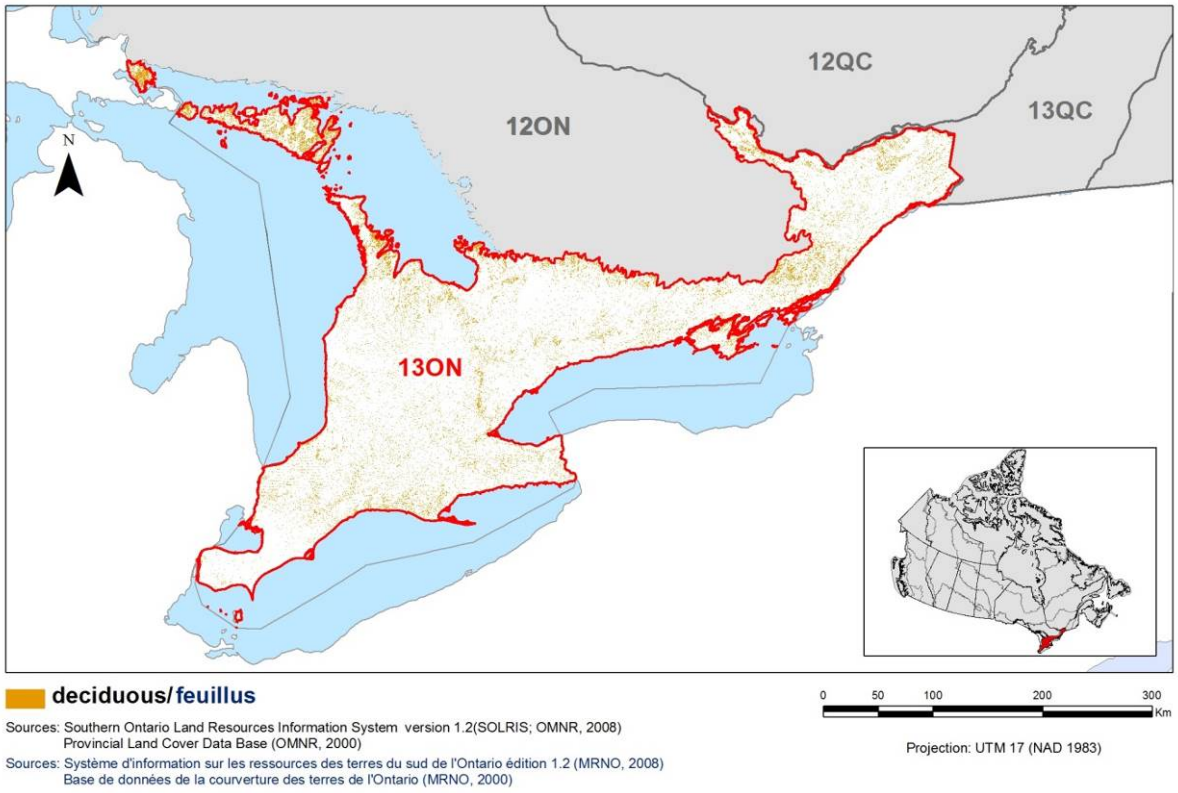

Figure 10. Map of deciduous forests in BCR 13 ON.

The 12 priority species using this habitat are all landbirds (Table 6), and populations of some forest landbirds in BCR 13 ON have increased in recent decades (as evidenced by a 31% increase in counts of forest birds in Breeding Bird Surveys; Ontario Partners in Flight 2008). These positive population trends are presumably due in large part to the increase in overall forest cover seen in the region between 1920 and the 1990s (Riley and Mohr 1994; Ontario Partners in Flight 2008) and increases in forest cover throughout eastern North America generally during the same period. Despite the overall pattern of increasing forest cover, the southwestern region of BCR 13 ON continues to have very low and highly fragmented forest cover, and as such does not effectively support many area-sensitive species (e.g., Louisiana Waterthrush). It should be noted that forest cover is now declining in the northeastern United States (Foster et al. 2008) after increasing through the 20th century. It is unclear whether this reversal has started or will occur in BCR 13 ON, but there have certainly been recent forest cover declines in areas such as Chatham Kent (Municipality of Chatham-Kent 2013).

Table 6. Priority species associated with deciduous forest habitat in BCR 13 ON, habitat descriptions, population objectives and reasons for priority status.

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Sub-regional Concern[5]	Regional/Sub-regional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
Acadian Flycatcher	Large blocks of mature, deciduous forests	Recovery objective	Y	Y	Y	Y		Y	Y
Baltimore Oriole	Mature deciduous forests with openings	Maintain current				Y			
Black-billed Cuckoo	Early successional deciduous forests with openings	Increase				Y	Y		
Canada Warbler	Moist deciduous forests with well-developed understory	Recovery objective[7]	Y	Y	Y	Y	Y	Y	
Cerulean Warbler	Mature deciduous forests with sparse understorey	Recovery objective	Y	Y	Y	Y		Y	
Eastern Wood-Pewee	Deciduous forests of any age with openings	Increase	Y			Y			
Hooded Warbler	Mature deciduous forests with canopy gaps	Recovery objective		Y		Y		Y	Y
Louisiana Waterthrush	Mature forests with cold water streams	Recovery objective	Y	Y	Y	Y		Y	Y
Prothonotary Warbler	Deciduous forests and floodplains	Recovery objective	Y	Y	Y	Y		Y	
Red-headed Woodpecker	Deciduous forests with openings	Recovery objective[7]	Y	Y	Y	Y		Y	
Rose-breasted Grosbeak	Deciduous forests with relatively open canopy	Maintain current					Y		
Wood Thrush	Mature deciduous forests with well-developed understorey	Maintain current	Y			Y		Y	

[1] Habitat descriptions are based on information found in the Atlas of the Breeding Birds of Ontario, 2001–2005 and, in most cases, follow definitions under the Land Cover Classification System (LCCS; see Kennedy et al. 2012).
[2] Assessed by COSEWIC (Committee on the Status of Endangered Wildlife in Canada) as Endangered; Threatened; Special Concern.
[3] Species listed on Schedule 1 of SARA as E, Endangered; T, Threatened; SC, Special Concern (Species at Risk Public Registry).
[4] Species listed as Endangered, Threatened or Special Concern on the Species at Risk in Ontario (SARO) List.
[5] Regional refers to BCR-wide (i.e., all jurisdictional data were used for the entire BCR) while sub-regional refers to the Ontario portion of the BCR only (i.e., Ontario BCR data were used).
[6] Only the landbird group distinguishes stewardship species from other priority species (see Panjabi et al. 2005).
[7] Species listed on Schedule 1 of SARA and/or SARO, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, the interim population objectives for these species in BCR 13 ON are Canada Warbler: Maintain Current; Red-headed Woodpecker: Increase.

Deciduous forest birds of BCR 13 ON face some very significant conservation challenges. Habitat loss due to development or agricultural expansion (threat sub-categories 1.1 and 2.1; Fig. 11), poor forest management (e.g., high-grading or removal of the best trees or tree species from a stand; sub-category 5.3), and outbreaks of invasive non-native forest insects (sub-category 8.1) including the emerald ash borer (*Agrilus planipennis)* and tree diseases such as butternut canker (*Ophiognomonia clavigignenti-juglandacearum*) all serve to reduce the quantity of trees or adversely affect forest health and habitat value (Fig. 11). These threats were all identified as very high overall magnitude threats to priority species in this habitat. Recommended conservation actions to mitigate these threats include the identification and protection of important areas through municipal planning, woodlot management and stewardship to retain important habitat features for priority species as well as awareness campaigns to deter the unauthorized or accidental release of invasive non-native species (e.g., transport of firewood harbouring pests such as the Emerald ash borer; Table 7).

This habitat class includes the Carolinian forests of southwestern Ontario. Unique in Canada, this habitat includes trees species such as tulip-tree (*Liriodendron tulipifera*) and sassafras (*Sassafras albidum*) and is used by a variety of bird species more common further south. Among these are the Acadian Flycatcher, the Louisiana Waterthrush and the Prothonotary Warbler. These birds are federally listed as species at risk and are at the northern extent of their continental range in BCR 13 ON. Only a small fraction of the original forest cover remains in the Carolinian zone, and the protection, expansion and enhancement of these remaining tracts, and creation of new woodlands, is a high priority for the species reliant on this unique ecosystem.

In BCR 13 ON, habitat loss, fragmentation and degradation from the construction and maintenance of transportation networks was assessed as a medium overall threat to priority species in deciduous habitats (sub-category 4.1). Southern Ontario has the highest density of roads of any region in Canada (Ontario Biodiversity Council 2010), and the construction, maintenance and use by vehicles of these networks pose risks to bird populations and the habitats upon which they rely (Kociolek et al. 2011). The effects of roads on wildlife depend on their location, density of road corridors and their level of use. Few natural areas in southwestern and central Ontario are more than 1.5 km from existing roads (Ontario Ministry of Natural Resources 2009). Roads between and within urban centres can have both direct and indirect effects on birds and other wildlife, including individual species disturbance attributed to noise and dust, habitat loss, fragmentation and degradation (loss of suitable nest sites, destruction of nest sites, decline of prey species), indirect mortality from increased predator/prey contact, and increased exposure to invasive species. Recommended deciduous habitat conservation actions related to these threats seek to mitigate the effects of roads through the implementation of BMPs or mitigation guidelines to avoid habitat loss and degradation (Table 7). The Widespread Issues section of this strategy addresses mortality caused by collisions with vehicles (sub-category 1.2).

Finally, a small percentage of identified threats relating to the loss of food sources due to non-selective pesticide use (sub-category 9.3) were assessed as a high overall magnitude for insectivorous priority species. Insect control programs (e.g., in response to West Nile virus and

gypsy moth outbreaks) have the potential to reduce arthropod food supplies for priority species such as the Prothonotary Warbler (Environment Canada 2011a). Similarly, the Black-billed Cuckoo also forages on insects (e.g., forest tent caterpillars, gypsy moth) and actions to reduce non-selective pesticide application could benefit these species by improving access to prey (Ontario Partners in Flight 2008). The full list of threats to and information needs (sub-category 12.1) for priority species in deciduous habitats of BCR 13 ON as well as the conservation objectives and recommended actions are presented in Table 7.

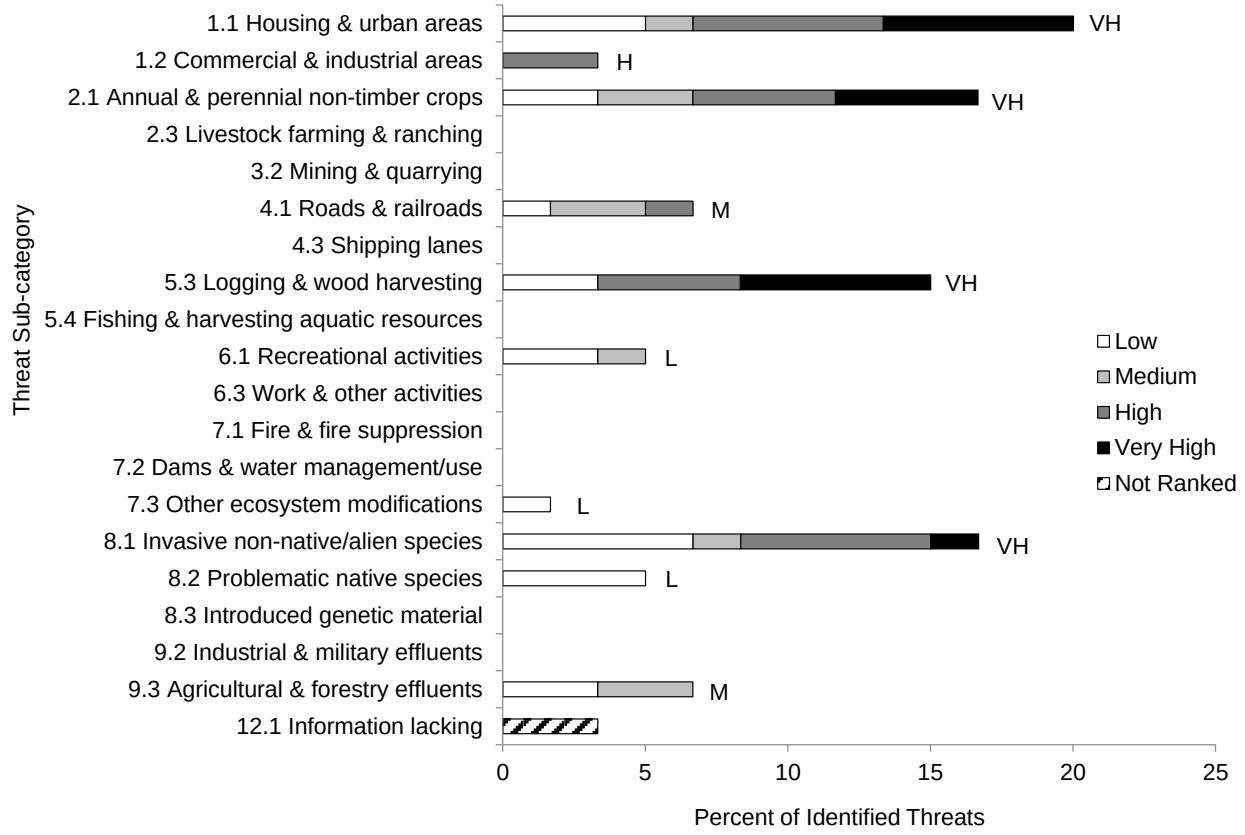

Figure 11. Percent of identified threats to priority species in deciduous habitats in each threat sub-category.

Each bar represents the percent of the total number of threats identified in each threat sub-category in deciduous habitat (for example, if 100 threats were identified in total for all priority species in deciduous habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). Threat sub-category 12.1 Information lacking was not ranked. The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category. The overall magnitude of the threat in deciduous habitat is shown at the end of each bar (also presented in Table 5). Only threats with a magnitude of medium or higher are typically assigned habitat-specific conservation objectives.

Table 7. Threats addressed, conservation objectives, recommended actions and list of priority species affected in deciduous habitats BCR 13 ON.

Note: Issues such as collisions with human-made structures and vehicles, and climate change, are not addressed in this table; instead they are addressed in the Widespread Issues section.

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
1.1 Housing & urban areas	Loss of forest habitat due to development	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain, enhance or restore the quality, quantity and diversity of deciduous forest habitats across the BCR	1.1 Site/area protection	Protect, restore and/or manage large intact deciduous forest tracts; mature and old growth forests for priority forest birds.	Black-billed Cuckoo, Eastern Wood-Pewee, Red-headed Woodpecker,[2] Wood Thrush
				1.2 Resource and habitat protection	At a watershed scale, maintain in decreasing order of risk and increasing order of preference: a minimum of 30 % forest cover; 40 % forest cover; or 50 % forest cover or more. The 30% minimum represents a high risk that less than half the potential species will be represented, while the 50% forest cover equates to a low-risk approach that is likely to support most of the potential species (Environment Canada 2013a).	
				2.3 Habitat and natural process restoration	Retain important habitat features such as wildlife trees (e.g., stick nests, cavity trees), snags and downed woody debris (see *A land manager's guide to conserving habitat for forest birds in southern Ontario*, Ontario Ministry of Natural Resources 2011). The proportion of a watershed that is forest cover and 100 m or further from the forest edge should be greater than 10% (Environment Canada 2013a).	Black-billed Cuckoo, Eastern Wood-Pewee, Red-headed Woodpecker,[2] Wood Thrush

[1] While many priority species may benefit from proposed conservation actions, priority species not mentioned in this table are absent because 1) identified threats in this habitat are of low magnitude, or 2) they are migrants with no threats identified in this habitat.

[2] Species listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published however, interim conservation objectives and recommended actions are presented here.

Table 7 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
					Watershed forest cover should be representative of the full diversity of naturally occurring forest communities found within the ecoregion. This should include components of mature and old growth forest (Environment Canada 2013a).	
				4.3 Awareness and communications	Encourage stewardship organizations to promote the use of appropriate habitat management guidelines by private landowners (e.g., *A land manager's guide to conserving habitat for forest birds in southern Ontario*, Ontario Ministry of Natural Resources, 2011).	
				5.2 Policies and regulations	Encourage municipalities to protect or restore significant woodlots (e.g., mature, old-growth), including having at least one, and preferably several, 200-hectare forest patches (Environment Canada, 2013a). Forest patches should be within two kilometres of one another or other supporting habitat features. "Big Woods" areas, representing concentrations of smaller forest patches as well as larger forest patches, should be a cornerstone of protection and enhancement within each watershed or land unit (Environment Canada 2013a). Discourage "greenfield" development in land-use planning and focus on redevelopment and development within existing urban areas	Black-billed Cuckoo, Eastern Wood-Pewee, Red-headed Woodpecker,[2] Wood Thrush
				8.1 Research	Conduct research to increase understanding of the effects of forest condition, management practices, and landscape variables (proximity for forests, regional forest cover) on the abundance, distribution and demographics of priority forest birds.	

Table 7 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Acadian Flycatcher, Cerulean Warbler, Hooded Warbler, Louisiana Waterthrush, Red-headed Woodpecker
2.1 Annual & perennial non-timber crops	Loss of forest habitat due to agricultural conversion/ intensification	Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain, enhance or restore the quality, quantity and diversity of deciduous forest habitats across the BCR	1.1 Site/area protection	Protect, restore and/or manage large intact deciduous forest tracts; mature and old growth forests for priority forest birds.	Black-billed Cuckoo, Canada Warbler,[2] Red-headed Woodpecker[2]
				1.2 Resource and habitat protection	At a watershed scale, maintain in decreasing order of risk and increasing order of preference: a minimum of 30% forest cover; 40% forest cover; or 50% forest cover or more. The 30% minimum represents a high risk that less than half the potential species will be represented, while the 50% forest cover equates to a low-risk approach that is likely to support most of the potential species (Environment Canada 2013a).	Baltimore Oriole, Black-billed Cuckoo, Canada Warbler,[2] Red-headed Woodpecker[2]
				2.3 Habitat and natural process restoration	Retain important habitat features such as wildlife trees (e.g., stick nests, cavity trees), snags and downed woody debris (see *A land manager's guide to conserving habitat for forest birds in Southern Ontario*, Ontario Ministry of Natural Resources, 2011). The proportion of a watershed that is forest cover and 100 m or further from the forest edge should be greater than 10% (Environment Canada 2013a).	

Table 7 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
					Watershed forest cover should be representative of the full diversity of naturally occurring forest communities found within the ecoregion. This should include components of mature and old growth forest (Environment Canada 2013a).	
				4.3 Awareness and communications	Encourage stewardship organizations to promote the use of appropriate habitat management guidelines by private landowners (see *A land manager's guide to conserving habitat for forest birds in southern Ontario*, Ontario Ministry of Natural Resources 2011).	Baltimore Oriole, Black-billed Cuckoo, Canada Warbler,[2] Red-headed Woodpecker[2]
				5.2 Policies and regulations	Encourage municipalities to protect or restore significant woodlots (e.g., mature, old-growth), including having at least one, and preferably several, 200-hectare forest patches (Environment Canada, 2013a). Forest patches should be within two kilometres of one another or other supporting habitat features. "Big Woods" areas, representing concentrations of smaller forest patches as well as larger forest patches, should be a cornerstone of protection and enhancement within each watershed or land unit (Environment Canada 2013a).	
				8.1 Research	Conduct research to increase understanding of the effects of forest condition, management practices, and landscape variables (proximity for forests, regional forest cover) on the abundance, distribution and demographics of priority forest birds.	

Table 7 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Acadian Flycatcher, Canada Warbler, Cerulean Warbler, Hooded Warbler, Louisiana Waterthrush, Red-headed Woodpecker
4.1 Roads & railroads	Habitat loss, fragmentation and degradation from the construction and maintenance of transportation networks	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Reduce/ eliminate habitat loss, fragmentation degradation and disturbance from the construction and maintenance of road networks and associated infrastructure	5.3 Private sector standards and codes	Develop and/or implement existing BMPs or mitigation guidelines to avoid habitat loss, fragmentation and/or degradation from road construction and maintenance.	Eastern Wood-Pewee, Wood Thrush
5.3 Logging & wood harvesting	Loss of forest habitat due to logging practices	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain or restore the quality, quantity and diversity of forest habitats across the BCR	1.1 Site/area protection	Protect, restore and/or manage large intact deciduous forest tracts; mature and old growth forests for priority forest birds.	Red-headed Woodpecker,[2] Wood Thrush
				1.2 Resource and habitat protection	At a watershed scale, maintain in decreasing order of risk and increasing order of preference: a minimum of 30% forest cover; 40% forest cover; or 50% forest cover or more. The 30% minimum represents a high risk that less than half the potential species will be represented, while the	Red-headed Woodpecker,[2] Wood Thrush

Table 7 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
					50% forest cover equates to a low-risk approach that is likely to support most of the potential species (Environment Canada 2013a).	
				2.3 Habitat and natural process restoration	Retain important habitat features such as wildlife trees (e.g., stick nests, cavity trees) and downed woody debris (see *A land manager's guide to conserving habitat for forest birds in southern Ontario*, Ontario Ministry of Natural Resources, 2011).	
				4.3 Awareness and communications	Promote the development and management of woodlots according to recognized silvicultural practices (e.g., *A land manager's guide to conserving habitat for forest bird in southern Ontario*, Ontario Ministry of Natural Resources 2011).	
				5.2 Policies and regulations	Encourage municipalities to protect or restore significant woodlots (e.g., mature, old-growth), including having at least one, and preferably several, 200-hectare forest patches (Environment Canada 2013a).	
				8.1 Research	Conduct research to increase understanding of the effects of forest condition, management practices, and landscape variables (proximity for forests, regional forest cover) on the abundance, distribution and demography of priority forest birds.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial Species at Risk legislation.	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Acadian Flycatcher, Cerulean Warbler, Hooded Warbler, Louisiana Waterthrush, Prothonotary Warbler, Red-headed Woodpecker

Table 7 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
8.1 Invasive non-native/alien species	Outbreaks of invasive, non-native forest insects and tree diseases are an ongoing concern for forest habitats (e.g., Emerald Ash Borer, Butternut canker)	3.5. Prevent and control the spread of invasive and exotic species	Prevent and control the spread of invasive non-native species	2.1 Site/area management	Follow guidance provided in provincial forest management guides (e.g., *Forest Health Landowner's Guide: When Invasive Species Threaten Your Woodlot*, Ontario Ministry of Natural Resources, 2008a).	Red-headed Woodpecker,[2] Wood Thrush
				4.3 Awareness and communications	Support public awareness efforts to deter unauthorized or accidental releases of invasive, non-native species.	
				5.2 Policies and regulations	Develop and/or strengthen policies or regulatory measures geared to preventing the introduction and spread of invasive non-native species (e.g., Emerald ash borer) and diseases.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial Species at Risk legislation.	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Acadian Flycatcher, Cerulean Warbler, Hooded Warbler, Prothonotary Warbler, Red-headed Woodpecker
9.3 Agricultural & forestry effluents	Loss of food source due to non-selective pesticide use (e.g., reduction in prey insects, leaching to adjacent habitats)	5.1 Maintain natural food webs and prey sources	Maintain/ improve forest habitat quality by reducing pesticide use	5.3 Private sector standards and codes	Develop or implement existing BMPs to reduce potential risks to birds and their habitats resulting from pesticide use in forestry/agriculture.	Baltimore Oriole, Black-billed Cuckoo
				5.4 Compliance and enforcement	Continue to monitor and enforce compliance with laws, policies and regulations at all levels.	
				8.1 Research	Research needed on breeding ecology, winter ecology, sensitivity to pesticides and response to habitat management (Ontario Partners in Flight, 2008).	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Prothonotary Warbler

Table 7 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
			Species at Risk legislation.			
12.1 Information Lacking	Lack of information on factors causing population declines	7.4 Improve understanding of causes of population declines	Determine sources of mortality or population decline.	8.1 Research	Conduct research to better determine cause of general population decline including effects of forest management treatments on breeding density, productivity and survivorship.	Canada Warbler[2]
					Conduct breeding ecology studies to increase understanding of species habitat requirements and causes of population decline in southern Ontario	Red-headed Woodpecker[2]
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial Species at Risk legislation.	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Canada Warbler, Red-headed Woodpecker

Mixed Wood

Mixed wood forests in BCR 13 ON consist of white pine, red pine, eastern hemlock (*Tsuga Canadensis*), sugar maple, red maple (*Acer rubrum*), yellow birch, red oak, basswood (*Tilia Americana*) and white elm (*Ulmus Americana*). Other wide-ranging species include eastern white cedar, largetooth aspen (*Populus grandidentata*), American beech, butternut (*Juglans cinerea*) and white ash (Lee et al. 1998). This habitat class amounts to 4.5% of the land cover/ land use of BCR 13 ON (Table 1; Fig. 12).

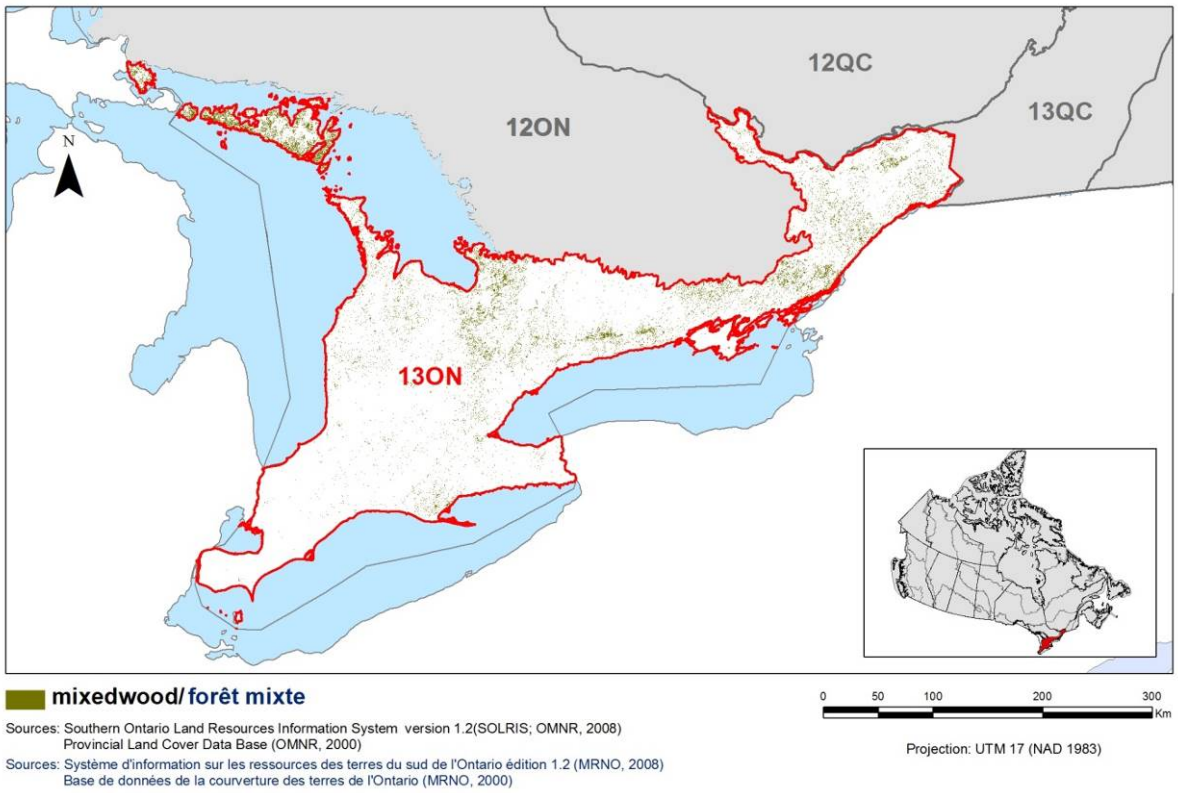

Figure 12. Map of mixed wood forests in BCR 13 ON.

Priority species using the mixed wood habitat class (13 in total) are all landbirds (including 7 species at risk), with the exception of the American Woodcock, a forest-dwelling shorebird (Table 8). Among the priority species using mixed wood forests are 2 aerial insectivores: the Common Nighthawk and the Eastern Whip-poor-will. These species move to open habitats at dusk and dawn to forage on the wing for flying insects. Like other aerial insectivores, these species have declined significantly in abundance and distribution in southern Ontario in recent decades. For example, the Ontario Breeding Bird Atlas reports a 45% decline in the number of atlas squares with Common Nighthawk and a 43% decline for Eastern Whip-poor-will between 1981–1985 and 2001–2004 (Ontario Partners in Flight 2008). As for all aerial insectivores, the causes of these alarming declines remain largely unknown but could be related to a reduction in the availability of their insect prey (sub-category 9.3 in Table 9; Nebel et al. 2010). Actions to reduce non-selective pesticide application could benefit these species by improving access to prey.

Table 8. Priority species associated with mixed wood habitats in BCR 13 ON, habitat descriptions, population objectives and reasons for priority status.

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Sub-regional Concern[5]	Regional/Sub-regional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
Acadian Flycatcher	Mixed forests	Recovery objective	Y	Y	Y	Y		Y	Y
American Woodcock	Young mixed forests	Increase				Y		Y	
Canada Warbler	Relatively open mixed forests	Recovery objective[7]	Y	Y	Y	Y		Y	
Common Nighthawk	Mixed deciduous forests	Recovery objective[7]	Y	Y	Y	Y		Y	
Eastern Whip-poor-will	Early-mid successional mixed forests with openings	Recovery objective[7]	Y	Y	Y	Y		Y	
Eastern Wood-Pewee	Mixed forests of any age with openings	Increase	Y			Y			
Hooded Warbler	Mature mixed forests with canopy gaps	Recovery objective		Y		Y		Y	Y
Louisiana Waterthrush	Mature mixed forests with coldwater streams	Recovery objective	Y	Y	Y	Y		Y	Y
Northern Flicker	Mixed forests with openings	Increase				Y			
Olive-sided Flycatcher	Mixed, coniferous-dominated forests	Recovery objective[7]	Y	Y	Y	Y		Y	
Red-shouldered Hawk	Mixed deciduous forests	Assess/Maintain				Y			Y
Rose-breasted Grosbeak	Mixed forests and forest edges; disturbed habitats	Maintain current					Y		
Wood Thrush	Mature mixed forest with well-developed understorey	Maintain current	Y			Y		Y	

[1] Habitat descriptions are based on information found in the Atlas of the Breeding Birds of Ontario (2001–2005) and, in most cases, follow definitions under the Land Cover Classification System (LCCS; see Kennedy et al. 2012).
[2] Assessed by COSEWIC as Endangered; Threatened; Special Concern.
[3] Species listed on Schedule 1 of SARA as E, Endangered; T, Threatened; SC, Special Concern.
[4] Species listed as Endangered, Threatened or Special Concern on the SARO List.
[5] Regional refers to BCR-wide (i.e., all jurisdictional data were used for the entire BCR) while sub-regional refers to the Ontario portion of the BCR only (i.e., Ontario BCR data were used).
[6] Only the landbird group distinguishes stewardship species from other priority species (see Panjabi et al. 2005).
[7] Species listed on Schedule 1 of SARA and/or SARO, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, the interim population objectives for these species in BCR 13 ON are Canada Warbler: Maintain current; Common Nighthawk: Increase; Eastern Whip-poor-will: Increase.

Despite the overall pattern of increasing forest cover within the BCR sub-region, habitat loss continues to be a very significant issue for many priority species using mixed wood habitats, particularly those that have restricted ranges (e.g., Acadian Flycatcher and Hooded Warbler) are area-sensitive (e.g., Louisiana Waterthrush), or have specialized habitat requirements such as requiring large tracts of mature forest (e.g., Red-shouldered Hawk) or large snags for nesting cavities (e.g., Northern Flicker). Ongoing urban and agricultural development (threat sub-categories 1.1 and 2.1), logging and wood harvesting (sub-category 5.3), outbreaks of invasive non-native forest insects and tree diseases (sub-category 8.1), and other human uses continue to reduce the quantity and quality of mixed wood habitat available to forest birds, and are assessed as high and very high overall magnitude threats to priority species (Fig. 13). As noted for deciduous forests, there is a concern that the recent trend of U.S. forest cover decline may similarly be occurring or will occur in BCR 13 ON.

In BCR 13 ON, habitat loss, fragmentation and degradation from the construction and maintenance of transportation networks was assessed as a medium overall magnitude threat to priority species in mixed wood habitats (sub-category 4.1). Southern Ontario has the highest density of roads of any region in Canada (Ontario Biodiversity Council 2010), and the construction, maintenance and use by vehicles of these networks pose risks to bird populations and the habitats upon which they rely (Kociolek et al. 2011). The effects of roads on wildlife depend on their location, density of road corridors and their level of use. Few natural areas in southwestern and central Ontario are more than 1.5 km from existing roads (Ontario Ministry of Natural Resources 2009). Roads between and within urban centres can have both direct and indirect effects on birds and other wildlife, including disturbance of individual species attributed to noise and dust, habitat loss, fragmentation and degradation (loss of suitable nest sites, destruction of nest sites, decline of prey species), indirect mortality from increased predator/prey contact, and increased exposure to invasive species. Recommended mixed wood habitat conservation actions seek to mitigate the effects of roads through the implementation of BMPs or mitigation guidelines to avoid habitat loss and degradation. The Widespread Issues section of this strategy addresses mortality caused by collisions with vehicles.

Actions recommended to mitigate threats to priority species in mixed wood forests seek to preserve and increase the amount and quality of forest habitat patches within the highly developed landscape matrix of BCR 13 ON as well as to undertake awareness campaigns to deter the unauthorized or accidental release of invasive non-native species (e.g., transport of firewood harbouring pests such as the Emerald ash borer; Table 9).

The full list of threats to and information needs (sub-category 12.1) for priority species in mixed wood habitats of BCR 13 ON as well as other conservation objectives and recommended actions are presented in Table 9.

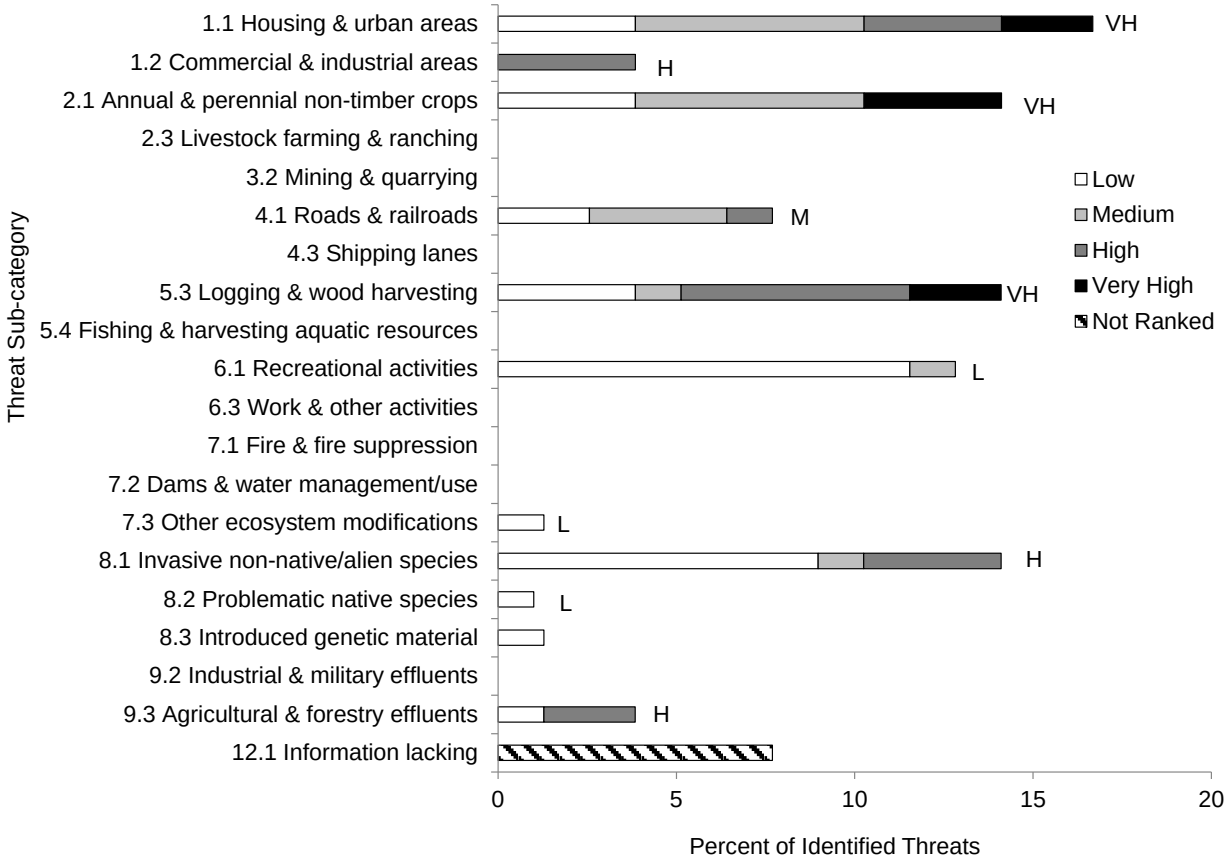

Figure 13. Percent of identified threats to priority species in mixed wood habitats in each threat sub-category.

Each bar represents the percent of the total number of threats identified in each threat sub-category in mixed wood habitat (for example, if 100 threats were identified in total for all priority species in mixed wood habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). Threat sub-category 12.1 Information lacking was not ranked. The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category. The overall magnitude of the threat in mixed wood habitat is shown at the end of each bar (also presented in Table 5). Only threats with a magnitude of medium or higher are typically assigned habitat-specific conservation objectives.

Table 9. Threats addressed, conservation objectives, recommended actions, and list of priority species affected in mixed wood habitats in BCR 13 ON.
Note: Issues such as collisions with human-made structures and vehicles, and climate change, are not addressed in this table; instead, they are addressed in the Widespread Issues section.

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
1.1 Housing & urban areas	Loss of forest habitat due to development	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain, enhance or restore the quality, quantity and diversity of forest habitats across the BCR	1.1 Site/area protection	Protect, restore and/or manage large intact mixed forest tracts; mature and old growth forests for priority forest birds.	American Woodcock, Common Nighthawk,[2] Eastern Whip-poor-will,[2] Eastern Wood-Pewee, Olive-sided Flycatcher,[2] Red-shouldered Hawk, Wood Thrush
				1.2 Resource and habitat protection	At a watershed scale, maintain in decreasing order of risk and increasing order of preference: a minimum of 30%forest cover; 40%forest cover; or 50%forest cover or more. The 30% minimum represents a high risk that less than half the potential species will be represented, while the 50% forest cover equates to a low-risk approach that is likely to support most of the potential species (Environment Canada 2013a).	
				2.3 Habitat and natural process restoration	Retain important habitat features such as wildlife trees (e.g., stick nests, cavity trees), snags and downed woody debris (see *A land manager's guide to conserving habitat for forest birds in southern Ontario*, Ontario Ministry of Natural Resources 2011). The proportion of a watershed that is forest cover and 100 m or further from the forest edge should be greater than 10% (Environment Canada 2013a).	American Woodcock, Common Nighthawk,[2] Eastern Whip-poor-will,[2] Eastern Wood-Pewee, Olive-sided Flycatcher,[2] Red-shouldered Hawk, Wood Thrush

[1] While many priority species may benefit from proposed conservation actions, priority species not mentioned in this table are absent because 1) identified threats in this habitat are of low magnitude, or 2) they are migrants with no threats identified in this habitat.
[2] Species listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published however, interim conservation objectives and recommended actions are presented here.

Table 9 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
					Watershed forest cover should be representative of the full diversity of naturally occurring forest communities found within the ecoregion. This should include components of mature and old growth forest (Environment Canada 2013a).	
				4.3 Awareness and communications	Promote the development and management of woodlots according to recognized silvicultural practices (e.g., *A land manager's guide to conserving habitat for forest birds*, *Ontario Ministry of Natural Resources, 2011*).	American Woodcock, Common Nighthawk,[2] Eastern Whip-poor-will,[2] Eastern Wood-Pewee, Olive-sided Flycatcher,[2] Red-shouldered Hawk, Wood Thrush
				5.2 Policies and regulations	Encourage municipalities to protect or restore significant woodlots (e.g., mature, old-growth), including having at least one, and preferably several, 200-hectare forest patches (Environment Canada 2013a). Forest patches should be within two kilometres of one another or other supporting habitat features. “Big Woods” areas, representing concentrations of smaller forest patches as well as larger forest patches, should be a cornerstone of protection and enhancement within each watershed or land unit (Environment Canada 2013a). Discourage "greenfield" development in land-use planning and focus on redevelopment and development within	American Woodcock, Common Nighthawk,[2] Eastern Whip-poor-will,[2] Eastern Wood-Pewee, Olive-sided Flycatcher,[2] Red-shouldered Hawk, Wood Thrush

Table 9 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
					existing urban areas.	
				8.1 Research	Conduct research to increase understanding of the effects of forest condition, management practices, and landscape variables (proximity for forests, regional forest cover) on the abundance, distribution and demographics of priority forest birds.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation.	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Acadian Flycatcher, Common Nighthawk, Eastern Whip-poor-will, Hooded Warbler, Louisiana Waterthrush, Olive-sided Flycatcher
2.1 Annual & perennial non-timber crops	Loss of forest habitat due to agricultural conversion	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain, enhance or restore the quality, quantity and diversity of forest habitats across the BCR	1.1 Site/area protection	Protect, restore and/or manage large intact mixed forest tracts; mature and old growth forests for priority forest birds.	American Woodcock, Canada Warbler,[2] Common Nighthawk,[2] Eastern Whip-poor-will,[2] Northern Flicker, Olive-sided Flycatcher,[2] Red-shouldered Hawk
				1.2 Resource and habitat protection	At a watershed scale, maintain in decreasing order of risk and increasing order of preference: a minimum of 30% forest cover; 40% forest cover; or 50% forest cover or more. The 30% minimum represents a high risk that less than half the potential species will be represented, while the 50% forest cover equates to a low-risk approach that is likely to support most of the potential species (Environment Canada 2013a).	
				2.3 Habitat and natural process restoration	Retain important habitat features such as wildlife trees (e.g., stick nests, cavity trees), snags and downed woody debris (see *A land manager's guide to conserving habitat for forest birds in southern*	American Woodcock, Canada Warbler,[2] Common Nighthawk,[2] Eastern Whip-poor-will,[2] Northern Flicker, Olive-

Table 9 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
					Ontario, Ontario Ministry of Natural Resources 2011). The proportion of a watershed that is forest cover and 100 m or further from the forest edge should be greater than 10% (Environment Canada 2013a). Watershed forest cover should be representative of the full diversity of naturally occurring forest communities found within the ecoregion. This should include components of mature and old growth forest (Environment Canada 2013a).	sided Flycatcher,[2] Red-shouldered Hawk
				4.3 Awareness and communications	Promote the development and management of woodlots according to recognized silvicultural practices (e.g., *A land manager's guide to conserving habitat for forest birds*, *Ontario Ministry of Natural Resources, 2011*).	
				5.2 Policies and regulations	Encourage municipalities to protect or restore significant woodlots (e.g., mature, old-growth), including having at least one, and preferably several, 200-hectare forest patches (Environment Canada 2013a). Forest patches should be within two kilometres of one another or other supporting habitat features. "Big Woods" areas, representing concentrations of smaller forest patches as well as larger forest patches, should be a cornerstone of protection and enhancement within each	American Woodcock, Canada Warbler,[2] Common Nighthawk,[2] Eastern Whip-poor-will,[2] Northern Flicker, Olive-sided Flycatcher,[2] Red-shouldered Hawk

Table 9 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
					watershed or land unit (Environment Canada 2013a).	
				8.1 Research	Conduct research to increase understanding of the effects of forest condition, management practices, and landscape variables (proximity for forests, regional forest cover) on the abundance, distribution and demographics of priority forest birds.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation.	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Acadian Flycatcher, Common Nighthawk, Eastern Whip-poor-will, Hooded Warbler, Louisiana Waterthrush, Olive-sided Flycatcher
4.1 Roads & railroads	Habitat loss, fragmentation, and degradation from the construction and maintenance of transportation networks	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Reduce/eliminate habitat loss, fragmentation, degradation and disturbance from the construction and maintenance of road networks and associated infrastructure.	5.2 Policies and regulations	Develop and/or implement existing BMPs or mitigation guidelines to avoid habitat loss, fragmentation and/or degradation from road construction and maintenance.	Eastern Wood-Pewee, Red-shouldered Hawk, Wood Thrush
5.3 Logging & wood harvesting	Loss of forest habitat due to logging practices.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain or restore the quality, quantity and diversity of forest habitats across the BCR	1.1 Site/area protection	Protect, restore and/or manage large intact mixed forest tracts; mature and old growth forests for priority forest birds.	Common Nighthawk,[2] Eastern Whip-poor-will,[2] Northern Flicker, Olive-sided Flycatcher,[2] Red-shouldered Hawk
				1.2 Resource and habitat protection	At a watershed scale, maintain in decreasing order of risk and increasing order of preference: a minimum of 30% forest cover; 40% forest cover; or 50%	

Table 9 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
					forest cover or more. The 30% minimum represents a high risk that less than half the potential species will be represented, while the 50% forest cover equates to a low-risk approach that is likely to support most of the potential species (Environment Canada 2013a).	
				2.3 Habitat and natural resource protection	Retain important habitat features such as wildlife trees (e.g., stick nests, cavity trees) and downed woody debris (see *A land manager's guide to conserving habitat for forest bird in southern Ontario*, Ontario Ministry of Natural Resources, 2011).	Common Nighthawk,[2] Eastern Whip-poor-will,[2] Northern Flicker, Olive-sided Flycatcher,[2] Red-shouldered Hawk
				4.3 Awareness and communications	Promote the development and management of woodlots according to recognized silvicultural practices (e.g., *A land manager's guide to conserving habitat for forest birds in southern Ontario*, Ontario Ministry of Natural Resources, 2011).	
				5.2 Policies and regulations	Encourage municipalities to protect or restore significant woodlots (e.g., mature, old-growth), including having at least one, and preferably several, 200-hectare forest patches (Environment Canada, 2013a).	
				8.1 Research	Conduct research to increase understanding of the effects of forest condition, management practices, and landscape variables (proximity for forests, regional forest cover) on the abundance, distribution and demography of priority	

Table 9 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
					forest birds.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Acadian Flycatcher, Common Nighthawk, Eastern Whip-poor-will, Hooded Warbler, Louisiana Waterthrush, Olive-sided Flycatcher
8.1 Invasive non-native/alien species	Outbreaks of invasive, non-native forest insects and tree diseases are an ongoing concern for forest habitats (e.g., Emerald Ash Borer, Butternut canker)	3.5. Prevent and control the spread of invasive and exotic species	Prevent and control the spread of invasive and invasive non-native species	2.1 Site/area management	Follow guidance provided in provincial forest management guides (e.g., *Forest Health Landowner's Guide: When Invasive Species Threaten Your Woodlot*, Ontario Ministry of Natural Resources, 2008a).	Red-shouldered Hawk, Wood Thrush
				4.3 Awareness and communications	Support public awareness efforts to deter unauthorized or accidental releases of invasive non-native species.	
				5.2 Policies and regulations	Develop and/or strengthen policies or regulatory measures geared to preventing the introduction and spread of invasive non-native species (e.g., Emerald ash borer) and diseases.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for a federal/provincial Species at Risk.	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Acadian Flycatcher, Hooded Warbler
9.3 Agricultural & forestry effluents	Loss of food source due to non-selective pesticide use (e.g., reduction in prey insects, leaching to	5.1 Maintain natural food webs and prey sources	Maintain/improve forest habitat quality by reducing pesticide use	5.3 Private sector standards and codes	Develop or implement existing BMPs to reduce potential risks to birds and their habitats resulting from pesticide use in forestry/agriculture.	Common Nighthawk,[2] Eastern Whip-poor-will[2]

Table 9 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
	adjacent habitats)					
				5.4 Compliance and enforcement	Continue to monitor and enforce compliance with laws, policies and regulations at all levels.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Common Nighthawk,[2] Eastern Whip-poor-will[2]
12.1 Information lacking	Lack of knowledge (trend, population size, and/or distribution range)	7.1 Improve population/ demographic monitoring	Improve monitoring efforts to increase reliability of population status/trend	8.2 Monitoring	Improve monitoring efforts to increase reliability of population status/trend for crepuscular species not well sampled by the Breeding Bird Survey.	Common Nighthawk,[2] Eastern Whip-poor-will[2]
	Lack of information on factors causing population declines	7.1 Improve population/ demographic monitoring	Improve population/demographic monitoring of aerial insectivores	8.2 Monitoring	Encourage submissions of current and historic nest record data to the Ontario Nest Records Scheme/Project NestWatch to improve understanding of changes in productivity.	
		7.4 Improve understanding of causes of population declines	Determine sources of mortality or population decline(s)	8.1 Research	Identify factors causing population decline and/or limiting population growth of aerial-foraging insectivores.	
			Determine cause(s) of population decline	8.1 Research	Conduct research to better determine cause of general population decline including effects of forest management treatments on breeding density, productivity and survivorship	Canada Warbler[2]
			Determine cause(s) of population decline	8.1 Research	Investigate potential causes of population decline including studying population demographics across a range of nesting sites and management regimes.	Olive-sided Flycatcher[2]

Table 9 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Canada Warbler,[2] Common Nighthawk,[2] Eastern Whip-poor-will,[2] Olive-sided Flycatcher[2]

Shrub and Early Successional

Shrub and early successional habitat as defined primarily by SOLRIS include tallgrass woodland, treed sand barrens and dunes, and vegetated shoreline (Table 1). Shrub and early successional habitats are generally transient, occurring where disturbance has removed the tree cover and the vegetation is dominated by shrubby, early seral[8] forms. The current extent of these habitats in southern Ontario is difficult to measure given the inherently unstable nature of successional habitats. They are difficult to differentiate from other classes in satellite imagery and are likely underrepresented in SOLRIS accounting for only 0.02% of the land cover/land use (Table 1; Fig. 14). Some estimates suggest that the actual amount of shrub and early successional habitat within a forest matrix in BCR 13 ON might be 7.5% or greater (Larson et al. 1999).

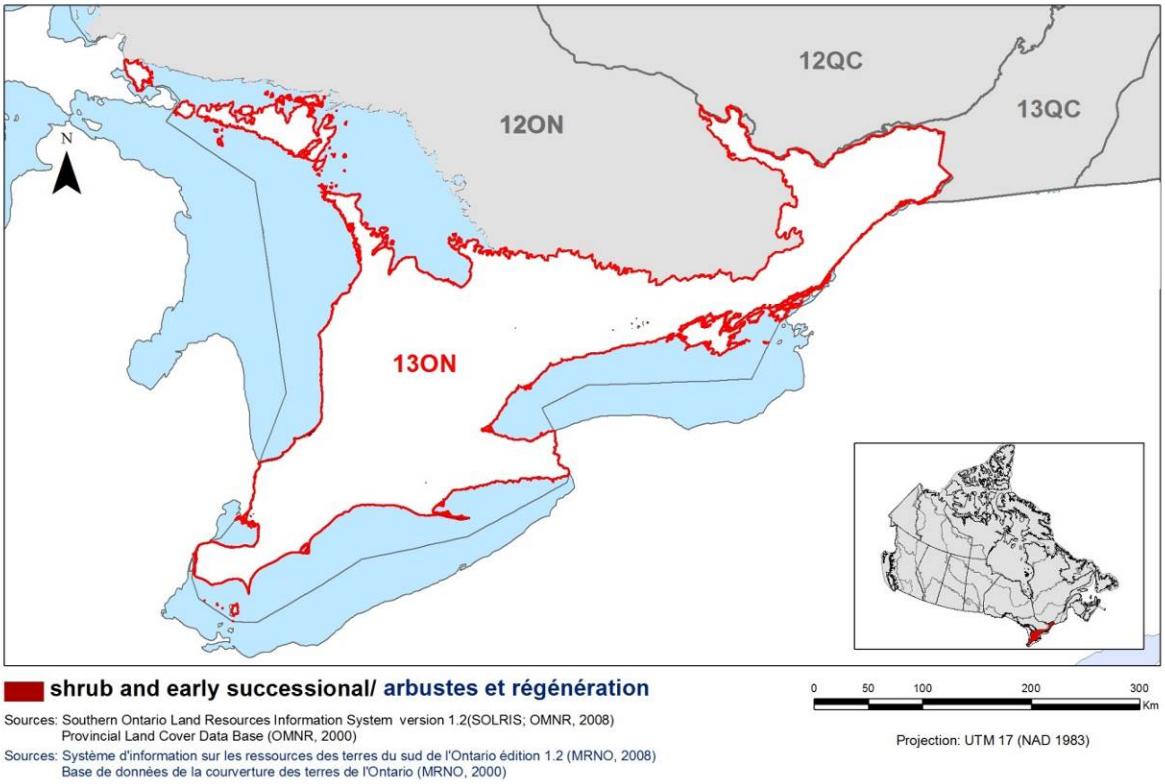

Figure 14. Map of shrub and early successional habitat in BCR 13 ON.

Eleven priority species use shrub and early successional habitats extensively in BCR 13 ON (Table 10). All are landbirds, except the American Woodcock, a shorebird. Included in this list are four species at risk: the Golden-winged Warbler, the Kirtland's Warbler, the Loggerhead Shrike (*migrans* subspecies) and the Yellow-breasted Chat (*virens* subspecies).

[8] An intermediate stage found in ecological succession in an ecosystem advancing towards its climax community.

Table 10. Priority species associated with shrub and early successional habitats in BCR 13 ON, habitat descriptions, population objectives and reasons for priority status.

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Sub-regional Concern[5]	Regional/Sub-regional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
American Woodcock	Shrubby old fields and forest openings	Increase				Y		Y	
Black-billed Cuckoo	Shrubby old fields and thickets; forest edges and openings	Increase				Y	Y		
Blue-winged Warbler	Dense early to mid-successional shrubland	Maintain current				Y		Y	
Brown Thrasher	Shrubby overgrown pastures; shrubby thickets, hedgerows	Increase				Y			Y
Eastern Towhee	Shrubby old fields and early successional habitat	Increase				Y		Y	Y
Field Sparrow	Shrubby old fields, forest edges, roadsides, brushy sand dunes	Increase				Y			
Golden-winged Warbler	Shrubby old fields, forest edges and openings	Recovery objective[7]	Y	Y	Y	Y		Y	
Kirtland's Warbler	Thickets; fire-dependant habitat specialist	Recovery objective	Y	Y	Y	Y		Y	
Loggerhead Shrike (*migrans*)	Early successional shrubby fields	Recovery objective	Y	Y	Y	Y		Y	
Prairie Warbler	Shrubby early to mid-successional habitats on sand plains; shrubby old fields with common juniper.	Assess/Maintain				Y		Y	
Yellow-breasted Chat (*virens*)	Thickets, shrubby old fields, young coniferous reforestations.	Recovery objective	Y	Y	Y	Y		Y	

The trend towards reforestation in Southern Ontario has had positive effects for priority bird species in forest habitats, but this reforestation may have come at the expense of shrub and early successional habitats. These habitats depend on natural or anthropogenic disturbances to

[1] Habitat descriptions are based on information found in the Atlas of the Breeding Birds of Ontario, 2001–2005; Ontario Partners in Flight, 2008 and the Land Cover Classification System (LCCS; see Kennedy et al. 2012).
[2] Assessed by COSEWIC as E, Endangered; T, Threatened; SC, Special Concern.
[3] Species listed on Schedule 1 of SARA as E, Endangered; T, Threatened; SC, Special Concern.
[4] Species listed as Endangered, Threatened or Special Concern on the SARO List.
[5] Regional refers to BCR-wide (i.e., all jurisdictional data were used for the entire BCR) while sub-regional refers to the Ontario portion of the BCR only (i.e., Ontario BCR data were used).
[6] Only the landbird pillar distinguishes stewardship species from other priority species (see Panjabi et al. 2005).
[7] Species listed on Schedule 1 of SARA and/or SARO, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, the interim population objective for the Golden-winged Warbler in BCR 13 ON is: Maintain current.

remain in an early successional state, and suppression of these disturbances may have led to a reduction in the amount and quality of shrub and early successional habitats in the region. In particular, suppression of fire, allowing shrub habitat to revert to forest, was noted as a significant threat to priority birds in this habitat class (threat sub-category 7.1; very high overall magnitude). Associated conservation actions encourage management practices that inhibit and reduce encroachment of woody vegetation (e.g., prescribed burns, grazing, strategic periodic cutting to prevent tree growth).

Habitat availability is an important factor for all shrub and early successional priority species given the inherently short-lived or dynamic nature of successional habitats. Habitat loss as a result of development (sub-category 1.1; Fig 15) and agricultural intensification (sub-category 2.1), including loss of hedgerows and cultivation of fallow fields, were identified as high overall magnitude threats to priority species in this habitat. A range of conservation actions are presented to address these threats, many of which relate to landscape-level planning to ensure an adequate quantity of shrub and early successional habitats, as well as the development of educational material for rural landowners and land managers to raise public awareness of the conservation value of "scrubby" lands (Table 11). Relatively little is known about the specific habitat requirements of the priority species, and given that the trend in availability of shrub habitat in BCR 13 ON is unknown, additional conservation actions focus on improving our understanding of trends in the availability and quality of shrub habitats, and the effects of management techniques on species' productivity.

Problematic native species (sub-category 8.2) were assessed as a high overall magnitude threat to two species: namely, Kirtland's Warbler and the Golden-winged Warbler, both of which are federally and provincially listed species at risk (Fig. 15). Brood parasitism by Brown-headed Cowbirds is considered a threat to the survival of Kirtland's Warbler (Environment Canada 2006). According to national Breeding Bird Survey data (Environment Canada 2014), the Golden-winged Warbler has declined by 79% over the last 10 years. The main threat appears to be competition and genetic swamping (hybridization) from the closely-related Blue-winged Warbler, which is spreading north because of habitat change and perhaps climate change (COSEWIC 2006). Conservation actions for Golden-winged Warbler include research to assess the effects of habitat management techniques on the abundance, productivity, recruitment and site fidelity of both species as well as to study habitat partitioning and hybridization between the two (Table 11).

Mortality from collisions with buildings, communication towers or windows (sub-category 1.2) was assessed as a high-magnitude threat for priority species in early successional habitats. Given that the effects of this threat are widespread, conservation objectives and actions are presented in the Widespread Issues section of this strategy, instead of in Table 11 below.

The full list of threats to and information needs for priority species in shrub and early successional habitats of BCR 13 ON as well as the conservation objectives and recommended actions are presented in Table 11.

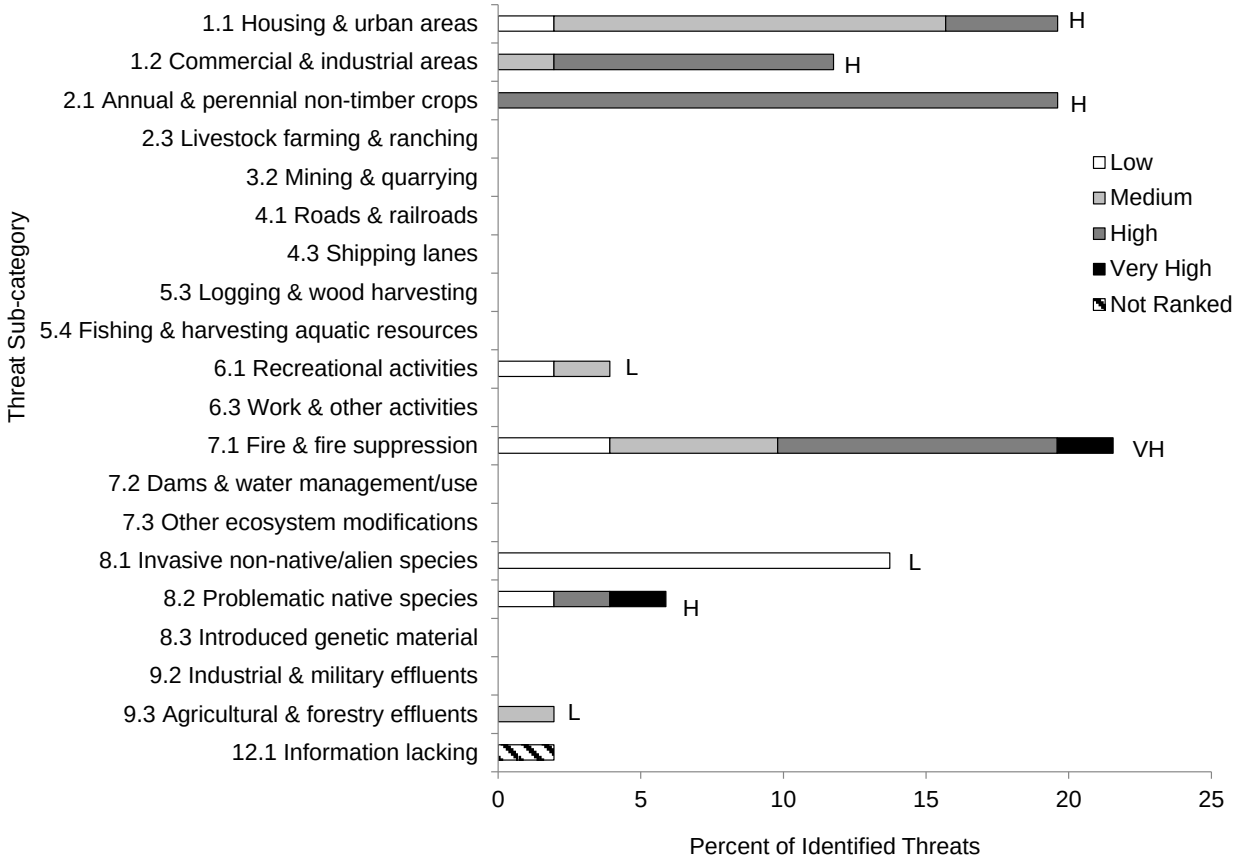

Figure 15. Percent of identified threats to priority species in shrub and early successional habitats in each threat sub-category by magnitude.

Each bar represents the percent of the total number of threats identified in each threat sub-category in shrub and early successional habitat (for example, if 100 threats were identified in total for all priority species in shrub and early successional habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). Threat sub-category 12.1 Information lacking was not ranked. The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category. The overall magnitude of the threat in shrub and early successional habitat is shown at the end of each bar (also presented in Table 5). Only threats with a magnitude of medium or higher are typically assigned habitat-specific conservation objectives.

Table 11. Threats addressed, conservation objectives, recommended actions, and list of priority species affected in shrub and early successional habitats in BCR 13 ON.

Note: Issues such as collisions with human-made structures and climate change are not addressed in this table; instead, they are addressed in the Widespread Issues section.

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
1.1 Housing & urban areas	Loss of shrub/early successional habitat due to development	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain, restore or enhance the quantity, quality and diversity of shrub and early successional habitats across the BCR	1.2 Resource and habitat protection	Conserve and manage shrubland habitats in areas of importance to priority shrub/early successional species.	American Woodcock, Black-billed Cuckoo, Blue-winged Warbler, Brown Thrasher, Eastern Towhee, Field Sparrow, Golden-winged Warbler,[2] Prairie Warbler
				2.1 Site/area management	Develop landscape-level management plans for rights-of-way, transmission corridors, and other managed shrub/early successional habitats to ensure an adequate and diverse supply of shrub/early successional habitat	
				4.3 Awareness and communications	Promote the development of educational material for rural landowners and land managers to raise public awareness of the conservation value of "scrubby" lands (e.g., Birds on the Farm: A Stewardship Guide. McGauley 2004)	

[1] While many priority species may benefit from proposed conservation actions, priority species not mentioned in this table are absent because 1) identified threats in this habitat are of low magnitude, or 2) they are migrants with no threats identified in this habitat.

[2] Species listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, interim conservation objectives and recommended actions are presented here.

Table 11 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
				8.1 Research	Determine an appropriate guideline for the minimum threshold area needed to maintain shrubland bird biodiversity throughout this region (Ontario Partners in Flight 2008). Evaluate the effects of increasing the amount of shrub/early successional habitat and/or using various habitat management techniques at demonstration sites on the abundance, productivity and site fidelity of priority shrub/early successional species.	American Woodcock, Black-billed Cuckoo, Blue-winged Warbler, Brown Thrasher, Eastern Towhee, Field Sparrow, Golden-winged Warbler,[2] Prairie Warbler
				8.2 Monitoring	Maintain or improve successional forest habitat mapping across BCR 13 ON (Ontario Partners in Flight 2008).	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation.	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Golden-winged Warbler, Loggerhead Shrike (*migrans*), Yellow-breasted Chat (*virens*)

Table 11 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
2.1 Annual & perennial non-timber crops	Loss of shrub/early successional habitat due to agricultural intensification (e.g., loss of fallow fields and hedgerows)	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain, restore or enhance the quantity, quality and diversity of shrub and early successional habitats across the BCR	1.2 Resource and habitat protection	Conserve and manage shrubland habitats in areas of importance to priority shrub/early successional species.	American Woodcock, Black-billed Cuckoo, Blue-winged Warbler, Brown Thrasher, Eastern Towhee, Field Sparrow, Golden-winged Warbler,[2] Prairie Warbler
				4.3 Awareness and communications	Promote the development of educational material for rural landowners and land managers to raise public awareness of the conservation value of "scrubby" lands (e.g., Birds on the Farm booklet by McGauley 2004)	
				8.1 Research	Determine an appropriate guideline for the minimum threshold area needed to maintain shrubland bird biodiversity throughout this region (Ontario Partners in Flight 2008). Evaluate the effects of increasing the amount of shrub/early successional habitat and/or using various habitat management techniques at demonstration sites on the abundance, productivity and site fidelity of priority shrub/early successional species.	

Table 11 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
				8.2 Monitoring	Maintain or improve successional forest habitat mapping across BCR 13 ON (Ontario Partners in Flight 2008).	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation.	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Loggerhead Shrike (*migrans*), Yellow-breasted Chat (*virens*)
7.1 Fire & fire suppression	Absence of fire or natural periodic disturbance allows natural succession and decline of habitat quality/quantity	1.3. Ensure the continuation of natural processes that maintain bird habitat	Maintain, restore or enhance the quantity, quality and diversity of shrub and successional habitats across the BCR	2.1 Site/area management	Encourage management practices that inhibit and reduce encroachment of woody vegetation (e.g., grazing, strategic periodic cutting to prevent tree growth).	Blue-winged Warbler, Brown Thrasher, Eastern Towhee, Field Sparrow, Loggerhead Shrike (*migrans*), Prairie Warbler, Yellow-breasted Chat (*virens*)
				2.3 Habitat and natural process restoration	Implement prescribed burn management activities as required for management of shrubland communities on public lands. Avoid burns during nesting and brood-rearing periods.	

Table 11 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
				8.1 Research	Evaluate the effects of increasing the amount of shrub/early successional habitat and/or using various habitat management techniques at demonstration sites on the abundance, productivity and site fidelity of priority shrub/early successional landbirds. Determine an appropriate guideline for the minimum threshold needed to maintain shrubland bird biodiversity throughout this region.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation.	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Loggerhead Shrike (*migrans*), Yellow-breasted Chat (*virens*)
8.2 Problematic native species	Golden-winged Warblers are threatened by hybridization with Blue-winged Warbler.	7.4 Improve understanding of causes of population declines	Improve understanding of basic ecology and potential limiting factors	8.1 Research	Assess the effects of habitat management techniques on the abundance, productivity, recruitment and site fidelity of Blue-winged and Golden-winged Warblers. Study habitat partitioning and hybridization between Blue-winged and Golden-winged Warblers in Ontario.	Golden-winged Warbler[2]

Table 11 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation.	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Golden-winged Warbler
	Brood Parasitism by Brown-headed Cowbird (reduces both hatchling and fledgling success)	3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Kirtland's Warbler
12.1 Information lacking	Lack of knowledge (trend, population size, and/or distribution range)	7.1 Improve population/ demographic monitoring	Improve monitoring efforts to increase reliability of population status/trend	8.2 Monitoring	Improve monitoring efforts to increase reliability of population status/trend for species not well sampled by the Breeding Bird Survey (small population occurring in areas away from roads).	Prairie Warbler

Herbaceous

Less than 1% of the land cover/land use classes in BCR 13 ON are attributed to herbaceous habitat and include naturally open habitats such as tallgrass prairie, tallgrass savannah and alvar (Table 1; Fig. 16). While vegetation varies in each alvar type, many in southern Ontario share grassland characteristics, and as such are being considered in this native grassland discussion (Environment Canada, 2013a). Prior to European settlement, forests dominated the landscape, but open alvar habitats, grasslands and savannahs (i.e., part forest, part prairie) covered at least 1.3% of the landscape and perhaps as much as 10% (Rodger 1998). In addition, small, often ephemeral, open habitat patches such as forest meadows, floodplain meadows and beaver meadows were embedded throughout the historic forests of BCR 13 ON. These habitats remain rare in Ontario. Up to 97% of the original prairie and savannah has been lost (Rodger 1998). Alvar habitats are rare globally (Bronwell and Riley 2000) and were likely always rare within BCR 13 ON.

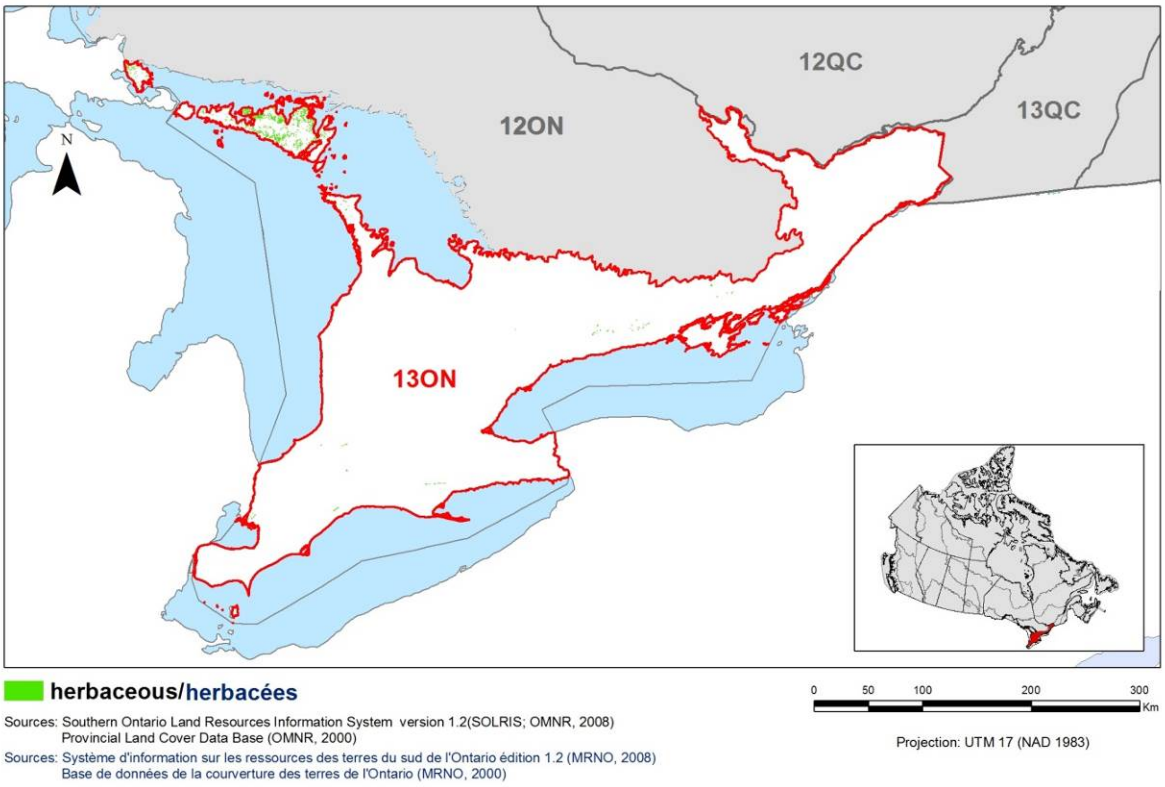

Figure 16. Map of herbaceous habitat in BCR 13 ON.

Twenty-two priority species use herbaceous habitats in BCR 13 ON, including 9 species at risk (Table 12). Included in this list are birds that nest in native grasslands such as the Bobolink (a provincially threatened species), the Green-winged Teal and the Upland Sandpiper. Also included are birds that forage in these open areas, such as the American Kestrel, and aerial insectivores that forage on the wing over these open habitats, such as the Purple Martin and the provincially threatened Barn Swallow.

Table 12. Priority species associated with herbaceous habitats in BCR 13 ON, habitat descriptions, population objectives and reasons for priority status.

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Sub-regional Concern[5]	Regional/Sub-regional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
American Kestrel	Native grasslands (foraging)	Maintain current				Y			
Bank Swallow	Native grasslands (foraging) near nesting sites; banks along shorelines; sand and gravel pits	Increase	Y				Y		
Barn Owl	Native grasslands (foraging)	Recovery objective	Y	Y	Y	Y			
Barn Swallow	Native grasslands (foraging)	Recovery objective	Y		Y	Y			
Blue-winged Teal	Dense, short to medium- tall native grasslands adjacent to wetlands	Increase				Y		Y	
Bobolink	Native tall grasslands	Recovery objective	Y		Y	Y	Y	Y	
Common Nighthawk	Alvars; sparsely vegetated rock outcrops	Recovery objective[7]	Y	Y	Y	Y		Y	
Eastern Kingbird	Native grasslands; savannah	Increase				Y			

[1] Habitat descriptions are based on information found in the Atlas of the Breeding Birds of Ontario (2001–2005), Neave and Baldwin (2011), and Birds of North America Online.
[2] Assessed by COSEWIC as E, Endangered; T, Threatened; SC, Special Concern.
[3] Species listed on Schedule 1 of SARA as E, Endangered; T, Threatened; SC, Special Concern.
[4] Species listed as Endangered, Threatened or Special Concern on the SARO List.
[5] Regional refers to BCR-wide (i.e., all jurisdictional data were used for the entire BCR) while sub-regional refers to the Ontario portion of the BCR only (i.e., Ontario BCR data were used).
[6] Only the landbird group distinguishes stewardship species from other priority species (see Panjabi et al. 2005).
[7] Species listed on Schedule 1 of SARA and/or SARO, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, the interim population objectives for these species in BCR 13 ON are: Common Nighthawk: Increase; Northern Bobwhite: Maintain Current; Short-eared Owl: Assess/Maintain.

Table 12 continued

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Sub-regional Concern[5]	Regional/Sub-regional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
Eastern Meadowlark	Native grasslands; prairie; short, moderately dense grasslands with few forbs	Recovery objective	Y		Y	Y			
Grasshopper Sparrow	Dry, sparsely- vegetated, native short-grass areas	Increase	Y			Y		Y	Y
Green-winged Teal	Native grasslands adjacent to wetlands	Maintain current				Y			
Henslow's Sparrow	Tall, dense native grasslands; high percentage standing, dead, residual plant cover	Recovery objective	Y	Y	Y	Y		Y	
Loggerhead Shrike (*migrans*)	Alvar	Recovery objective	Y	Y	Y	Y		Y	
Mallard	Native grasslands adjacent to wetlands	Increase				Y		Y	
Northern Bobwhite	Native grasslands; oak savannah	Recovery objective[7]	Y	Y	Y	Y		Y	
Northern Harrier	Native tall grasslands; prairie	Maintain current				Y			
Northern Rough-winged Swallow	Native grasslands (foraging)	Increase				Y			
Purple Martin	Native grasslands (foraging)	Increase				Y			
Savannah Sparrow	Native grasslands with forbs	Increase				Y			
Short-eared Owl	Tall native grasslands	Recovery objective[7]	Y	Y	Y	Y		Y	
Upland Sandpiper	Dry, short to medium native grasslands	Increase				Y			
Vesper Sparrow	Dry, native short-grass habitats with scattered perches	Increase				Y			

These herbaceous habitats were among the few open habitats available prior to European settlement, and continue to play a role in the conservation of grassland and open-country birds in BCR 13 ON. The most significant threats (i.e., very high and high overall magnitude) to priority birds identified in herbaceous habitats are those related to habitat loss and degradation from a variety of sources including urban development (threat sub-category 1.1; Fig. 17), conversion to agriculture (sub-category 2.1), sustained overgrazing (sub-category 2.3), and lack of fire or active native grassland management causing natural succession and decline in habitat quantity and/or quality (sub-category 7.1).

Among the priority species using native tallgrass prairie is the Northern Bobwhite, a species listed as endangered both provincially and federally. A majority, perhaps all, of Canada's remaining native breeding population of this species is on Walpole Island in southwestern Ontario (COSEWIC 2003). Elsewhere in the species' restricted range, interbreeding with non-native captive-reared birds (with lower survival rates) may have served to dilute the native gene pool. The potential for ongoing interbreeding between captive-reared and native birds is considered a significant, very high-magnitude threat to this species (sub-category 8.3).

Recommended conservation actions are diverse and aim to maintain and restore quality, quantity and diversity of native grassland habitats across the BCR. As is the case for all habitats important to aerial insectivores, research and monitoring actions focus on improving our understanding of sources of mortality and changes in productivity to inform future conservation actions aimed at reversing population declines (Table 13). For these rare and restricted natural habitats, protection is also an important conservation action. Recent activities by the Nature Conservancy of Canada and partners have succeeded in protecting significant alvar habitats in the Carden Plain (2500 ha), and ongoing work by the Ontario Ministry of Natural Resources, Tallgrass Ontario, naturalist clubs and ENGOs seeks to protect other remnant native grassland habitats in areas such as the Bruce Peninsula, Manitoulin Island and the Napanee Plain.

The full list of threats to and information needs (sub-category 12.1) for priority species in herbaceous habitats of BCR 13 ON as well as the conservation objectives and recommended actions are presented in Table 13. Note that although mortality related to collisions with buildings (sub-category 1.2 Commercial and industrial areas) and collisions with vehicles (sub-category 4.1 Roads and railroads) are high overall magnitude threats to priority species in this habitat, they are not examined in Table 13, given that the effects of these threats are widespread. They are instead addressed in the Widespread Issues section of this strategy.

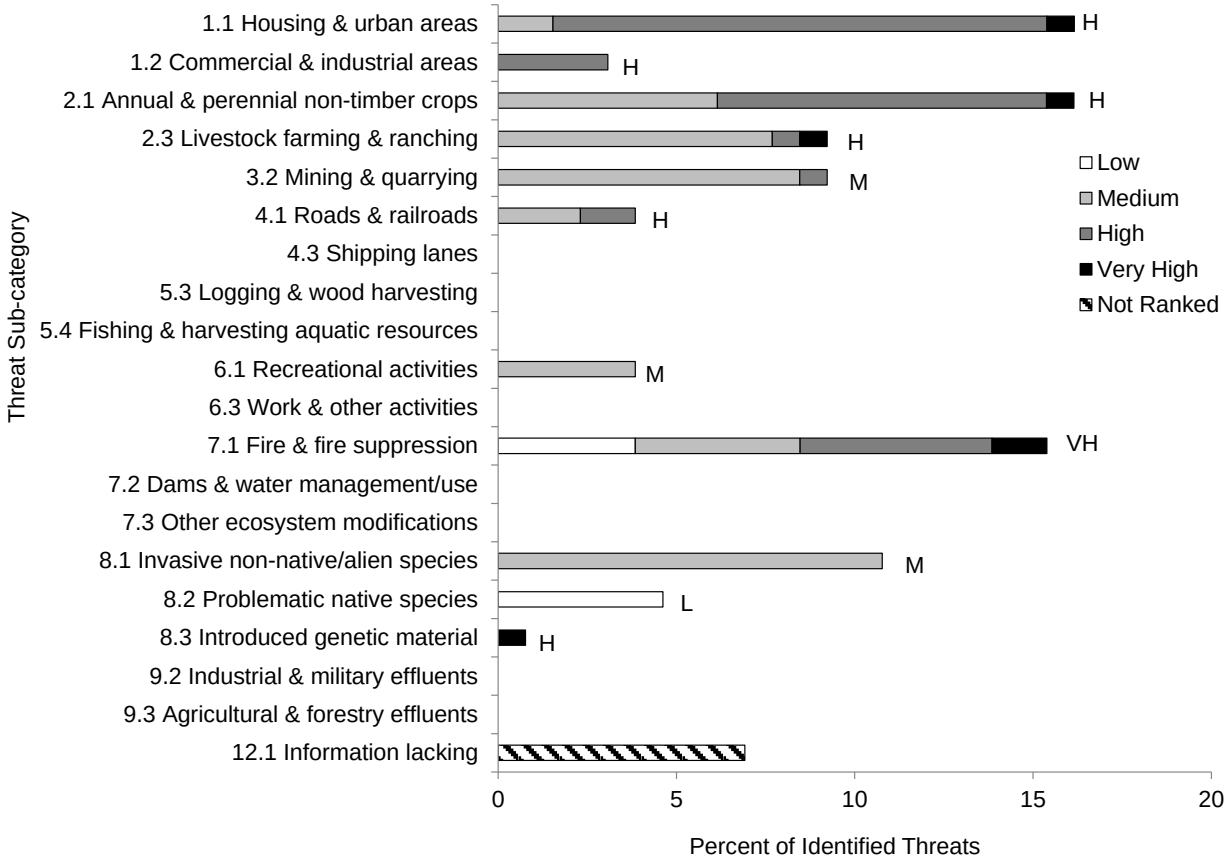

Figure 17. Percent of identified threats to priority species in herbaceous habitats in each threat sub-category.

Each bar represents the percent of the total number of threats identified in each threat sub-category in herbaceous habitat (for example, if 100 threats were identified in total for all priority species in herbaceous habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). Threat sub-category 12.1 Information lacking was not ranked. The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category. The overall magnitude of the threat in herbaceous habitat is shown at the end of each bar (also presented in Table 5). Only threats with a magnitude of medium or higher are typically assigned habitat-specific conservation objectives.

Table 13. Threats addressed, conservation objectives, recommended actions and list of priority species affected in herbaceous habitats in BCR 13 ON.

Note: Issues such as collisions with human-made structures and vehicles, and climate change and pollution, are not addressed in this table; instead, they are addressed in the Widespread Issues section.

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
1.1 Housing & urban areas	Loss of native grassland habitat due to development	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain/restore quality, quantity and diversity of native grassland habitats across the BCR	1.1 Site/area protection	Expand a network of protected native grassland communities (e.g., alvar, tallgrass prairie, tallgrass savannah).	American Kestrel, Bank Swallow, Barn Owl, Blue-winged Teal, Common Nighthawk,[2] Eastern Kingbird, Grasshopper Sparrow, Green-winged Teal, Northern Bobwhite, Northern Harrier, Northern Rough-winged Swallow, Purple Martin, Savannah Sparrow, Short-eared Owl, Upland Sandpiper, Vesper Sparrow
				2.1 Site/area management	Some grassland habitat should be located adjacent to hedgerows, riparian and wetland habitats for species that require different habitat types in close proximity (Environment Canada 2013a). Retain large snags and mature trees in open native grassland settings for nesting cavities and hunting perches; install nest boxes where natural cavities are limiting.	

[1] While many priority species may benefit from proposed conservation actions, priority species not mentioned in this table are absent because 1) identified threats in this habitat are of low magnitude, or 2) they are migrants with no threats identified in this habitat.

[2] Species listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, interim conservation objectives and recommended actions are presented here.

Table 13 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
				2.3 Habitat and natural process restoration	Maintain, restore and create native grassland patches to their historic extent and type at a county, municipal and/or watershed scale considering past presence and current conditions. Grassland habitat patches should be clustered or aggregated, and any intervening land cover should be open or semi-open in order to be permeable to species movement (Environment Canada 2013a).	American Kestrel, Bank Swallow, Barn Owl, Blue-winged Teal, Common Nighthawk,[2] Eastern Kingbird, Grasshopper Sparrow, Green-winged Teal, Northern Bobwhite, Northern Harrier, Northern Rough-winged Swallow, Purple Martin, Savannah Sparrow, Short-eared Owl, Upland Sandpiper, Vesper Sparrow
				4.3 Awareness and communications	Raise public awareness and appreciation of native grassland communities.	
				5.2 Policies and regulations	Encourage public land managers to include native grassland conservation in their regional land-use policies and planning efforts.	
				8.1 Research	Evaluate the effect of various land management practices on the abundance, distribution and demographics of priority grassland birds.	

Table 13 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Barn Owl, Barn Swallow, Bobolink, Common Nighthawk, Eastern Meadowlark, Henslow's Sparrow, Loggerhead Shrike (*migrans*), Northern Bobwhite,[2] Short-eared Owl
2.1 Annual & perennial non-timber crops	Loss of native grassland habitat to agricultural conversion	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain/restore quality, quantity and diversity of native grassland habitats across the BCR	1.1 Site/area protection	Expand a network of protected native grassland communities (e.g., alvar, tallgrass prairie, tallgrass savannah).	American Kestrel, Bank Swallow, Barn Owl, Blue-winged Teal, Common Nighthawk,[2] Eastern Kingbird, Grasshopper Sparrow, Green-winged Teal, Northern Bobwhite,[2] Northern Harrier, Northern Rough-winged Swallow, Purple Martin, Savannah Sparrow, Short-eared Owl,[2] Upland Sandpiper, Vesper Sparrow
				2.1 Site/area management	Retain large snags and mature trees in open native grassland settings for nesting cavities and hunting perches; install nest boxes where natural cavities are limiting.	
				2.3 Habitat and natural process restoration	Maintain, restore and create native grassland patches to their historic extent and type at a county, municipal and/or watershed scale considering past presence and current conditions. Grassland habitat patches should be clustered or aggregated, and any intervening land cover should be open or semi-open in order to be permeable to species movement (Environment Canada 2013a).	

Table 13 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
				4.3 Awareness and communications	Raise public awareness and appreciation of native grassland communities.	
				5.2 Policies and regulations	Encourage public land managers to include native grassland conservation in their regional land-use policies and planning efforts.	
				8.1 Research	Evaluate the effect of various land management practices on the abundance, distribution and demographics of priority grassland birds.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Barn Owl, Barn Swallow, Bobolink, Common Nighthawk, Eastern Meadowlark, Henslow's Sparrow, Loggerhead Shrike (*migrans*), Northern Bobwhite, Short-eared Owl
2.3 Livestock farming & ranching	Sustained overgrazing can significantly degrade or destroy tallgrasses	1.2 Maintain the size, shape and configuration of habitat within the natural range of variation	Maintain/foster complex, heterogeneous vegetation structure	2.1 Site/area management	Plan livestock grazing to maintain the desired structure and density of the plant community for priority species. Grazing levels may not be the same for each of these species.	American Kestrel, Eastern Kingbird, Grasshopper Sparrow, Northern Bobwhite,[2] Northern Harrier, Savannah Sparrow, Short-eared Owl,[2] Upland Sandpiper, Vesper Sparrow

Table 13 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
					Use grazing systems that contain rest, rotation, deferment and prescribed burning to produce a mosaic of habitat patches on the landscape which benefit a variety of grassland species. Where necessary, use fencing to control livestock access.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Bobolink, Bobwhite, Eastern Meadowlark, Henslow's Sparrow, Northern Short-eared Owl
3.2 Mining & quarrying	Loss of alvar habitat due to the expansion of rock quarries	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain/restore quality, quantity and diversity of alvar habitats across the BCR	1.2 Site/area protection	Expand a network of protected native grassland communities (e.g., alvar, tallgrass prairie, tallgrass savannah).	American Kestrel, Bank Swallow, Common Nighthawk,[2] Eastern Kingbird, Purple Martin, Northern Harrier, Northern Rough-winged Swallow, Savannah Sparrow, Upland Sandpiper
				5.2 Policies and regulations	Include habitat restoration for priority species into post-mining remediation or closure plans. Encourage public land managers to include native grassland conservation in their regional land-use policies and planning efforts.	American Kestrel, Bank Swallow, Common Nighthawk,[2] Eastern Kingbird, Purple Martin, Northern Harrier, Northern Rough-winged Swallow, Savannah Sparrow, Upland Sandpiper

Table 13 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
				8.1 Research	Evaluate the effect of various land management practices on the abundance, distribution and demographics of priority grassland birds.	American Kestrel, Bank Swallow, Common Nighthawk,[2] Eastern Kingbird, Purple Martin, Northern Harrier, Northern Rough-winged Swallow, Savannah Sparrow, Upland Sandpiper
				5.3 Private sector standards and codes	Include guidelines for the protection and management of bank-nesting species such as Bank Swallow, in BMPs for municipalities and operators of sand and gravel pits (e.g., Ontario Stone, Sand and Gravel Association 2013).	Bank Swallow
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Bobolink, Common Nighthawk, Eastern Meadowlark, Loggerhead Shrike (*migrans*)
6.1 Recreational activities	Disturbance from human recreation (e.g., vehicles such as ATVs make excessive amounts of noise)	4.1. Reduce disturbance from human recreation	Reduce/eliminate disturbance from recreational activities in native grasslands	4.3 Awareness and communications	Raise public awareness of the vulnerability of priority species to human disturbance.	Northern Harrier, Savannah Sparrow, Upland Sandpiper, Vesper Sparrow
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Bobolink

Table 13 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
7.1 Fire & fire suppression	Absence of fire or active management allows natural succession and decline of habitat quality/quantity	1.3. Ensure the continuation of natural processes that maintain bird habitat	Maintain and enhance fire-dependent ecosystems in native grassland habitats	2.3 Habitat and natural process restoration	Implement prescribed burn management activities as required for management of native grassland communities on public lands. Avoid burns during nesting and brood-rearing periods.	Blue-winged Teal, Grasshopper Sparrow, Green-winged Teal, Northern Bobwhite,[2] Northern Harrier, Northern Rough-winged Swallow, Purple Martin, Savannah Sparrow, Short-eared Owl,[2] Upland Sandpiper
				2.1 Site/area management	Encourage grazing practices that inhibit and reduce woody vegetation encroachment into native grasslands.	Blue-winged Teal, Grasshopper Sparrow, Green-winged Teal, Northern Bobwhite,[2] Northern Harrier, Northern Rough-winged Swallow, Purple Martin, Savannah Sparrow, Short-eared Owl,[2] Upland Sandpiper
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Barn Owl, Bobolink, Bobwhite, Eastern Meadowlark, Henslow's Sparrow, Loggerhead Shrike (*migrans*), Northern Short-eared Owl

Table 13 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
8.1 Invasive non-native/alien species	Invasive species in native grassland habitats outcompete native species and change habitat composition	3.5 Prevent and control the spread of invasive and exotic species	Prevent and control the spread of invasive and exotic species	2.2 Invasive/ problematic species control	Eliminate or control non-native weeds through mechanical control or through grazing. In some sites, prescribed burning may enhance native plant growth and reduce non-native, invasive weeds.	American Kestrel, Bank Swallow, Eastern Kingbird, Northern Bobwhite,[2] Northern Harrier, Northern Rough-winged Swallow, Purple Martin, Vesper Sparrow, Savannah Sparrow, Short-eared Owl,[2] Upland Sandpiper
				4.3 Awareness and communications	Raise public awareness of invasive plant species and measures to control their spread.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Bobolink, Barn Swallow, Eastern Meadowlark, Northern Bobwhite, Short-eared Owl
8.3 Introduced genetic material	Dilution of the native gene pool due to interbreeding with non-native captive-reared birds	7.4. Improve understanding of causes of population declines	Develop an understanding of reasons for population decline	8.1 Research	Determine whether interbreeding with non-native, pen reared birds has population-level effects	Northern Bobwhite[2]
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Northern Bobwhite

Table 13 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
12.1 Information Lacking	Lack of information on factors causing population declines	7.4 Improve understanding of causes of population declines	Determine sources of mortality or population decline(s)	8.1 Research	Determine factors (nest cavities, habitat availability, food supply) limiting population abundance and productivity.	American Kestrel
		7.4 Improve understanding of causes of population declines	Determine sources of mortality or population decline(s)	8.1 Research	Identify factors causing population decline and/or limiting population growth of aerial-foraging insectivores.	Bank Swallow, Common Nighthawk,[2] Eastern Kingbird, Northern Rough-winged Swallow, Purple Martin
		7.1 Improve population/ demographic monitoring	Improve population/ demographic monitoring of aerial insectivores	8.2 Monitoring	Encourage submissions of current and historic nest record data to the Ontario Nest Records Scheme/Project NestWatch to improve understanding of changes in productivity.	Bank Swallow, Common Nighthawk,[2] Purple Martin
	Lack of knowledge (trend, population size, and/or distribution range)	7.1 Improve population/ demographic monitoring	Improve monitoring efforts to increase reliability of population status/trend	8.2 Monitoring	Improve monitoring efforts to increase reliability of population status/trend for colonial nesters (Bank Swallow) and crepuscular species (Common Nighthawk) not well sampled by the Breeding Bird Survey.	Bank Swallow, Common Nighthawk[2]
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial Species at Risk legislation	3.2 Species recovery	Implement species at risk recovery strategies or management plans.	Barn Swallow, Common Nighthawk

Cultivated and Managed Areas

Cultivated and managed areas that include fields and forage crops, hedgerows and other undifferentiated, anthropogenic managed habitats are the dominant land cover/land use class in BCR 13 ON, accounting for nearly 60% of the land base (Table 1; Fig. 18). Many of the bird species using native herbaceous habitats also occur in cultivated and managed habitats such as agricultural fields.

Today, cultivated and managed grasslands are largely agriculturally derived and include pastures and hayfields that have been seeded with non-native forage plants that are maintained as a permanent land cover. Fallow and "old" fields are cultivated and managed areas that are agriculturally derived and often represent a mix of native and non-native plants and features. Agricultural grasslands are by far the most common and widespread form of grassland habitat in BCR 13 ON. Consequently, agricultural habitats are the most important driver for grassland breeding bird richness and abundance today and likely into the future (Environment Canada 2013a).

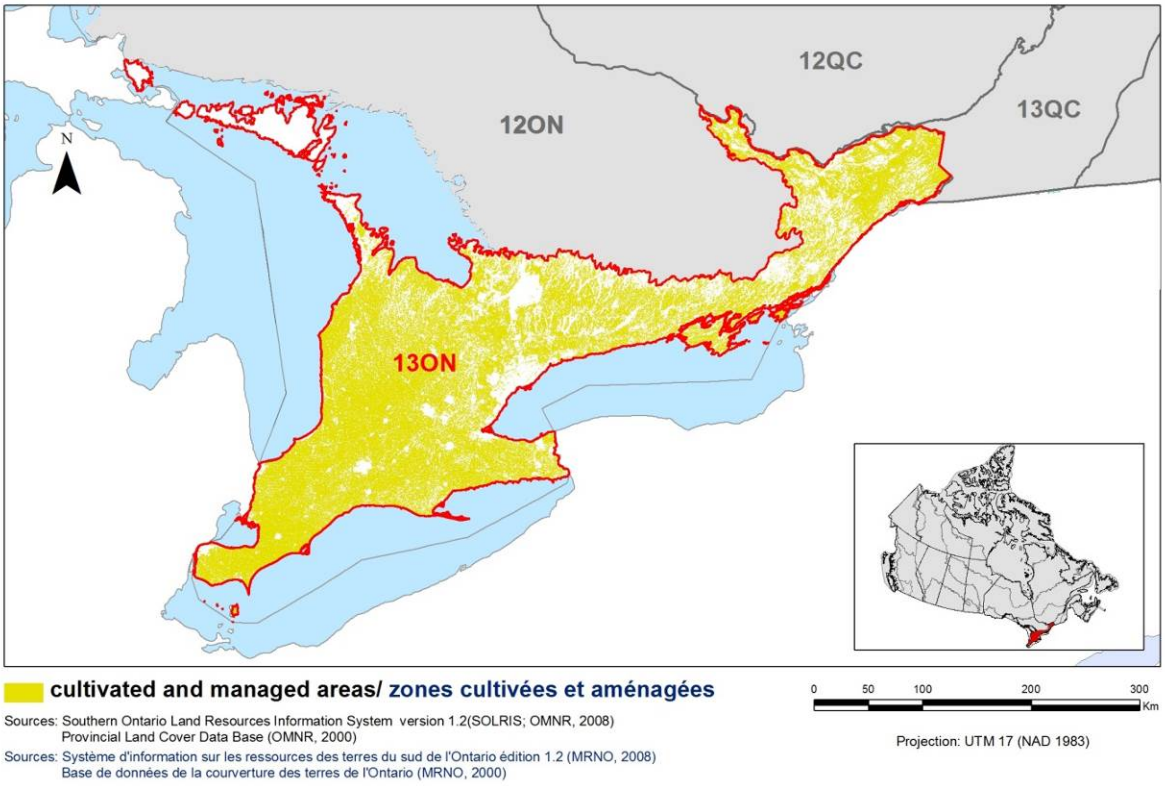

Figure 18. Map of cultivated and managed areas BCR 13 ON.

In BCR 13 ON, the 31 priority species using this habitat class are varied including 18 landbirds, 7 waterfowl, 5 shorebirds and a waterbird. The diversity of landbirds in agricultural habitats is lower than in forests, but a high proportion of these are priority species. Seventeen priority

landbirds, including 8 species at risk, use cultivated and managed areas (Table 14), especially hay fields and other areas of lower-intensity agricultural use.

Table 14. Priority species associated with cultivated and managed habitats in BCR 13 ON, habitat descriptions, population objectives and reasons for priority status.

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Sub-regional Concern[5]	Regional/Sub-regional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
American Black Duck	Agricultural fields; cropland	Maintain current				Y		Y	
American Golden-Plover	Short-grass pastures, cropland, sod farms	Migrant (no BCR 13-ON population objective)				Y		Y	
American Kestrel	Graminoid crops; grasslands, short to medium height groundcover	Maintain current				Y			
Bank Swallow	Graminoid crops; old fields, hayfields, fallow fields	Increase	Y				Y		
Barn Owl	Pastures, hayfields, and other grassy habitats	Recovery objective	Y	Y	Y	Y			
Barn Swallow	Graminoid crops; old fields, hayfields, pastures, fallow fields	Recovery objective	Y		Y	Y			
Black-bellied Plover	Flooded pastures and fields	Migrant (no BCR 13-ON population objective)				Y		Y	
Blue-winged Teal	Hayfields (nesting); short-grass fields (foraging)	Increase				Y		Y	
Bobolink	Tall graminoid crops; hayfields (prefers > 50 ha); large open grasslands, older hayfields, meadows and fallow fields	Recovery objective	Y		Y	Y	Y	Y	
Buff-breasted Sandpiper	Short-grass pastures, grain stubble, sod farms, onion fields	Migrant (no BCR 13-ON population objective)				Y		Y	

[1] Habitat descriptions are based on information found in the Atlas of the Breeding Birds of Ontario (2001–2005), Neave and Baldwin (2011), and Sandilands (2005; 2010).
[2] Assessed by COSEWIC as E, Endangered; T, Threatened; SC, Special Concern.
[3] Species listed on Schedule 1 of SARA as E, Endangered; T, Threatened; SC, Special Concern.
[4] Species listed as Endangered, Threatened or Special Concern on the SARO List.
[5] Regional refers to BCR-wide (i.e., all jurisdictional data were used for the entire BCR) while sub-regional refers to the Ontario portion of the BCR only (i.e., Ontario BCR data were used).
[6] Only the landbird group distinguishes stewardship species from other priority species (see Panjabi et al. 2005).

Table 14 continued

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Sub-regional Concern[5]	Regional/Sub-regional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
Canada Goose (Southern James Bay)	Agricultural fields; cropland	Migrant (no BCR 13-ON population objective)				Y		Y	
Canada Goose (Eastern Temperate-breeding population)	Agricultural fields; cropland; short graminoid crops, managed landscapes, parks, lawns, golf courses	Decrease				Y			
Common Nighthawk	Graminoid crops; agricultural fields, pastures	Recovery objective[7]	Y	Y	Y	Y		Y	
Eastern Kingbird	Pastures, old fields, hedgerows, orchards	Increase				Y			
Eastern Meadowlark	Pastures, hayfields, old fields and meadows	Recovery objective	Y		Y	Y			
Grasshopper Sparrow	Short graminoid crops; rough or improved pastures	Increase	Y			Y		Y	Y
Green-winged Teal	Agricultural fields; cropland	Maintain current				Y			
Henslow's Sparrow	Regenerating old fields, lightly used pastures, hay fields, wet meadows	Recovery objective	Y	Y	Y	Y		Y	
Killdeer	Short graminoid crops; heavily grazed fields, cultivated fields, airports, golf courses	Increase				Y		Y	
Loggerhead Shrike (*migrans*)	Heavily grazed pastures with scattered low trees and shrubs	Recovery objective	Y	Y	Y	Y		Y	
Mallard	Agricultural fields; cropland	Increase				Y		Y	
Northern Bobwhite	Old fields, pastures, hayfields with nearby woody cover	Recovery objective[7]	Y	Y	Y	Y		Y	
Northern Harrier	Large meadows, pastures and hayfields	Maintain current				Y			
Northern Rough-winged Swallow	Graminoid crops; agricultural fields (foraging)	Increase				Y			
Purple Martin	Graminoid crops; agricultural fields (foraging)	Increase				Y			
Sandhill Crane	Harvested fields with waste grain (foraging)	Assess/Maintain				Y			

[7] Species listed on Schedule 1 of SARA and/or SARO, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, the interim population objectives for these species in BCR 13 ON are: Common Nighthawk: Increase; Northern Bobwhite: Maintain current; Short-eared Owl: Assess/Maintain.

Table 14 continued

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Sub-regional Concern[5]	Regional/Sub-regional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
Savannah Sparrow	Lightly grazed pastures, grassy meadows, cultivated fields	Increase				Y			
Short-eared Owl	Agricultural lands (large open areas; > 100 ha); grain fields, stubble, hay and low perennial crops	Recovery Objective[7]	Y	Y	Y	Y		Y	
Tundra Swan	Agricultural fields (corn, soybean, grain; foraging)	Maintain current				Y			
Upland Sandpiper	Hayfields, pastures, hawthorn meadows	Increase				Y			
Vesper Sparrow	Short graminoid crops; dry short grass fields; heavily grazed pastures interspersed with shrubs and small trees	Increase				Y			

Prior to the arrival of European settlers, cultivation by First Nations along with beaver or floodplain meadows, and scattered prairie, savannah and alvar landscapes provided the region's only open terrestrial habitats. Between the 1700s and 1900s, the clearing of land for conversion to agriculture was widespread and nearly complete (Ontario Partners In Flight 2008). By some estimates, nearly 90% of the landscape was converted to agricultural production, with forest cover estimated at only 10.6% in 1920 (Larson et al. 1999). These profound changes in habitat availability resulted in correspondingly profound changes in the avifauna of the region, with grassland birds adapting to these managed habitats and increasing in abundance and distribution. Recent decades have seen further changes, with marginal agricultural lands being abandoned and reverting to shrubland or forest (threat sub-category 7.3; Table 15; Fig. 19), and agricultural activity in the remaining productive lands being intensified and shifting from uses such as pasture and hay to row crops (sub-category 2.1). These threats are believed to be major factors contributing to recent decreases in many grassland bird populations.

Among the priority species occurring in this habitat type are a number of aerial insectivores, which are species of high conservation concern owing to pronounced recent declines in abundance (North American Bird Conservation Initiative 2012). Insectivorous birds in agricultural areas can encounter harmful levels of pesticides (e.g., Mora et al. 2006), and this exposure is recognized as a very high overall magnitude threat (sub-category 9.3) to these and other priority species in cultivated and managed habitats. For example, there has been growing concern as to potential biological impacts of neonicotinoid insecticides, a new class of insecticide that was first used in Canada in the 1990s. Recent studies have indicated that

neonicotinoid pesticides, which are the most widely used insecticide in the world, are highly toxic to birds and aquatic systems (Mineau and Palmer 2013). They have been implicated in the decline of honeybee colonies and other insect pollinators in Europe and North America and to global wildlife declines (Mason et al. 2013). There is growing evidence that these insecticides could be impacting bird populations directly due to toxicity and also indirectly as a result of the overall reduction in insect biomass (Mineau and Palmer 2013). A range of recommended actions are presented in Table 15, including the need to assess whether population declines of aerial insectivores can be linked to the use of pesticides and for changes to the regulation of agricultural pesticides in Canada to reduce bird mortality and sub-lethal effects.

In addition to pesticides, the loss of nesting habitat due to the replacement of older-style wooden farm structures (sub-category 2.3) by modern buildings that lack easy access to suitable nesting sites has been cited as a principal reason for recent Barn Swallow declines in North America (COSEWIC 2011) and may also be contributing to Barn Owl declines in southern Ontario (Ontario Barn Owl Recovery Team 2010).

Aerial insectivores use the habitat primarily for foraging, but other priority landbirds nest in the vegetation of managed grasslands and croplands, including the Bobolink and Eastern Meadowlark. These species, both listed provincially as Threatened, breed in hayfields and have suffered as a result of the succession of marginal farmland to shrub and forest habitats (sub-category 7.3), as well as a trend towards more intensive agriculture on remaining lands (sub-category 2.1). Agricultural practices such as mowing of hay during the breeding season may inadvertently kill and disturb nesting adults and young birds and destroy eggs and nests (sub-category 6.3). Cutting hay often coincides with the time that young birds are in the nest and are not able to fly. In addition, the quality of nesting habitat has likely declined over time due to the availability of earlier maturing seed mixtures and shorter cropping cycles. A variety of changes in land management and the implementation of BMPs could benefit this and other priority species (Table 15).

In southern Ontario, the number of farms and farmers has declined with growing efficiency and specialization, while the non-farming rural population has grown significantly (sub-category 1.1). According to Statistics Canada, Ontario has over half (52%) of the nation's Class I agricultural land and by 1996 had lost over 18% of the province's Class I land to urban encroachment and non-agricultural interests (Statistics Canada 2001). While land-use planning has been used to restrict activities in order to conserve forests and wetlands, it has not traditionally been used to conserve agricultural grasslands. Developing and supporting policies, programs and land-use planning to protect or encourage agricultural land use in near-urban areas (e.g., the provincial *Greenbelt Act*, 2005), developing and implementing grassland conservation incentive programs, creating or restoring grassland habitat patches in existing and potential grassland landscapes and at a site level, managing agricultural grasslands to include a mosaic of management prescriptions, including both recently disturbed (i.e., burned, grazed, mowed) and undisturbed (retained woody vegetation) are some of the recommended approaches to mitigate threats related to habitat loss (Table 15).

Several waterfowl species use cultivated or managed habitats for breeding or foraging during migration, including the Green-winged Teal and the two priority populations of Canada Goose. The Southern James Bay population of the Canada Goose migrates through this BCR, stopping briefly in agricultural fields to forage before continuing on to their wintering grounds. The Eastern Temperate-breeding population of the Canada Goose, unlike most populations of geese that nest in arctic or sub-arctic areas, nests in temperate climates associated with more southerly latitudes. Temperate-breeding Canada Geese have benefited greatly from adapting to the human-modified landscape present today, primarily because there is an abundance of food in the form of agricultural crops and manicured lawns (residential lawns, parks, golf courses, etc.). Since the early 1970s, the population in southern Ontario has increased from about 2,000 breeding pairs to an average of about 80,000 by 2005 (Environment Canada, in prep.). They use food and other resources present in urban and agricultural landscapes for nesting, raising young, molting, feeding and resting. This has led to increasing conflict between geese and people (e.g., depredation and damage to agricultural crops), especially in BCR 13 ON. Given the very high abundance of this species in southern Ontario, it is a species of management interest with respect to preventing and reducing human-goose conflicts (see Management of Nuisance Species in Table 15).

Other species using cultivated and managed grasslands include breeding or migrant shorebirds such as the Upland Sandpiper or American Golden-Plover, waterfowl such as the American Black Duck and Blue-winged Teal, and waterbirds including the Sandhill Crane. Due to the wide diversity of species using this habitat type, no one management prescription can eliminate all threats and benefit all species. For example, birds of prey benefit from shorter grass and the presence of woody vegetation for perching and hunting, while nesting waterfowl require dense vegetative cover ideally situated adjacent to wetlands. Also, row crops that have low breeding bird value have high post-harvest stopover value for some foraging waterfowl and shorebirds.

Accordingly, the recommended conservation actions for priority species in cultivated and managed areas include management at a large spatial scale to ensure a suitable mosaic and supply of habitats, especially given the ephemeral nature of open habitats in BCR 13 ON. Areas of intensive row-crop agriculture are almost universally less valuable as habitat for priority species, and these intensive activities also expose birds to a variety of threats including pesticides, destruction of nests or disturbance of breeding birds (Fig. 19, Table 15). The recommended conservation actions focus on promotion of less intensive agriculture, adoption of BMPs such as delayed haying and Integrated Pest Management, and other activities that allow priority birds to coexist with agriculture.

Maintaining an adequate supply of grassland habitat over the entire BCR is required to maintain grassland bird populations at present or historic levels. Within the agricultural landscape, maintaining an overall supply of managed grassland rather than specific place-based sites better reflects the ephemeral nature of this habitat and will accommodate practices such as crop rotation. However, this must be balanced with the need to protect and restore native grasslands such as prairies and savannahs. Such native grasslands are not only habitat for birds but required and essential habitat for many non-bird species. Moreover, native grasslands are

an imperilled habitat in themselves, with only 3% of their historic coverage remaining. A possible overall approach is to maintain managed grassland across the BCR and also to focus on restoring and creating native grassland habitat in areas with existing or potential grassland landscapes. In these existing and potential grassland areas, lower intensity managed habitat could be located in a complementary fashion adjacent to more permanent native or naturalized patches. This provides complementary patches, creates a permeable open landscape that allows birds to move between grassland patches, and helps create a diverse and dynamic mosaic of native and managed grasslands that allows for redundancy and resilience and a stable supply of habitat.

Research and monitoring objectives (sub-category 12.1) were also identified that focus on gathering ecological and demographic information for specific priority species in the region. For example, migrating shorebirds in southern Ontario tend to be widely dispersed and seem adept at finding and using a variety of agricultural habitats. There is a need to more clearly identify the use and significance of these and other habitat types across the BCR in order to determine appropriate conservation actions (e.g., broad-based or site-specific) for these species.

The full list of threats to and information needs (sub-category 12.1) for priority species in cultivated and managed habitats of BCR 13 ON as well as the conservation objectives and recommended actions are presented in Table 15. Note that although mortality from collisions with vehicles (sub-category 4.1 Roads and railroads) is a high overall magnitude threat to priority species in this habitat, it is not examined in Table 15, given that the effects of this threat are widespread. It is instead addressed in the Widespread Issues section of this strategy.

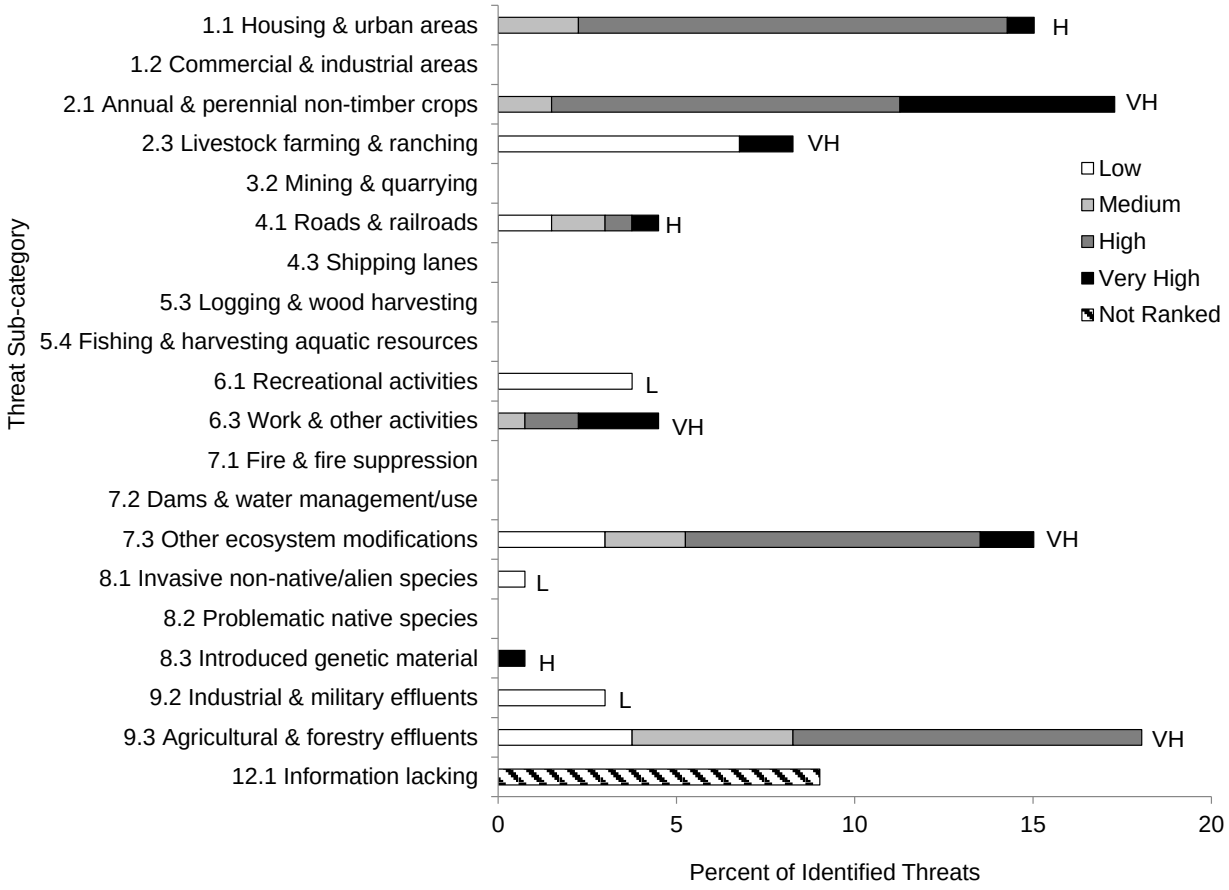

Figure 19. Percent of identified threats to priority species in cultivated and managed habitats in each threat sub-category.

Each bar represents the percent of the total number of threats identified in each threat sub-category in cultivated and managed habitats (for example, if 100 threats were identified in total for all priority species in cultivated and managed habitats, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). Threat sub-category 12.1 Information lacking was not ranked. The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category. The overall magnitude of the threat in cultivated and managed habitats is shown at the end of each bar (also presented in Table 5). Only threats with a magnitude of medium or higher are typically assigned habitat-specific conservation objectives.

Table 15. Threats addressed, conservation objectives, recommended actions, and list of priority species affected in cultivated and managed areas in BCR 13 ON.

Note: Issues such as collisions with vehicles and climate change are not addressed in this table; instead they are addressed in the Widespread Issues section.

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
1.1 Housing & urban areas	Loss of managed grassland habitats due to development	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat	Conserve and restore the quality, quantity and diversity of managed grassland habitats across the BCR	1.2 Resource and habitat protection	Develop and support policies, programs and land-use planning that protects or encourages agricultural land-use in near-urban areas (e.g., the provincial *Greenbelt Act*, 2005).	American Kestrel, Bank Swallow, Blue-winged Teal, Eastern Kingbird, Grasshopper Sparrow, Green-winged Teal, Northern Bobwhite,[2] Northern Harrier, Northern Rough-winged Swallow, Purple Martin, Savannah Sparrow, Short-eared Owl,[2] Upland Sandpiper, Vesper Sparrow
				2.3 Habitat and natural process restoration	Create and/or restore small and large grassland habitat (e.g., meadow, pasture) patches in existing and potential grassland landscapes, with an average grassland patch area of greater than or equal to 50 hectares and at least one 100-hectare patch (Environment Canada, 2013a).	
				6.4 Conservation payments	Develop and/or implement incentive programs geared to conserving grasslands for priority species.	
		3.4. Implement recovery plans for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Barn Owl, Barn Swallow, Bobolink, Eastern Meadowlark, Henslow's Sparrow, Loggerhead Shrike (migrans), Northern Bobwhite, Short-eared Owl

[1] While many priority species may benefit from proposed conservation actions, priority species not mentioned in this table are absent because 1) identified threats in this habitat are of low magnitude, or 2) they are migrants with no threats identified in this habitat.

[2] Species listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, interim conservation objectives and recommended actions are presented here.

Table 15 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
2.1 Annual & perennial non-timber crops	Loss of managed grassland habitats due to intensification (e.g.. removal of hedgerows, monocultures, conversion of pasture to row crops, wetland	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat	Conserve and restore the quality, quantity and diversity of managed grassland habitats across the BCR	1.2 Resource and habitat protection	Develop and support policies, programs and land-use planning that protects or encourages agricultural land-use in near-urban areas (e.g., the provincial *Greenbelt Act*, 2005).	American Kestrel, Bank Swallow, Blue-winged Teal, Buff-breasted Sandpiper, Common Nighthawk,[2] Eastern Kingbird, Grasshopper Sparrow, Green-winged Teal, Killdeer, Northern Bobwhite,[2] Northern Harrier,
				2.3 Habitat and natural process restoration	Create and/or restore small and large grassland habitat patches in existing and potential grassland landscapes, with average grassland patch area of greater than or equal to 50 hectares and at least one 100-hectare patch (Environment Canada 2013a).	

Table 15 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
	drainage)			2.1 Site/area management	At local levels, grassland sites should be managed to include a mosaic of management prescriptions, including both recently disturbed (i.e., burned, grazed, mowed) and undisturbed (retained woody vegetation) to benefit a variety of species. Some grassland habitat should be located adjacent to hedgerows, riparian and wetland habitats for species that require different habitat types in close proximity (Environment Canada 2013a). Retain large cavity trees and mature trees in open grassland/agricultural settings for nesting cavities and hunting perches. Install nest boxes in areas of suitable habitat where natural cavities are lacking. Grassland habitat patches should be clustered or aggregated, and any intervening land cover should be open or semi-open in order to be permeable to species movement (Environment Canada 2013a).	Northern Rough-winged Swallow, Purple Martin, Savannah Sparrow, Short-eared Owl,[2] Upland Sandpiper, Vesper Sparrow
				6.4 Conservation payments	Develop and/or implement incentive programs geared to conserving grasslands for priority species (e.g., Habitat Stewardship Program for Species at Risk; Species at Risk Farm Incentive Program).	

Table 15 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
		3.4. Implement recovery plans for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Barn Owl, Barn Swallow, Bobolink, Common Nighthawk, Eastern Meadowlark, Henslow's Sparrow, Loggerhead Shrike (migrans), Northern Bobwhite, Short-eared Owl
2.3 Livestock farming & ranching	Reduction in the availability of artificial nesting sites	3.4. Implement recovery plans for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Barn Owl, Barn Swallow
6.3 Work & other activities	Reduced or no productivity if disturbed during the nesting season.	4.2 Reduce disturbance from industrial or work activity	Reduce or eliminate human disturbance from work or other activities	2.1 Site/area management	Grassland habitat patches should be clustered or aggregated and any intervening land cover should be open or semi-open in order to be permeable to species movement (Environment Canada 2013a).	Short-eared Owl[2]
				4.3 Awareness and communications	Promote bird-friendly grassland management practices to farmers and land managers (see Solymar 2005; McGauley 2004). Raise awareness about the impact of human disturbance on priority bird species.	
				5.3 Private sector standards and codes	Develop and/or implement BMPs for agricultural grasslands such as delayed haying as appropriate for the protection of priority grassland birds (e.g., *Birds on the Farm: A Stewardship Guide*, McGauley 2004).	
		3.4. Implement recovery plans	Meet the legal requirements for	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Barn Owl, Barn Swallow, Bobolink,

Table 15 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
		for species at risk	federal/provincial Species at Risk legislation			Eastern Meadowlark, Henslow's Sparrow, Short-eared Owl
7.3 Other ecosystem modifications	Lack of grazing or active management results in natural succession of idle or abandoned agricultural land	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain or restore the quality, quantity and diversity of managed grassland habitats across the BCR	2.1 Site/area management	At local levels, grassland sites should be managed to include a mosaic of management prescriptions, including both recently disturbed (i.e., burned, grazed, mowed) and undisturbed (retained woody vegetation) to benefit a variety of priority species (Vickery et al. 2000). Some grassland habitat should be located adjacent to hedgerows, riparian and wetland habitats for species that require different habitat types in close proximity (Environment Canada 2013a).	American Kestrel, Bank Swallow, Blue-winged Teal, Common Nighthawk,[2] Grasshopper Sparrow, Green-winged Teal, Northern Bobwhite,[2] Northern Harrier, Short-eared Owl,[2] Upland Sandpiper, Vesper Sparrow
				4.3 Awareness and communications	Educate landowners on the importance of grassland habitats and the need for active management (mowing, controlled burns) to maintain ecological integrity (see *A Stewardship Guide to Grasslands in Southern Ontario: An introduction for Farmers and Rural Landowners*, Solymar 2005).	
				5.3 Private sector standards and codes	Develop and implement a suite of regionally appropriate BMPs (e.g., guidelines for the amount, type, size and configuration, distribution and management of grassland habitats) to benefit priority species in this BCR.	
				8.1 Research	Evaluate the effect of various land management practices on the abundance, distribution and demographics of priority grassland birds.	

Table 15 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
		3.4. Implement recovery plans for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Barn Owl, Barn Swallow, Bobolink, Common Nighthawk, Eastern Meadowlark, Henslow's Sparrow, Northern Bobwhite, Short-eared Owl
8.3 Introduced genetic material	Dilution of the native gene pool due to interbreeding with non-native captive-reared birds	7.4. Improve understanding of causes of population declines	Develop an understanding of reasons for population decline	8.1 Research	Determine whether interbreeding with non-native, pen-reared birds has population-level effects.	Northern Bobwhite[2]
		3.4. Implement recovery plans for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	
9.3 Agricultural & forestry effluents	Mortality, sub-lethal effects, reductions in prey populations, and habitat alteration caused by	2.1. Reduce mortality and/or sub-lethal effects from pesticide use	Reduce use/impact of pesticides	4.3 Awareness and communications	Undertake education and awareness activities regarding the impact of environmental contaminants on birds and their habitats.	American Kestrel, Bank Swallow, Buff-breasted Sandpiper, Common Nighthawk,[2] Eastern Kingbird, Grasshopper Sparrow, Killdeer, Northern
				5.2 Policies and regulations	Make changes to the regulation of agricultural pesticides in Canada to reduce bird mortality and sub-lethal effects.	
				5.3 Private sector standards and codes	Promote the use of IPM programs to reduce pesticide use.	

Table 15 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
	exposure to or use of pesticides			5.4 Compliance and enforcement	Continue to monitor and enforce compliance with laws, policies and regulations at all levels.	Bobwhite,[2] Northern Harrier, Northern Rough-winged Swallow, Purple Martin, Savannah Sparrow, Short-eared Owl,[2] Upland Sandpiper, Vesper Sparrow
		3.4. Implement recovery plans for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Barn Swallow, Bobolink, Common Nighthawk, Eastern Meadowlark, Loggerhead Shrike (*migrans*), Northern Bobwhite, Short-eared Owl
12.1 Information Lacking	Lack of knowledge of the importance of various habitat types used by migrating shorebirds in southern Ontario	7.1 Improve population/ demographic monitoring	Improve understanding of habitat use and/or impacts of changes to habitats to guide conservation and management	8.1 Research	Assess importance of BCR 13 ON to migrating shorebirds by determining shorebird use of appropriate habitats throughout the area during peak migration, and applying these usage levels to estimates of the total amounts of the various habitat types. Determine the degree of repeat use by shorebirds of particular areas in southern Ontario to establish whether they are traditional stop-over sites used by specific individuals, or are used on a more random and opportunistic basis by migrants.	American Golden-Plover, Black-bellied Plover, Buff-breasted Sandpiper

Table 15 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
	Lack of information on factors causing population declines	7.4 Improve understanding of causes of population declines	Determine cause(s) of population decline	8.1 Research	Identify factors causing population decline and/or limiting population growth of aerial-foraging insectivores. Assess whether population declines of aerial insectivores is linked to the use of pesticides (e.g., neonicotinoids).	Bank Swallow, Common Nighthawk,[2] Eastern Kingbird, Northern Rough-winged Swallow, Purple Martin
		7.1 Improve population/ demographic monitoring	Improve population/ demographic monitoring of aerial insectivores	8.2 Monitoring	Encourage submissions of current and historic nest record data to the Ontario Nest Records Scheme/Project NestWatch to improve understanding of changes in productivity.	
		3.4. Implement recovery plans for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Barn Swallow, Common Nighthawk
	Lack of knowledge (trend, population size, and/or distribution range)	7.1 Improve population/ demographic monitoring	Improve monitoring efforts to increase reliability of population status/trend	8.2 Monitoring	Improve monitoring efforts to increase reliability of population status/trend for species not well sampled by the Breeding Bird Survey.	Bank Swallow, Common Nighthawk[2]
			Expand monitoring effort to inform population management		Assess population status and distribution to inform population management.	Sandhill Crane
		3.4. Implement recovery plans for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Common Nighthawk
Management of Nuisance Species						

Table 15 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
Conservation Issue: Increasing conflicts between geese and human activities (e.g., agriculture) due to very abundant Eastern temperate-breeding Canada Geese		3.6 Manage nuisance species	Reduce Human-Goose Conflicts	3.1 Species management	Implement strategies within *Handbook – Canada and Cackling Geese: management and population control in southern Canada* (Environment Canada 2010).	Canada Goose (Temperate-breeding in Eastern Canada)
				5.4 Compliance and enforcement	Undertake compliance promotion of federal *Migratory Birds Regulations* and provide advice for stakeholders and the public.	

Bare Areas

In BCR 13 ON, habitats classified as bare include open shorelines such as beaches, mudflats, exposed earthen banks; sand and gravel pits; exposed aggregate from current or past extraction operations, cliffs, talus and bare rock (e.g., unvegetated islands). For several species using this habitat type, preferred habitat is concentrated along the shorelines of the Great Lakes. The region includes more than 8,400 km of this shoreline, along with innumerable bare areas along the shorelines of smaller lakes and rivers. However, because these habitats are typically restricted in area, they account for <1% of the land cover/ land use[9] (Table 1; Fig. 20).

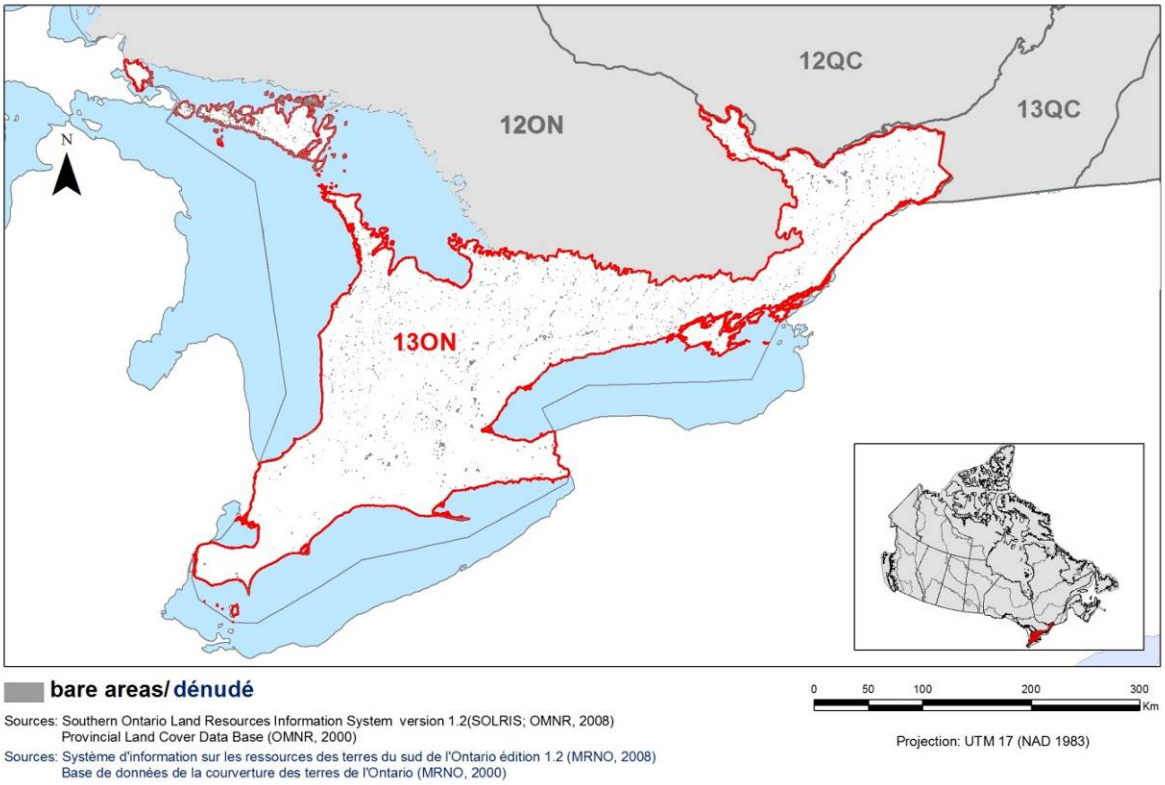

Figure 20. Map of bare areas in BCR 13 ON.

The 17 priority species using these habitats (Table 16) can be divided into several groups, and each faces a suite of unique threats which are described below. Among these, 4 are species at risk: Common Nighthawk, Peregrine Falcon (*anatum/tundrius*), Piping Plover (*circumcinctus*) and Red Knot (*rufa*).

[9] Less than 1% bare areas does not include the area of bare islands in the Great Lakes, which is captured within the *Undifferentiated* category of SOLRIS)

Table 16. Priority species associated with bare areas in BCR 13 ON, habitat descriptions, population objectives and reasons for priority status.

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Sub-regional Concern[5]	Regional/Sub-regional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
American Golden-Plover	Beaches, mudflats	Migrant (no BCR 13-ON population objective)				Y		Y	
Bank Swallow	Exposed earthen banks, sand and gravel pits	Increase	Y				Y		
Belted Kingfisher	Earthen banks near water, coastal bare areas	Increase				Y			
Black-bellied Plover	Beaches, mudflats	Migrant (no BCR 13-ON population objective)				Y		Y	
Buff-breasted Sandpiper	Beaches, mudflats	Migrant (no BCR 13-ON population objective)				Y		Y	
Caspian Tern	Coastal bare areas; islands	Maintain current				Y			
Common Nighthawk	Alvars; rock outcrops, sand barrens	Recovery objective[7]	Y	Y	Y	Y		Y	
Common Tern	Coastal bare areas; islands	Increase				Y		Y	
Great Black-backed Gull	Beaches; islands; offshore rocks	Maintain current				Y			
Killdeer	Open shorelines, beaches, mudflats	Increase				Y		Y	
Northern Rough-winged Swallow	Exposed earthen banks, sand and gravel pits, open shorelines	Increase				Y			

[1] Habitat descriptions, in most cases, follow definitions under the Land Cover Classification System (LCCS; see Kennedy et al. 2012).
[2] Assessed by COSEWIC as E, Endangered; T, Threatened; SC, Special Concern.
[3] Species listed on Schedule 1 of SARA as E, Endangered; T, Threatened; SC, Special Concern.
[4] Species listed as Endangered, Threatened or Special Concern on the SARO List.
[5] Regional refers to BCR-wide (i.e., all jurisdictional data were used for the entire BCR) while sub-regional refers to the Ontario portion of the BCR only (i.e., Ontario BCR data were used).
[6] Only the landbird group distinguishes stewardship species from other priority species (see Panjabi et al. 2005).
[7] Species listed on Schedule 1 of SARA and/or SARO, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, the interim population objectives for these species in BCR 13 ON are: Common Nighthawk: Increase.

Table 16 continued

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Sub-regional Concern[5]	Regional/Sub-regional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
Peregrine Falcon *(anatum/tundrius)*	Beaches; open shoreline; cliff ledges or crevices	Recovery objective	Y	Y	Y	Y			Y
Piping Plover (*circumcinctus*)	Gravelly beaches	Recovery objective	Y	Y	Y	Y		Y	
Purple Martin	Open shorelines for foraging	Increase				Y			
Red Knot (*rufa*)	Beaches; mudflats	Migrant (no BCR 13-ON population objective)	Y		Y	Y		Y	
Semipalmated Sandpiper	Beaches; mudflats	Migrant (no BCR 13-ON population objective)				Y		Y	
Spotted Sandpiper	River banks; open shoreline; islands; sand and gravel pits	Increase				Y		Y	

The Spotted Sandpiper, Piping Plover (*circumcinctus*), Common and Caspian Terns, Peregrine Falcon (*anatum/tundrius*), and Great Black-backed Gull are all priority species that nest along open shorelines (coastal bare areas) and/or on cliffs and bare islands. The loss and degradation of shoreline habitats owing to urban development (threat sub-category 1.1) was assessed as a very high-magnitude threat in part due to the number of species at risk using these habitats (Fig. 21). Piping Plovers are endangered provincially and federally and are extremely rare and localised breeders in Ontario. Recent known breeding locations in BCR 13 ON include one site on Manitoulin Island where a male and four fledglings were found in July 2009 (Environment Canada 2011b). Actions to conserve this species and the Peregrine Falcon *(anatum/tundrius)*, listed as Special Concern, appear in federal and provincial recovery documents. However, recommended actions that seek to protect important nesting and/or stopover habitats for priority species will also benefit species at risk (Table 17).

Bank Swallows, Belted Kingfishers and Northern Rough-winged Swallows nest in exposed earthen banks, and these species are susceptible to loss of these habitats to development and sand and gravel extraction (sub-categories 1.1 and 3.2, very high and high overall magnitude threats, respectively). Recommended actions to mitigate these threats focus primarily on the implementation of BMP guidelines for the protection of bank-nesting species by municipalities and the private sector (Table 17).

Caspian and Common Terns nest colonially on islands. Competition for nesting sites with more numerous waterbirds, such as Ring-billed Gulls or Double-crested Cormorants, were considered

to be threats of high overall magnitude to these terns (sub-category 8.2). Threats associated with disturbance from recreational activities (sub-category 6.1) were also determined to be of high overall magnitude to several colonial species due to the potential for abandonment of nests or tern colonies and, as a result, lower nesting success. Management of abundant species such as cormorants for the benefit of less abundant waterbirds is recommended, as is increasing the awareness of the effects of human activities on priority species.

Migrant shorebirds such as the *rufa* subspecies of the Red Knot or the Black-bellied Plover use primarily beach and mudflat habitats, especially along the shoreline of the Great Lakes. These long-distance migrants, many of which breed in the Arctic and winter in Central and South America, use shoreline habitats to forage and gain mass prior to continuing on their migrations (Ross et al. 2003). Recent analyses suggest that counts of shorebirds migrating through Ontario may have declined by more than 75% (Ross et al. 2012), making these species the subject of significant conservation concern in the region. The loss of shoreline habitat is particularly severe on the Great Lakes, where encroaching development (sub-category 1.1) and shoreline stabilization activities continue (Ross et al. 2003). Water-level regulation practices (sub-category 7.2; high overall magnitude), for example in Lake Ontario and the Upper St. Lawrence River, can dampen yearly water cycles, effectively reducing periodic shoreline exposure and the availability of invertebrate prey for some priority species (e.g., Killdeer; Bain et al. 2008). Also, because coastal beaches are often heavily used for recreation, human disturbance (sub-category 6.1) was identified as a threat of high overall magnitude. Studies at other coastal sites have demonstrated that human disturbance can reduce shorebirds' use of staging sites by up to 50% (e.g., Pfister et al. 1992). Recommended actions to mitigate these threats are presented in Table 17.

The full extent to which the Red Knot and other migrant shorebirds use bare areas in BCR 13 ON, however, is unknown, as are the severity of threats they might face. To address this and other information gaps (sub-category 12.1), research and monitoring objectives were identified that focus on gathering ecological and demographic information for specific priority species or groups of species in the region (Table 17).

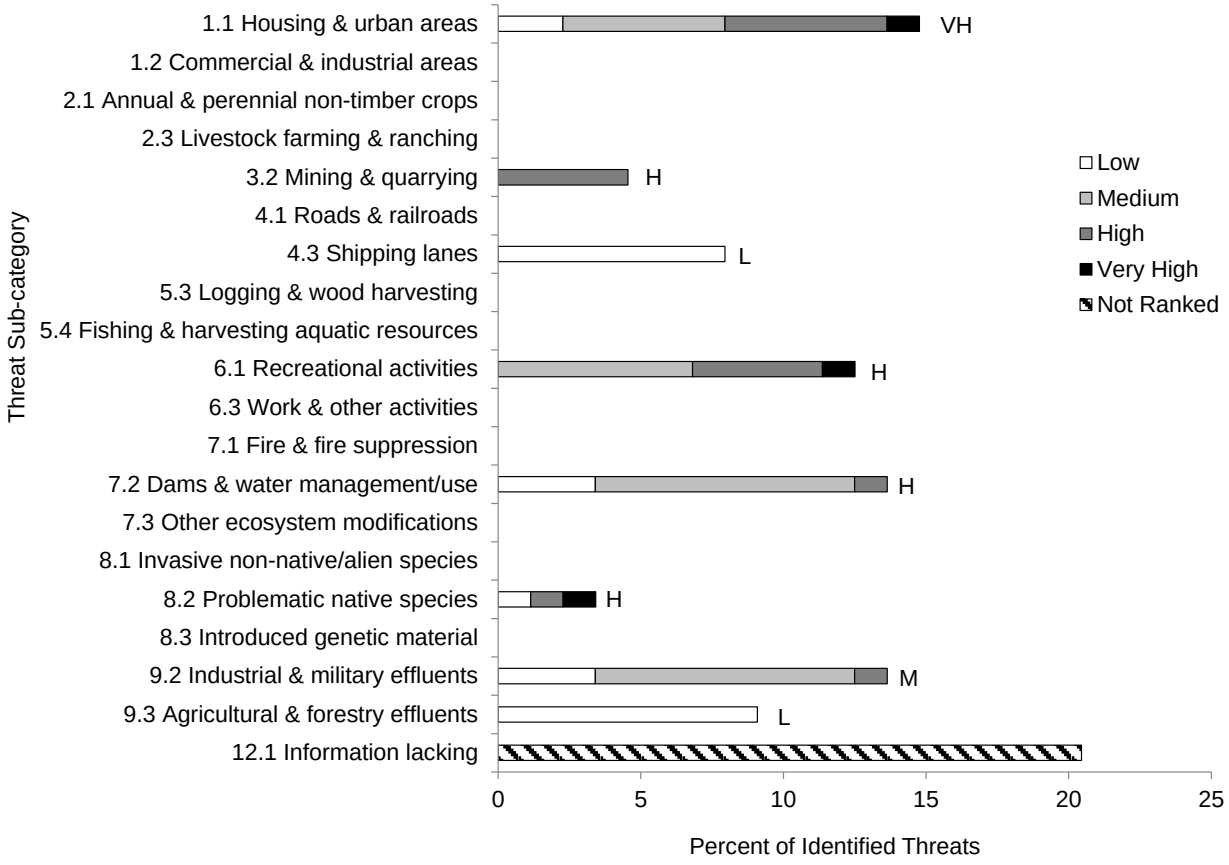

Figure 21. Percent of identified threats to priority species in bare areas in each threat sub-category. Each bar represents the percent of the total number of threats identified in each threat sub-category in bare areas (for example, if 100 threats were identified in total for all priority species in bare areas, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). Threat sub-category 12.1 Information lacking was not ranked. The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category. The overall magnitude of the threat in bare areas is shown at the end of each bar (also presented in Table 5). Only threats with a magnitude of medium or higher are typically assigned habitat-specific conservation objectives.

Table 17. Threats addressed, conservation objectives, recommended actions and list of priority species affected in bare areas in BCR 13 ON.
Note: Issues such as climate change are not addressed in this table; instead, they are addressed in the Widespread Issues section.

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
1.1 Housing & urban areas	Loss and/or degradation of bare areas due to development	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat	Identify, protect and maintain important nesting and/or foraging sites and important migration stopover areas	1.1 Site/area protection	Protect important nesting/stopover habitats for priority birds.	American Golden-Plover, Bank Swallow, Belted Kingfisher, Buff-breasted Sandpiper, Common Tern, Killdeer, Northern Rough-winged Swallow, Red Knot (*rufa*), Semipalmated Sandpiper, Spotted Sandpiper
				5.2 Policies and regulations	Include BMP guidelines for the protection of coastal bare areas for breeding and migrating birds in municipal planning; establish guidelines/rules for visitors to protected areas.	
				8.1 Research	Assess importance of BCR 13 ON to migrating shorebirds by determining shorebird use of appropriate habitats throughout the area during peak migration, and applying these usage levels to estimates of the total amounts of the various habitat types (Ontario Shorebird Conservation Plan 2003). Determine the degree of	American Golden-Plover, Buff-breasted Sandpiper, Killdeer, Red Knot (*rufa*), Semipalmated Sandpiper

[1] While many priority species may benefit from proposed conservation actions, priority species not mentioned in this table are absent because 1) identified threats in this habitat are of low magnitude, or 2) they are migrants with no threats identified in this habitat.

Table 17 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
					repeat use by shorebirds of particular areas in southern Ontario to establish whether they are traditional stop-over sites used by specific individuals, or are used on a more random and opportunistic basis by migrants (Ross 2003; Ontario Shorebird Conservation Plan 2003).	
		3.4. Implement recovery plans for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Piping Plover (*circumcinctus*), Red Knot (*rufa*)
3.2 Mining & quarrying	Habitat loss and/or degradation from the extraction of sand and gravel	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat	Protect, manage and maintain important nesting sites.	5.2 Policies and regulations	Include habitat restoration for priority species into post-mining remediation or closure plans.	Bank Swallow, Belted Kingfisher, Northern Rough-winged Swallow
				5.3 Private sector standards and codes	Include guidelines for the protection and management of bank-nesting species such as Belted Kingfisher and Bank Swallow, in BMPs for municipalities and operators of sand and gravel pits (e.g., see *Ontario Stone, Sand and Gravel Association Bank Swallow Fact Sheet,* 2013*)*.	

Table 17 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
	Vulnerable to disturbance by active mines and quarries during the breeding season	3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Peregrine Falcon (*anatum/tundrius*)
6.1 Recreational activities	Decrease in habitat quality due to human activity and recreation	4.1. Reduce disturbance from human recreation	Minimize human disturbance of priority species in bare areas.	4.3 Awareness and communications	Develop education and outreach initiatives to increase public awareness (e.g., signage) of shorebirds and the potential influences of human activities on shorebirds and their habitats.	American Golden-Plover, Bank Swallow, Black-bellied Plover, Buff-breasted Sandpiper, Common Tern, Killdeer, Red Knot (*rufa*), Semipalmated Sandpiper, Spotted Sandpiper
				8.1 Research	Investigate the effects of recreational activities on breeding and staging birds.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for a federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Peregrine Falcon (*anatum/tundrius*), Piping Plover (*circumcintus*), Red Knot (*rufa*)
7.2 Dams & water management/ use	Habitat loss due to water level stabilization, dampening yearly water cycles and reducing periodic	1.3. Ensure the continuation of natural processes that maintain bird habitat	Maintain natural hydrologic cycles to ensure a variety of coastal bare areas	5.2 Policies and regulations	Develop recommendations for international water-level regulation criteria for Lake Ontario which include maintaining coastal habitat diversity and health.	American Golden-Plover, Belted Kingfisher, Black-bellied Plover, Buff-breasted Sandpiper, Killdeer,

Table 17 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
	shoreline exposure.			8.1 Research	Determine the impact of erosion and flood control on the availability of nest and/or foraging sites.	Red Knot (*rufa*), Semipalmated Sandpiper, Spotted Sandpiper
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Piping Plover (*circumcintus*), Red Knot (*rufa*)
8.2 Problematic native species	Competition with other colonial waterbirds for nesting habitat (such as large Ring-billed Gull and Cormorant colonies)	3.2. Reduce competition with problematic native species	Reduce competition with Ring-billed Gulls and Double-crested Cormorants	2.2 Invasive/ problematic species control	Implement population management procedures (e.g., egg-oiling, substrate modification) under approved permits as required (Quinn et al. 1996; Morris et al. 2011).	Caspian Tern, Common Tern
9.2 Industrial & military effluents	Mortality, sub-lethal effects and/or habitat degradation from heavy metals and other environmental contaminants	2.2 Reduce mortality and/or sub-lethal effects from exposure to contaminants	Reduce exposure to environmental contaminants	4.3 Awareness and communications	Undertake education and awareness activities regarding the impact of environmental contaminants on birds and their habitats.	American Golden-Plover, Black-bellied Plover, Buff-breasted Sandpiper, Common Tern, Great Black-backed Gull, Killdeer, Red Knot (*rufa*), Spotted Sandpiper
				5.2 Policies and regulations	Work with industry and policy makers to reduce the quantity of toxic chemicals released into the environment. Encourage the inclusion of effective protection and emergency response measures within environmental policies and	

Table 17 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
					regulations to prevent or mitigate oil spills, industry outfalls and other chemical spills.	
				5.4 Compliance and enforcement	Continue to monitor and enforce compliance with laws, policies and regulations at all levels.	
		7.1 Improve population/ demographic monitoring	Monitor and assess the effects of contaminants on birds	8.1 Research	Determine population-level effects of environmental contaminants and pesticides on the vital rates of priority species.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Piping Plover (*circumcinctus*), Red Knot (*rufa*)
12.1 Information Lacking	Lack of information on factors causing population declines	7.4 Improve understanding of causes of population declines	Determine sources of mortality or population decline(s)	8.1 Research	Implement research and monitoring priorities described within the *Ontario Shorebird Conservation Plan* (Ross et al. 2003).	American Golden-Plover, Black-bellied Plover, Buff-breasted Plover, Killdeer, Red Knot (*rufa*), Spotted Sandpiper
					Identify factors causing population decline and/or limiting population growth of aerial-foraging insectivores.	Bank Swallow, Northern Rough-winged Swallow, Purple Martin

Table 17 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
						Common Nighthawk[2]
		7.1 Improve population/ demographic monitoring	Improve population/ demographic monitoring of aerial insectivores	8.2 Monitoring	Encourage submissions of current and historic nest record data to the Ontario Nest Records Scheme/Project NestWatch to improve understanding of changes in productivity.	Bank Swallow, Common Nighthawk,[2] Northern Rough-winged Swallow, Purple Martin
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Common Nighthawk, Red Knot (*rufa*)
	Lack of knowledge of the importance of various habitat types used by migrating shorebirds in southern Ontario	7.1 Improve population/ demographic monitoring	Improve understanding of habitat use and/or impacts of changes to habitats to guide conservation and management	8.1 Research	Assess importance of BCR 13 ON to migrating shorebirds by determining shorebird use of appropriate habitats throughout the area during peak migration, and applying these usage levels to estimates of the total amounts of the various habitat types. Determine the degree of repeat use by shorebirds of particular areas in southern Ontario to establish whether they are traditional stop-over sites used by specific	American Golden-Plover, Black-bellied Plover, Buff-breasted Plover, Red Knot (*rufa*), Semipalmated Sandpiper

[2] Species listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, interim conservation objectives and recommended actions are presented here.

Table 17 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
					individuals, or are used on a more random and opportunistic basis by migrants.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Red Knot (*rufa*)
	Lack of knowledge (trend, population size, and/or distribution range)	7.1 Improve population/ demographic monitoring	Improve monitoring efforts to increase reliability of population status/trend	8.2 Monitoring	Improve monitoring efforts to increase reliability of population status/trend for colonial nesters (Bank Swallow) and crepuscular species (Common Nighthawk) not well sampled by the Breeding Bird Survey.	Bank Swallow, Common Nighthawk[2]
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Common Nighthawk

Urban

BCR 13 ON is the most heavily populated BCR in Canada. Urban areas are far more extensive here than in many other parts of the country, accounting for 8% of the land cover/land use, which is defined as "settlement, built-up areas and infrastructure" (Table 1; Fig. 22). Rooftops, roadsides, human-built structures (e.g., bridges) and other urban habitats are used by numerous species of birds to some extent, but relatively few priority species use these areas extensively or preferentially, especially during the breeding season (Table 18).

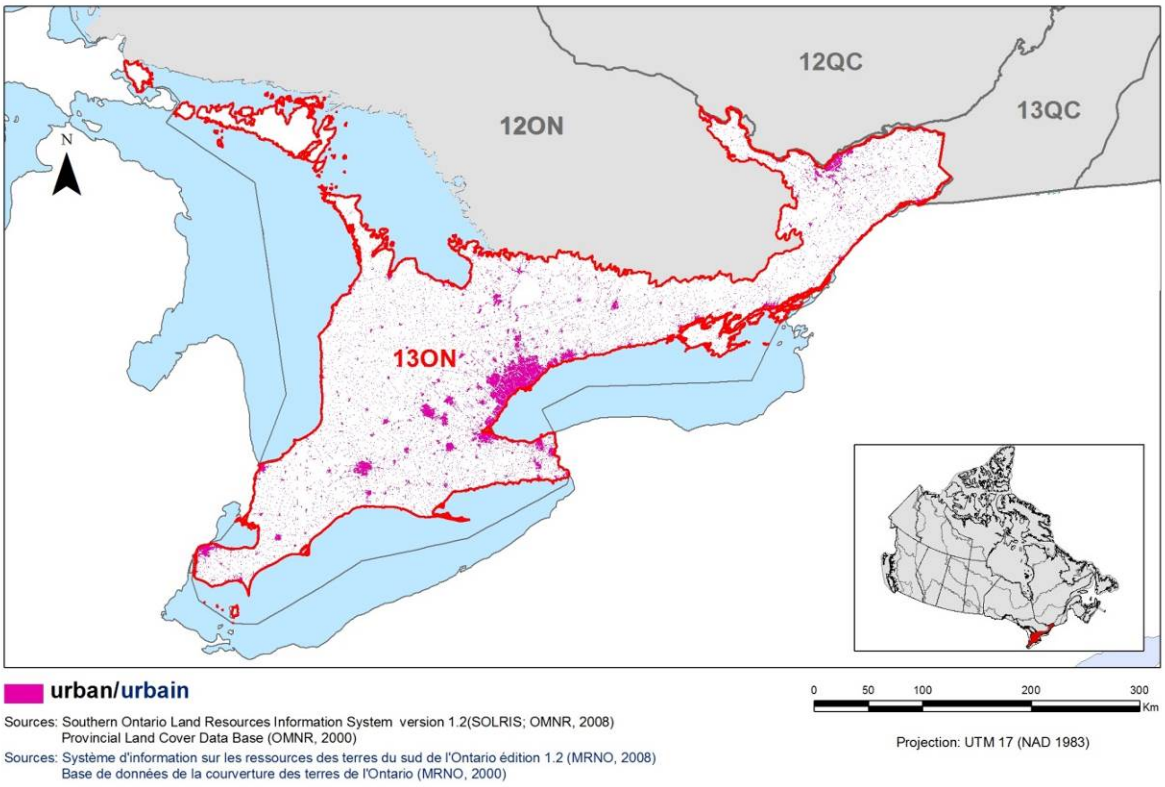

Figure 22. Map of urban areas in BCR 13 ON.

There are six priority species that use urban habitats in BCR 13 ON. Among these are five species that have adapted to nest on or in artificial structures: the Chimney Swift, the Common Nighthawk, the Barn Swallow, the Killdeer and the Peregrine Falcon (*anatum/tundrius*), which, except for the Killdeer, are species at risk.

Table 18. Priority species associated with urban habitats in BCR 13 ON, habitat descriptions, population objectives and reasons for priority status.

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Sub-regional Concern[5]	Regional/Sub-regional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
Barn Swallow	Rural and settled landscapes; barns, buildings and bridges	Recovery objective	Y		Y	Y			
Canada Goose (Eastern Temperate-breeding)	Managed green spaces; lawns, parks, golf courses, rooftops, industrial sites, adjacent to water	Decrease				Y			
Chimney Swift	Artificial surfaces (chimneys, walls, rafters, building gables)	Recovery objective[7]	Y	Y	Y	Y		Y	
Common Nighthawk	Artificial surfaces (gravel areas including rooftops, occasionally railways)	Recovery objective[7]	Y	Y	Y	Y		Y	
Killdeer	Artificial surfaces (gravel areas including rooftops, road edges)	Increase				Y		Y	
Peregrine Falcon (*anatum/tundrius*)	Bare areas; artificial surfaces (ledges of tall building or bridges)	Recovery objective	Y	Y	Y	Y			Y

For the Common Nighthawk, a species of Special Concern in Ontario and Threatened federally, a trend towards fewer gravelled roofs in urban settings has reduced the availability of suitable nesting habitat (threat sub-category 1.1; Fig. 23; Table 19; see also COSEWIC 2007a). Chimney Swifts (threatened provincially and assessed by COSEWIC as threatened nationally) once roosted and nested in large, hollow trees. The disappearance of these snags as land was cleared through the 19th and early 20th century coincided with the widespread appearance of brick chimneys. The species adapted to nest and roost in these and other human-built structures, but the disappearance of many brick chimneys and the capping off of others has reduced the availability of these structures to the species (sub-category 1.1; COSEWIC 2007b). Actions to address these threats include identifying and protecting key urban roosting and nesting sites (e.g., through conservation payments) and enhanced monitoring and research to better

[1] Habitat descriptions are based on information found in the Atlas of the Breeding Birds of Ontario, 2001–2005 and, in most cases, follow definitions under the Land Cover Classification System (LCCS; see Kennedy et al. 2012).
[2] Assessed by COSEWIC as E, Endangered; T, Threatened; SC, Special Concern.
[3] Species listed on Schedule 1 of SARA as E, Endangered; T, Threatened; SC, Special Concern.
[4] Species listed as Endangered, Threatened or Special Concern on the SARO List.
[5] Regional refers to BCR-wide (i.e., all jurisdictional data were used for the entire BCR) while sub-regional refers to the Ontario portion of the BCR only (i.e., Ontario BCR data were used).
[6] Only the landbird group distinguishes stewardship species from other priority species (see Panjabi et al. 2005).
[7] Species listed on Schedule 1 of SARA and/or SARO, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, the interim population objectives for these species in BCR 13 ON are: Chimney Swift: Increase; Common Nighthawk: Increase.

understand the reason(s) for population declines, as well as the distribution and trends of this and other priority aerial insectivore species (sub-category 12.1; Table 19).

Killdeer, one of the most common and familiar North American shorebirds, has declined in parts of the province (Cadman et al. 2007). This priority species has also adapted to breeding in anthropogenic habitats such as gravel rooftops, roadsides, parks, lawns and building sites. As a result of their close association with humans, Killdeer are particularly vulnerable to disturbance and the adverse impacts of human activities (medium-magnitude threat sub-categories 6.1 and 6.3; Fig. 23). Raising public awareness regarding the vulnerability of this species to human disturbance at nesting sites is among the recommended actions to mitigate these threats (Table 19).

The Canada Goose is also a familiar bird in urban settings, inhabiting parks and other urban green spaces near water. The Eastern Temperate-breeding population of the Canada Goose has been so successful at adapting to this environment that its population size now brings it into frequent conflict with humans. Management strategies to reduce these conflicts are being defined in a Management Plan for Temperate-breeding Canada Geese in Ontario (Environment Canada, in prep.), and implementing the recommendations of this plan was identified as a key management action for this species (Table 19).

The use of pesticides in urban landscapes such as parks, golf courses, sports fields and lawns (medium-magnitude threat sub-category 9.3) can pose a direct (e.g., poisoning) or indirect threat (e.g., reduction in prey availability) to some priority species such as Killdeer and Common Nighthawk. Conservation actions focus on increasing awareness of the responsible use of chemical pesticides as well as promoting IPM programs to reduce pesticide use, coupled with monitoring and enforcing compliance with laws, policies and regulations at all levels (Table 19).

The full list of threats to and information needs (sub-category 12.1) for priority species in urban habitats of BCR 13 ON as well as the conservation objectives and recommended actions are presented in Table 19. Note that although mortality from collisions with vehicles (sub-category 4.1 Roads and railroads) is a medium overall magnitude to priority species in this habitat, it is not examined in Table 19, given that the effects of this threat are widespread. It is instead addressed in the Widespread Issues section of this strategy.

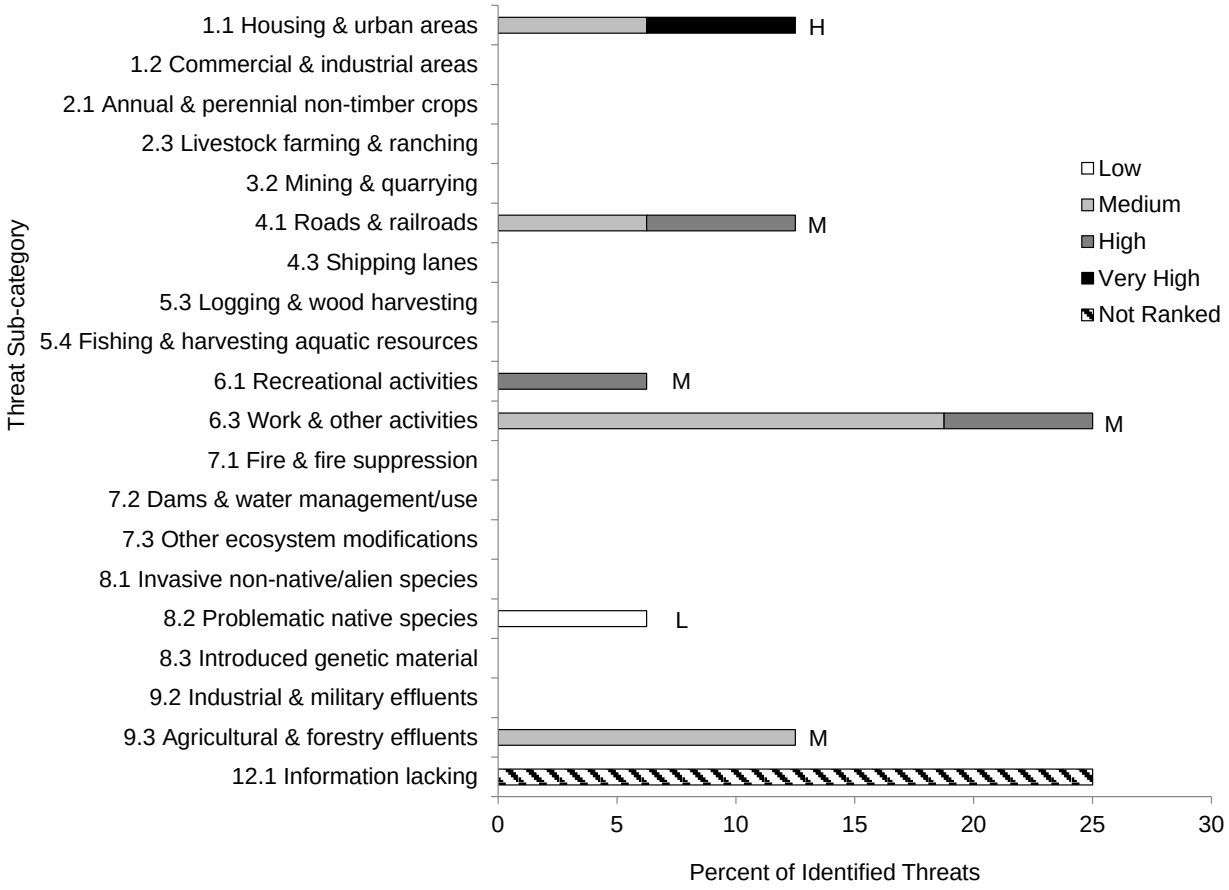

Figure 23. Percent of identified threats to priority species in urban habitats in each threat sub-category.

Each bar represents the percent of the total number of threats identified in each threat sub-category in urban habitat (for example, if 100 threats were identified in total for all priority species in urban habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). Threat sub-category 12.1 Information lacking was not ranked. The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category. The overall magnitude of the threat in urban habitat is shown at the end of each bar (also presented in Table 5). Only threats with a magnitude of medium or higher are typically assigned habitat-specific conservation objectives.

Table 19. Threats addressed, conservation objectives, recommended actions and list of priority species affected in urban habitats in BCR 13 ON.

Note: Issues such as collisions with human-made structures and collisions with vehicles, and climate change, are not addressed in this table; instead, they are addressed in the Widespread Issues section.

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
1.1 Housing and urban areas	Reduction in the number of gravelled roofs reduces urban population of Common Nighthawk	1.4. Maintain important bird features on the landscape	Protect nesting areas in urban landscapes	2.1 Site/area management	Identify, protect and monitor nesting sites in urban areas (Ontario Partners in Flight 2008).	Common Nighthawk[2]
				6.4 Conservation Payments	Property owners may be eligible for stewardship programs that support the protection and recovery of species at risk and their habitats (see *Ontario Ministry of Natural Resources Common Nighthawk Fact Sheet*, 2009*).*	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Common Nighthawk
	Loss of nesting and roosting sites due to the demolition of chimneys or installation of screening/loss	1.4. Maintain important bird features on the landscape	Protect nesting and roosting sites in urban landscapes.	2.1 Site/area management	Identify, monitor and protect nesting and roosting sites in urban areas (Ontario Partners in Flight 2008).	Chimney Swift[2]
				2.1 Site/area management	Research and develop effective artificial nesting towers for use on building rooftops where existing chimneys are capped.	

[1] While many priority species may benefit from proposed conservation actions, priority species not mentioned in this table are absent because 1) identified threats in this habitat are of low magnitude, or 2) they are migrants with no threats identified in this habitat.

[2] Species listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, interim conservation objectives and recommended actions are presented here.

Table 19 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
	of hollow trees.			4.3 Awareness and communications	Increase awareness of the importance of chimneys as nesting and roosting sites for Chimney Swifts.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Chimney Swift
6.1 Recreational activities	Disturbance at nest sites from recreational activity/ human presence	4.1 Reduce disturbance from human recreation	Reduce disturbance at nesting sites	2.1 Site/area management	Establish buffer zones around known nesting sites.	Killdeer
				4.3 Awareness and communications	Raise public awareness of the vulnerability of this species to human disturbance at nesting sites.	
6.3 Work & other activities	Disturbance at nest sites from urban development	4.2. Reduce disturbance from industrial or work activity	Reduce disturbance at nesting sites	2.1 Site/area management	Establish buffer zones around known nesting sites.	Chimney Swift,[2] Killdeer
				4.3 Awareness and communications	Raise public awareness of the vulnerability of this species to human disturbance at nesting sites.	
				5.3 Private sector standards and codes	Develop BMPs as a means to reduce disturbance (e.g., to prevent birds from initiating nesting on artificial structures scheduled for construction or maintenance).	

Table 19 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Barn Swallow, Chimney Swift, Peregrine Falcon (*anatum/ tundrius*)
9.3 Agricultural & forestry effluents	Pesticide use in urban landscapes (e.g., golf courses, lawns, parks) has direct (toxic) and indirect effects (e.g., decreased prey abundance)	2.1. Reduce mortality and/or sub-lethal effects from pesticide use	Reduce use of pesticides	4.3 Awareness and communications	Increase awareness of the responsible use of chemical pesticides on golf courses and in urban landscapes.	Killdeer, Common Nighthawk[2]
				5.3 Private sector standards and codes	Promote the use of IPM programs to reduce pesticide use in urban landscapes.	
				5.4 Compliance and enforcement	Continue to monitor and enforce compliance with laws, policies and regulations at all levels.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Common Nighthawk
12.1 Information Lacking	Lack of information on factors causing population	7.4. Improve understanding of causes of population declines	Determine source(s) of mortality or population decline(s)	8.1 Research	Identify factors causing population decline and/or limiting population growth of aerial-foraging insectivores.	Common Nighthawk,[2] Chimney Swift[2]

Table 19 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
	declines	7.1. Improve population/demographic monitoring	Improve population/demographic monitoring of aerial insectivores	8.2 Monitoring	Encourage submissions of current and historic nest record data to the Ontario Nest Records Scheme/Project NestWatch to improve understanding of changes in productivity (Ontario Partners in Flight 2008).	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Barn Swallow, Chimney Swift, Common Nighthawk
	Lack of knowledge (trend, population size, and/or distribution range)	7.1. Improve population/demographic monitoring	Improve monitoring efforts to increase reliability of population status/trend	8.2 Monitoring	Improve monitoring efforts to increase reliability of population status/trend for crepuscular species not well sampled by the Breeding Bird Survey.	Common Nighthawk[2]
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	
Management of Nuisance Species						
***Conservation Issue*:** Increasing conflicts between geese and human activities (e.g., agriculture) due to very abundant Eastern temperate-breeding Canada Geese		3.6 Manage nuisance species	Reduce human-goose conflicts	3.1 Species management	Implement strategies within *A Management Plan for Temperate Breeding Canada Geese in Ontario* (Environment Canada, in prep.).	Canada Goose (Temperate-breeding in Eastern Canada)
				5.4 Compliance and enforcement	Undertake compliance promotion of the federal *Migratory Birds Regulations* and provide advice for stakeholders and the	

Table 19 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
					public.	

Wetlands

Wetlands include vegetated habitats that are aquatic or regularly flooded such as bogs, fens, swamps, and marshes and account for approximately 13% of the land cover/land use of BCR 13 ON (Table 1, Fig. 24). Loss of wetland habitats to agriculture, development, water diversion and other land use change is a common issue across much of the country. However, the proportion lost has been especially high in southern Ontario. Prior to European settlement, vast swamps and marshes covered perhaps 25% or more of the region. Wetlands remain common in the northern portion of the BCR in areas where agricultural potential is poor, but more than 90% of original pre-settlement wetlands have been lost from the fertile southwestern portion of Ontario along with 80% of those in eastern Ontario, on the Niagara peninsula and along western Lake Ontario (Snell 1987).

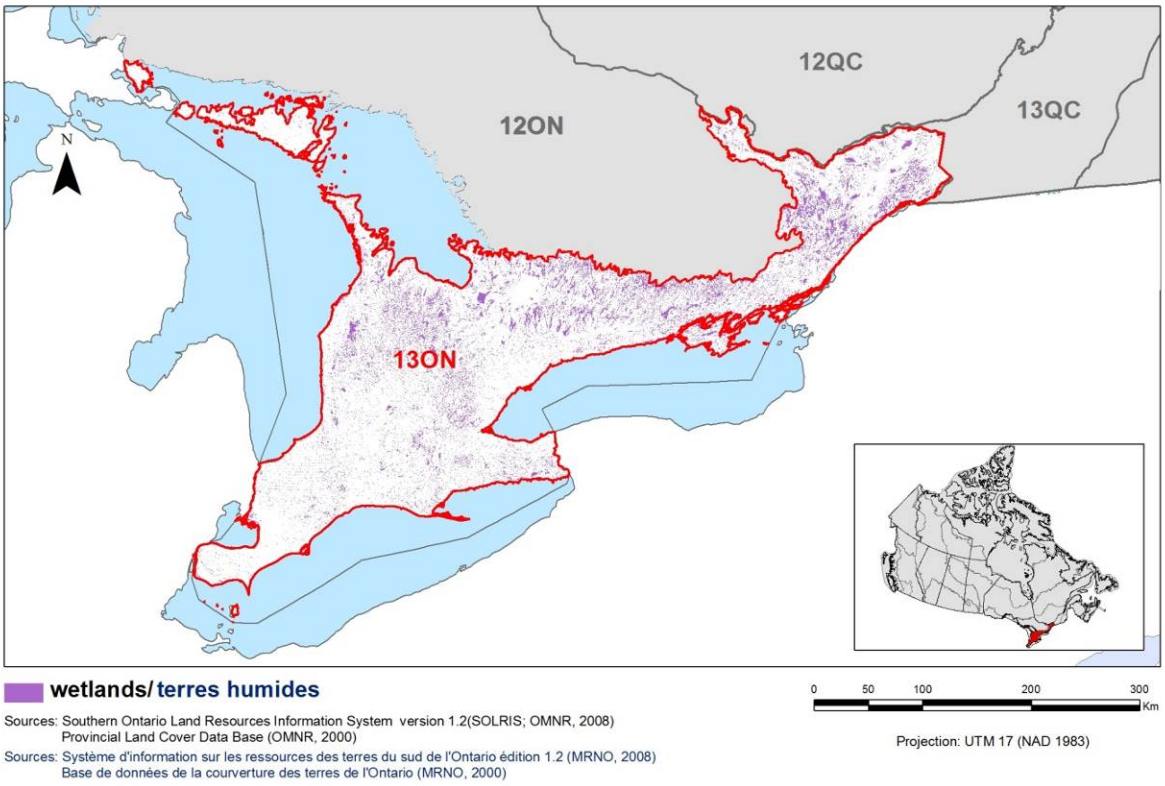

Figure 24. Map of wetlands in BCR 13 ON.

There are 39 priority species that use wetlands in BCR 13 ON, 8 of which are listed as species at risk at the federal and/or provincial level. Wetland habitats are used extensively by 40% of priority species (Table 20).

Table 20. Priority species associated with wetland habitats in BCR 13 ON, habitat descriptions, population objectives and reasons for priority status.

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Sub-regional Concern[5]	Regional/Sub-regional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
American Bittern	Marshes	Assess/Maintain				Y		Y	
American Black Duck	Riverine marshes, bogs, wooded swamps, beaver ponds	Maintain current				Y		Y	
American Coot	Large cattail marshes	Increase				Y			
Belted Kingfisher	Swamps and riparian wetlands	Increase				Y			
Black Tern	Marshes; coastal marshes	Recovery objective			Y	Y		Y	
Black-bellied Plover	Shallow, muddy wetlands; coastal wetlands	Migrant (no BCR 13-ON population objective)				Y		Y	
Black-crowned Night-Heron	Marshes; swamps	Assess/Maintain				Y			
Blue-winged Teal	Marshes	Increase				Y		Y	
Bonaparte's Gull	Marshes; coastal marshes	Migrant (no BCR 13-ON population objective)				Y		Y	
Canada Goose (Southern James Bay)	Marshes; coastal wetlands	Migrant (no BCR 13-ON population objective)				Y		Y	
Canada Goose (Eastern Temperate-breeding population)	Marshes; coastal wetlands	Decrease				Y			

[1] Habitat descriptions, in most cases, follow definitions under the Land Cover Classification System (LCCS; see Kennedy et al. 2012).
[2] Assessed by COSEWIC as E, Endangered; T, Threatened; SC, Special Concern.
[3] Species listed on Schedule 1 of SARA as E, Endangered; T, Threatened; SC, Special Concern.
[4] Species listed as Endangered, Threatened or Special Concern on the SARO List.
[5] Regional refers to BCR-wide (i.e., all jurisdictional data were used for the entire BCR) while sub-regional refers to the Ontario portion of the BCR only (i.e., Ontario BCR data were used).
[6] Only the landbird group distinguishes stewardship species from other priority species (see Panjabi et al. 2005).

Table 20 continued

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Sub-regional Concern[5]	Regional/Sub-regional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
Canvasback	Coastal marshes	Maintain current				Y		Y	
Common Gallinule	Large permanent marshes with open water and tall emergent vegetation	Assess/Maintain				Y			
Forster's Tern	Coastal marshes	Assess/Maintain				Y		Y	
Great Blue Heron	Marshes; swamps	Maintain current				Y			
Great Egret	Marshes; swamps	Increase				Y			
Green Heron	Marshes; shrub swamps;	Increase				Y			
Green-winged Teal	Marshes, bogs, fens, beaver meadows	Maintain current				Y			
Horned Grebe (western population)	Marshes and shallow bays	Migrant (no BCR 13-ON population objective)			Y	Y		Y	
King Rail	Marshes	Recovery objective	Y	Y	Y	Y		Y	
Least Bittern	Marshes dominated by emergent vegetation with open water	Recovery objective	Y	Y	Y	Y		Y	
Lesser Scaup	Coastal marshes	Assess/Maintain				Y		Y	
Little Gull	Coastal marshes	Migrant (no BCR 13-ON population objective)				Y		Y	
Louisiana Waterthrush	Clear headwater streams and associated wetlands; heavily wooded swamps	Recovery objective	Y	Y	Y	Y		Y	
Mallard	Marshes, beaver ponds, swamps	Increase				Y		Y	
Mute Swan	Coastal and inland marshes with dense emergent vegetation	Decrease				Y			
Northern Harrier	Bogs; fens; marshes	Maintain current				Y			

Table 20 continued

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Sub-regional Concern[5]	Regional/Sub-regional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
Olive-sided Flycatcher	Bogs; fens; tall trees in expansive bogs	Recovery objective[7]	Y	Y	Y	Y		Y	
Pied-billed Grebe	Marshes	Maintain current				Y			
Prothonotary Warbler	Deciduous swamps	Recovery objective	Y	Y	Y	Y		Y	
Redhead	Large marshes	Maintain current				Y		Y	
Red-necked Grebe	Coastal marshes	Assess/Maintain				Y			
Ring-necked Duck	Coastal marshes for staging; swamps; fens; bogs; beaver ponds	Maintain current				Y			
Sandhill Crane	Marshes and wet sedge fens	Assess/Maintain				Y			
Sora	Marshes	Assess/Maintain				Y		Y	
Virginia Rail	Marshes	Maintain current				Y		Y	
Wilson's Snipe	Bogs; fens; willow swamps; wet meadows; coastal marshes	Assess/Maintain				Y			
Wood Duck	Deciduous swamps; beaver ponds	Increase				Y			
Yellow Rail	Marshes dominated by sedges	Recovery objective	Y	Y	Y	Y		Y	

The loss of both inland and coastal wetland habitat poses the highest-level threat to priority species in BCR 13 ON. Wetlands along the Great Lakes coast are of particular importance as staging habitat for migratory waterfowl, swallows, shorebirds and breeding habitat for many waterbirds including the endangered King Rail and the threatened Least Bittern. Like inland wetlands, a substantial fraction of these coastal wetlands have been lost to development (threat sub-category 1.1, Fig. 25), which has been identified as a threat of very high overall magnitude for priority species in this habitat. For example, estimates suggest losses of 43% along the shore of Lake Ontario west of the Bay of Quinte (Whillans 1982).

[7] Species listed on Schedule 1 of SARA and/or SARO, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, the interim population objective for the Olive-sided Flycatcher in BCR 13 ON is: Increase.

Away from the shores of the Great Lakes, the threat of wetland loss to development is ongoing. Draining and filling of wetlands to make room for urban development and agricultural uses (sub-categories 1.1 and 2.1; very high overall magnitude threat) as well as removing natural features such as nesting cavities (sub-category 5.3; high overall magnitude threat) were all identified as significant threats to priority species. Actions to restore wetlands at a local and landscape scale seek to regain the valuable ecosystem services they provide. Wetlands function as natural flood-control mechanisms, and the aggregate value of this and other services provided by wetlands was recently estimated at nearly $52 billion annually for BCR 13 ON alone (Troy and Bagstad 2009). Planning land uses to maintain a target quantity of wetland habitat at a watershed scale is both beneficial for birds and other elements of biodiversity, and also sensible from the perspective of infrastructure protection.

For wetlands in BCR 13 ON, invasive species also posed an overall threat of very high magnitude (sub-category 8.1). Exotic or non-native invasives such as Phragmites and Purple Loosestrife thrive in wetlands, outcompeting native vegetation, reducing plant diversity and reducing the quality of wetlands for many birds and other wildlife. Direct management of invasive species is sometimes necessary, and actions to restore hydrologic cycles and other natural ecosystem functions allow native species to recolonize (Table 21). In addition, the Mute Swan is a non-native invasive species that was brought here by European settlers during the late 1800s to adorn parks, gardens and estates. Since then, feral populations have established and flourished in some areas due to escapes or intentional releases from captive flocks (Environment Canada 2013b; Cadman et al. 2007). Between 1986 and 2011, the abundance of Mute Swans along the Ontario side of the lower Great Lakes had grown from 615 to over 3,000 swans (Meyer et al. 2012). The Mute Swan is a highly territorial and aggressive species that can pose risks to native wildlife and people. Its aggressive nature can disrupt the nesting of native waterfowl, and they are capable of causing serious injury to people and pets. Attacks can occur on land and water when attempting to feed swans or entering their territories. Furthermore, feeding activities of large numbers of Mute Swans over time can damage or drastically alter wetland ecosystems (Environment Canada 2013b). Given the increasing abundance and distribution of this species in southern Ontario, it is a species of management interest (see Management of Nuisance Species in Table 21).

Furthermore, human activities to enhance commercial shipping and curb shoreline erosion have altered hydrologic processes in Lake Ontario (Wires et al. 2010). Research has shown that water-level regulation practices (sub-category 7.2), identified as a threat of high magnitude, have compressed the range of water levels to the point of causing widespread degradation of the coastal wetlands on Lake Ontario and the upper St. Lawrence River (International Joint Commission 2013; Wilcox et al. 1992). However, despite significant losses, nearly 64,000 ha of coastal wetlands remain (Zeran et. al. unpubl.; Ontario Eastern Habitat Joint Venture 2007). Their protection, management and restoration are among the most critical conservation needs for priority birds in wetland habitats. Suggested actions for key coastal wetlands include direct protection of important nesting and stopover sites (e.g., through protected areas, land acquisition and conservation easements), and conservation-related initiatives geared to

ensuring no net loss of wetland area, as well as maintaining wetland functions and natural hydrologic cycles (Table 21).

Degradation of aquatic habitats by direct and indirect sources of pollutants from industry and agriculture poses a significant threat to priority birds across the region. Degradation of aquatic habitats from nutrient inputs (e.g., chemical fertilizers and manure), agricultural pesticides (sub-category 9.3) and industrial chemicals (sub-category 9.2) were identified as high and medium overall magnitude threats to priority birds in wetlands, respectively (Table 21). Conservation actions focus on implementing BMPs to reduce potential risks to aquatic birds and their habitats resulting from agricultural production (e.g., nutrient management), improving habitat quality through maintaining naturally vegetated riparian areas, promoting the inclusion of effective protection and emergency response measures within environmental policies and regulations to prevent or mitigate oil spills, industry outfalls and other chemical spills, promoting the use of IPM programs to reduce pesticide use in upland agricultural areas as well as monitoring and enforcing compliance with laws, policies and regulations at all levels.

In BCR 13 ON, habitat loss and degradation from the construction and maintenance of transportation networks was assessed as a high overall threat to priority species in wetland habitats (sub-category 4.1). Southern Ontario has the highest density of roads of any region in Canada (Ontario Biodiversity Council 2010), and the construction, maintenance and use by vehicles of these networks pose risks to bird populations and the habitats upon which they rely (Kociolek 2011). The effects of roads on wildlife depend on their location, density of road corridors and their level of use. Few natural areas in southwestern and central Ontario are more than 1.5 km from existing roads (Ontario Ministry of Natural Resources 2009). In southeastern Ontario, the species richness of wetland plants, amphibians, reptiles and birds each correlated negatively with road density within 1–2 km of a wetland (Ontario Biodiversity Council 2010). Roads between and within urban centres can have both direct and indirect effects on birds and other wildlife, including individual species disturbance attributed to noise and dust, habitat loss, fragmentation and degradation (loss of suitable nest sites, destruction of nest sites, decline of prey species), indirect mortality from increased predator/prey contact, and increased exposure to invasive species. Recommended wetland habitat conservation actions seek to mitigate the effects of roads through the implementation of BMPs or mitigation guidelines to avoid habitat loss and degradation. The Widespread Issues section of this strategy addresses mortality caused by collisions with vehicles.

Finally, human disturbance of breeding, staging and wintering birds in BCR 13 ON wetlands by a variety of recreational activities (e.g., boating) was assessed as a high overall magnitude threat to a number of priority species (sub-category 6.1). Excessive disturbance of birds can increase flight time, decrease feeding time, force birds to forage in less preferred habitats and potentially influence their ability to acquire the fat reserves necessary for migration. Recommended actions include establishing protection zones to buffer wetlands from disturbance, restricting access to known stopover areas and increasing public awareness of the important role of stopover sites and the detrimental effects of disturbance on breeding, staging and foraging birds (Table 21).

The full list of threats to and information needs (sub-category 12.1) for priority species in wetland habitats of BCR 13 ON as well as the conservation objectives and recommended actions are presented in Table 21. Note that although mortality from collisions with structures and buildings (sub-category 1.2) is a threat of medium magnitude in this habitat, given that the effects of this threat are widespread, it is discussed in the Widespread Issues section of this strategy.

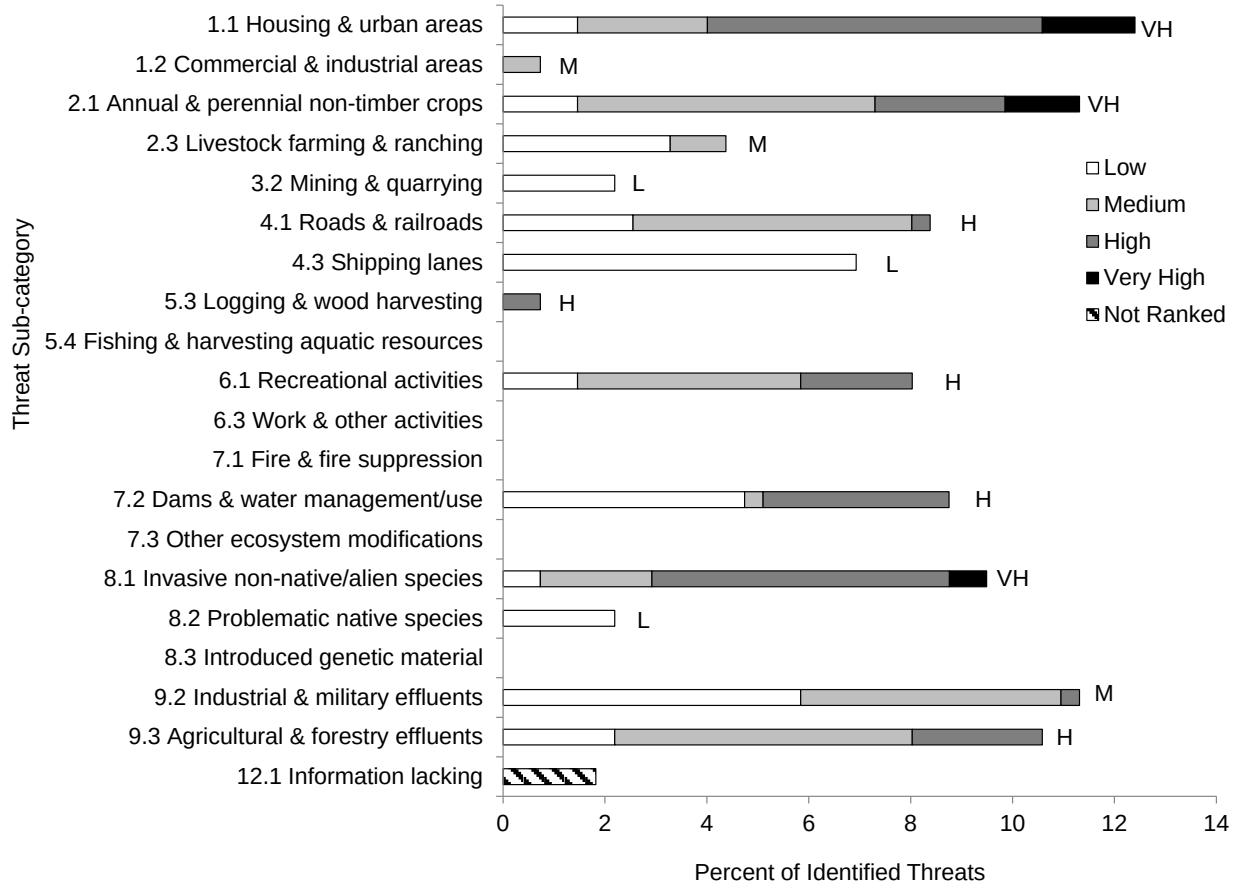

Figure 25. Percent of identified threats to priority species in wetland habitats in each threat sub-category.

Each bar represents the percent of the total number of threats identified in each threat sub-category in wetland habitat (for example, if 100 threats were identified in total for all priority species in wetland habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). Threat sub-category 12.1 Information lacking was not ranked. The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category. The overall magnitude of the threat in wetland habitat is shown at the end of each bar (also presented in Table 5). Only threats with a magnitude of medium or higher are typically assigned habitat-specific conservation objectives.

Table 21. Threats addressed, conservation objectives, recommended actions, and list of priority species affected in wetland habitats in BCR 13 ON.

Note: Issues such as collisions with human-made structures and vehicles, and climate change, are not addressed in this table; instead, they are addressed in the widespread issues section.

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
1.1 Housing & urban areas	Loss of wetland habitat due to development	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain, enhance or restore quantity, quality and diversity of wetlands across the landscape	1.1 Site/area protection	Identify and protect important nesting/stopover wetland habitats for priority birds.	American Bittern, American Black Duck, American Coot, Belted Kingfisher, Black-crowned Night-Heron, Blue-winged Teal, Canvasback, Common Gallinule, Forster's Tern, Great Blue Heron, Great Egret, Green Heron, Green-winged Teal, Horned Grebe (western population),[2] Lesser Scaup, Little Gull, Northern Harrier, Olive-sided Flycatcher,[2] Pied-billed Grebe, Ring-necked Duck, Sora, Virginia Rail, Wilson's Snipe, Wood Duck
				1.2 Resource and habitat protection	Protect wetlands of a variety of sizes, configuration and habitat conditions (e.g., emergent cover, water level, hydroperiods) in order to ensure a diversity of sub-habitat types and species across the landscape.	
				2.3 Habitat and natural process restoration	Ensure no net loss of wetland area, and focus on maintaining and restoring wetland functions at a watershed and sub-watershed scale based on historic reference conditions. At a minimum, the greater of (a) 10% of each major watershed and 6% of each sub-watershed, or (b) 40% of the historic watershed wetland coverage, should be protected and restored (Environment Canada 2013a). Restore wetlands in key locations. Headwater areas, flood plains, and coastal areas should be prioritized. Special attention should be paid to historic wetland locations or the site and soil conditions (Environment Canada 2013a).	

[1] While many priority species may benefit from proposed conservation actions, priority species not mentioned in this table are absent because 1) identified threats in this habitat are of low magnitude, or 2) they are migrants with no threats identified in this habitat.

[2] Species listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, interim conservation objectives and recommended actions are presented here.

Table 21 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
					Ensure presence of important bird features such as cavity nesting trees, natural vegetation cover as appropriate to the priority species.	
				4.3 Awareness and communications	Promote wetland conservation and ecosystem services as a means to maintaining a healthy environment.	
				5.3 Private sector standards and codes	Develop land-use policies and BMPs that support wetland habitat protection/restoration by all sectors (e.g., construction, agriculture, forestry, mining, wind power, and aggregate extraction).	
				7.2 Alliance and partnership development	Improve coordination of existing private land stewardship incentive programs and encourage governments to develop/expand incentive programs for specific conservation needs.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Black Tern, Horned Grebe (western population), King Rail, Least Bittern, Louisiana Waterthrush, Olive-sided Flycatcher, Prothonotary Warbler, Yellow Rail
2.1 Annual & perennial non-timber crops	Loss of wetland habitat due to agricultural development/ intensification (e.g., drainage	1.1. Ensure land and resource-use policies and practices maintain or improve bird	Maintain, enhance or restore quantity, quality and diversity of wetlands	1.1 Site/area protection	Identify and protect important nesting/stopover wetland habitats for priority birds.	American Bittern, American Black Duck, American Coot, Black-bellied Plover, Black-crowned Night-Heron, Blue-winged Teal, Common
				1.2 Resource and habitat protection	Protect wetlands of a variety of sizes, configuration and habitat conditions (e.g., emergent cover, water level, hydroperiods) in order to ensure a diversity of sub-habitat types and species across the landscape.	

Table 21 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
	and filling of wetlands)	habitat	across the landscape	2.3 Habitat and natural process restoration	Ensure no net loss of wetland area, and focus on maintaining and restoring wetland functions at a watershed and sub-watershed scale based on historic reference conditions. At a minimum, the greater of (a) 10% of each major watershed and 6% of each sub-watershed, or (b) 40% of the historic watershed wetland coverage, should be protected and restored (Environment Canada 2013a). Restore wetlands in key locations. Headwater areas, flood plains, and coastal areas should be prioritized. Special attention should be paid to historic wetland locations or the site and soil conditions. Ensure presence of important bird features such as cavity nesting trees, natural vegetation cover as appropriate to the priority species.	Gallinule, Forster's Tern, Great Blue Heron, Great Egret, Green Heron, Green-winged Teal, Horned Grebe (western population),[2] Lesser Scaup, Northern Harrier, Olive-sided Flycatcher,[2] Pied-billed Grebe, Ring-necked Duck, Sora, Virginia Rail, Wilson's Snipe, Wood Duck
				4.3 Awareness and communications	Promote wetland conservation and ecosystem services as a means to maintaining a healthy environment.	
				5.2 Policies and regulations	Policies pertaining to wetland conservation and restoration, water quality, water drainage, and agricultural practices should include conservation guidelines for small wetlands currently not viewed as provincially significant.	
				5.3 Private sector standards and codes	Develop land-use policies and BMPs that support wetland habitat protection/restoration by all sectors (e.g., construction, agriculture, forestry, mining, wind power, and aggregate extraction).	

Table 21 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
				7.2 Alliance and partnership development	Improve coordination of existing private land stewardship incentive programs and encourage governments to develop/expand incentive programs for specific conservation needs.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Black Tern, Horned Grebe (western population, King Rail, Least Bittern, Louisiana Waterthrush, Olive-sided Flycatcher, Yellow Rail
2.3 Livestock farming & ranching	Degradation of wetland habitats from livestock access (e.g., reduced vegetative cover, bacterial, sediment and nutrient loading)	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain, enhance or restore quantity, quality and diversity of wetlands across the landscape	2.1 Site/area management	Maintain/restore suitable riparian buffers around wetlands to reduce erosion and runoff, and provide foraging and nesting habitat for birds.	Great Blue Heron, Belted Kingfisher
				2.3 Habitat and natural process restoration	Where wetlands have been degraded by livestock activity, restore and enhance wetland habitat through fencing, grazing management, and planting of native wetland and riparian vegetation.	
				5.2 Policies and regulations	Policies pertaining to wetland conservation and restoration, water quality, water drainage, and agricultural practices should include conservation guidelines for small wetlands currently not viewed as provincially significant.	
				5.3 Private sector standards and codes	Restrict livestock access to surface water and provide alternate water sources.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Least Bittern

Table 21 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
			Species at Risk legislation			
4.1 Roads & railroads	Habitat loss and degradation from the construction and maintenance of transportation networks	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Reduce/ eliminate habitat loss, fragmentation and/or degradation from the construction and maintenance of road networks	5.2 Policies and regulations 5.3 Private sector standards and codes	Develop and/or implement existing BMPs or mitigation guidelines to avoid habitat loss, fragmentation or degradation from road construction and maintenance.	American Bittern, American Black Duck, American Coot, Blue-winged Teal, Common Gallinule, Great Blue Heron, Green Heron, Green-winged Teal, Northern Harrier, Pied-billed Grebe, Red-necked Grebe, Sora, Virginia Rail, Wilson's Snipe, Wood Duck
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Black Tern
5.3 Logging & wood harvesting	Loss of nesting cavities	1.4 Maintain important bird features on the landscape	Maintain or restore important bird features in wetland	2.3 Habitat and natural process restoration	Ensure presence of important bird features (e.g., cavity nesting trees, natural vegetation cover) as appropriate to the priority species (see *Extension Note: "Cavity Trees are Refuges for Wildlife"* Landowner Resource Centre 2011).	Wood Duck

Table 21 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
			habitat	2.1 Site/area management	Critical Function Zones should be established around wetlands based on knowledge of species present and their use of habitat types. Protection Zones (PZ) should protect or buffer the wetland attributes from stressors. Recommended widths should consider sensitivities of the wetland and the species that depend upon it, as well as local environmental conditions (e.g., slopes, soils and drainage), vegetative structure of the PZ, and nature of the changes in adjacent land uses. Stressors need to be identified and mitigated through PZ design (Environment Canada 2013a). Install nest boxes to enhance breeding success.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Prothonotary Warbler
6.1 Recreational activities	Human activities causing disturbance to breeding, foraging and/or staging birds	4.1 Reduce disturbance from human activities	Minimize human disturbance of priority species	2.1 Site/area management	Critical Function Zones should be established around wetlands based on knowledge of species present and their use of habitat types. Protection Zones (PZ) should protect or buffer the wetland attributes from stressors. Recommended widths should consider sensitivities of the wetland and the species that depend upon it, as well as local environmental conditions (e.g., slopes, soils and drainage),	American Bittern, Black-crowned Night-Heron, Canvasback, Forster's Tern, Great Blue Heron, Great Egret, Green Heron, Northern Harrier, Pied-billed Grebe, Ring-necked Duck, Sora, Virginia Rail,

Table 21 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
					vegetative structure of the PZ, and nature of the changes in adjacent land uses. Stressors need to be identified and mitigated through PZ design (Environment Canada 2013a).	Wilson's Snipe, Wood Duck
					Restrict access to important stopover areas during migration (e.g., limit recreational boating and recommend unobtrusive distances for observing waterbirds).	Canvasback, Ring-necked Duck
				4.3 Awareness and communications	Increase public awareness of the crucial role of stopover sites, and detrimental effects of disturbance on breeding, staging and/or foraging birds.	American Bittern, Black-crowned Night-Heron, Canvasback, Forster's Tern, Great Blue Heron, Great Egret, Green Heron, Northern Harrier, Pied-billed Grebe, Ring-necked Duck, Sora, Virginia Rail, Wilson's Snipe, Wood Duck
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Black Tern, King Rail, Least Bittern, Yellow Rail
7.2 Dams & water management/ use	Loss and degradation of coastal wetland habitat by Great Lakes	1.1. Ensure land and resource-use policies and practices maintain or	Maintain natural hydrologic cycles to ensure coastal wetland	5.2 Policies and regulations	Develop recommendations for international water-level regulation criteria for Lake Ontario which include maintaining coastal habitat diversity and health.	American Bittern, American Coot, Black-crowned Night-Heron, Pied-billed Grebe, Redhead, Sora, Virginia Rail

Table 21 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
	water level management (stabilization).	improve bird habitat	habitat diversity and integrity.	8.1 Research	Investigate the impact of water level stabilization on Great Lakes coastal wetlands and determine if management is necessary to protect and improve habitat (Zeran et al. unpubl.).	Pied-billed Grebe, Sora, Virginia Rail
				8.2 Monitoring	Support the bi-national Great Lakes Coastal Wetland Inventory Program, which aims to provide a standard reference for the Great Lakes wetland community.	American Bittern, American Coot, Black-crowned Night-Heron, Pied-billed Grebe, Redhead, Sora, Virginia Rail
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Black Tern, King Rail, Least Bittern, Yellow Rail
8.1 Invasive non-native/alien species	Invasive species in wetlands influence habitat quality and food availability (e.g., carp, loosestrife, phragmites, mute swan)	3.5 Prevent and control the spread of invasive non-native species	Prevent and control the spread of invasive and exotic species	2.2 Invasive/problematic species control	Prevent the introduction and spread of invasive non-native species into aquatic ecosystems and develop eradication protocols for coordinated management efforts.	American Bittern, American Black Duck, Black-bellied Plover, Black-crowned Night-Heron, Blue-winged Teal, Common Gallinule, Forster's Tern, Great Blue Heron, Great Egret, Green Heron, Green-winged Teal, Horned Grebe (western population),[2] Pied-billed Grebe, Redhead, Ring-necked Duck, Sora,
				2.3 Habitat and natural process restoration	Diversify wetland site conditions by using management techniques such as removal of invasive species or manage water levels to encourage a mosaic of marsh vegetation.	
				4.3 Awareness and communications	Raise public awareness of the need to prevent the introduction and spread of invasive non-native species.	
				5.2 Policies and regulations	Develop and/or strengthen policies or regulatory measures geared to preventing the introduction and spread of non-native invasive	

Table 21 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
					species (e.g., zebra mussels).	Virginia Rail, Wilson's Snipe
				8.2 Monitoring	Encourage participation in volunteer monitoring efforts (e.g., Invading Species Awareness Program) to help address threats from non-native invasive species on aquatic habitats.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Black Tern, Horned Grebe (western population), King Rail, Least Bittern, Prothonotary Warbler, Yellow Rail
9.2 Industrial & military effluents	Mortality, sub-lethal effects and/or habitat degradation from heavy metals and other environmental contaminants	1.5 Reduce habitat degradation from contaminants	Maintain, restore or improve wetland habitat quality	2.1 Site/area management	Critical Function Zones should be established around wetlands based on knowledge of species present and their use of habitat types. Protection Zones (PZ) should protect or buffer the wetland attributes from stressors. Recommended widths should consider sensitivities of the wetland and the species that depend upon it, as well as local environmental conditions (e.g., slopes, soils and drainage), vegetative structure of the PZ, and nature of the changes in adjacent land uses. Stressors need to be identified and mitigated through PZ design (Environment Canada 2013a).	American Bittern, American Black Duck, Black-crowned Night-Heron, Bonaparte's Gull, Canvasback, Common Gallinule, Forster's Tern, Lesser Scaup, Little Gull, Ring-necked Duck
				5.2 Policies and regulations	Work with industry and policy makers to reduce the quantity of toxic chemicals released into the environment. Encourage the inclusion of effective protection and emergency response measures within	

Table 21 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
					environmental policies and regulations to prevent or mitigate oil spills, industry outfalls and other chemical spills.	
				5.4 Compliance and enforcement	Continue to monitor and enforce compliance with laws, policies and regulations at all levels.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Black Tern, King Rail, Least Bittern, Louisiana Waterthrush, Yellow Rail
9.3 Agricultural & forestry effluents	Mortality, sub-lethal effects, reductions in prey populations, and habitat alteration (e.g., eutrophication) caused by fertilizers and pesticides	5.1 Maintain natural food webs and prey sources	Maintain, restore or improve wetland habitat quality	2.1 Site/area management	Critical Function Zones should be established around wetlands based on knowledge of species present and their use of habitat types. Protection Zones (PZ) should protect or buffer the wetland attributes from stressors. Recommended widths should consider sensitivities of the wetland and the species that depend upon it, as well as local environmental conditions (e.g., slopes, soils and drainage), vegetative structure of the PZ, and nature of the changes in adjacent land uses. Stressors need to be identified and mitigated through PZ design (Environment Canada 2013a).	American Bittern, American Black Duck, American Coot, Black-crowned Night Heron, Blue-winged Teal, Common Gallinule, Great Blue Heron, Great Egret, Green Heron, Green-winged Teal, Northern Harrier, Pied-pilled Grebe, Redhead, Sora, Virginia Rail, Wilson's Snipe, Wood Duck
				4.3 Awareness and communications	Undertake education and awareness activities regarding the impact of environmental contaminants on birds and their habitats.	
				5.3 Private sector standards and codes	Develop or implement existing BMPs to reduce potential risks to aquatic birds and their habitats resulting from agricultural production (e.g.,	

Table 21 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
					Ontario Ministry of Agriculture and Rural Affairs Best Management Practices Series at www.omafra.gov.on.ca/english/environment/bmp/series.htm). Promote the use of IPM programs to reduce pesticide use in upland agricultural areas.	
				5.4 Compliance and enforcement	Continue to monitor and enforce compliance with laws, policies and regulations at all levels.	
		7.1 Improve population/ demographic monitoring	Evaluate the effects of pesticides on birds and their habitats	8.1 Research	Determine population-level effects of environmental contaminants on the vital rates of priority species.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Black Tern, King Rail, Least Bittern, Louisiana Waterthrush, Prothonotary Warbler, Yellow Rail
12.1 Information lacking	Lack of knowledge (trend, population size, and/or distribution range)	7.1 Improve population/ demographic monitoring	Improve monitoring efforts to increase reliability of population status/trend	8.2 Monitoring	Evaluate alternative monitoring strategies for filling gaps in coverage for colonial waterbirds.	Little Gull
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Black Tern

Table 21 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
			Species at Risk legislation			
	Lack of information on factors causing population declines	7.4 Improve understanding of causes of population declines	Determine cause(s) of population decline	8.1 Research	Investigate potential causes of population decline including studying population demographics across a range of nesting sites and management regimes. (Ontario Partners in Flight 2008).	Olive-sided Flycatcher[2]
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Olive-sided Flycatcher
	Lack of knowledge on the biological or demographic parameters for proper management of populations	7.1 Improve population/ demographic monitoring	Expand monitoring effort to inform population management	8.2 Monitoring	Assess population status and distribution to inform population management.	Mute Swan, Sandhill Crane
Management of Nuisance Species						
Conservation Issue: Increasing conflicts between geese and human activities (e.g., agriculture) due to very abundant Eastern temperate-breeding Canada Geese	3.6 Manage nuisance species	Reduce human-goose conflicts	3.1 Species management	Implement strategies within *A Management Plan for Temperate Breeding Canada Geese in Ontario* (Environment Canada, in prep.).	Canada Goose (Temperate-breeding in Eastern Canada)	
			5.4 Compliance and enforcement	Undertake compliance promotion of federal *Migratory Birds Regulations* and provide advice for stakeholders and the public.		
Conservation Issue: Mute Swans are a problematic non-native invasive species which pose risks to wetland	3.5 Prevent and control the spread of invasive, non-	***Objective***: Reduce/ eliminate Mute Swans	2.1 Site/area management	Do not encourage Mute Swans to use an area by providing them with food or nesting materials.	Mute Swan	
			2.2 Invasive/problem	Do not allow captive-reared Mute Swans to escape into the wild.		

Table 21 continued

Threat Sub-category	Threat Addressed	Objective Category	Objectives	Action Category	Recommended Actions	Priority Species Affected[1]
ecosystems, to native wildlife and to people.		native species	to reduce the risk to native wildlife, wetland ecosystems and people.	atic species control	Landowners can obtain a permit from the Canadian Wildlife Service to remove Mute Swans or their eggs.	
				5.2 Policies and regulations	Develop and/or strengthen policies or regulatory measures geared to preventing the introduction and spread of exotic species.	

Waterbodies

BCR 13 ON borders three of the Great Lakes, and therefore waterbodies are an important habitat type in this region. In addition, inland lakes and rivers amount to roughly 3% of the total land cover of BCR 13 ON exclusive of the Great Lakes (Table 1; Fig. 26).

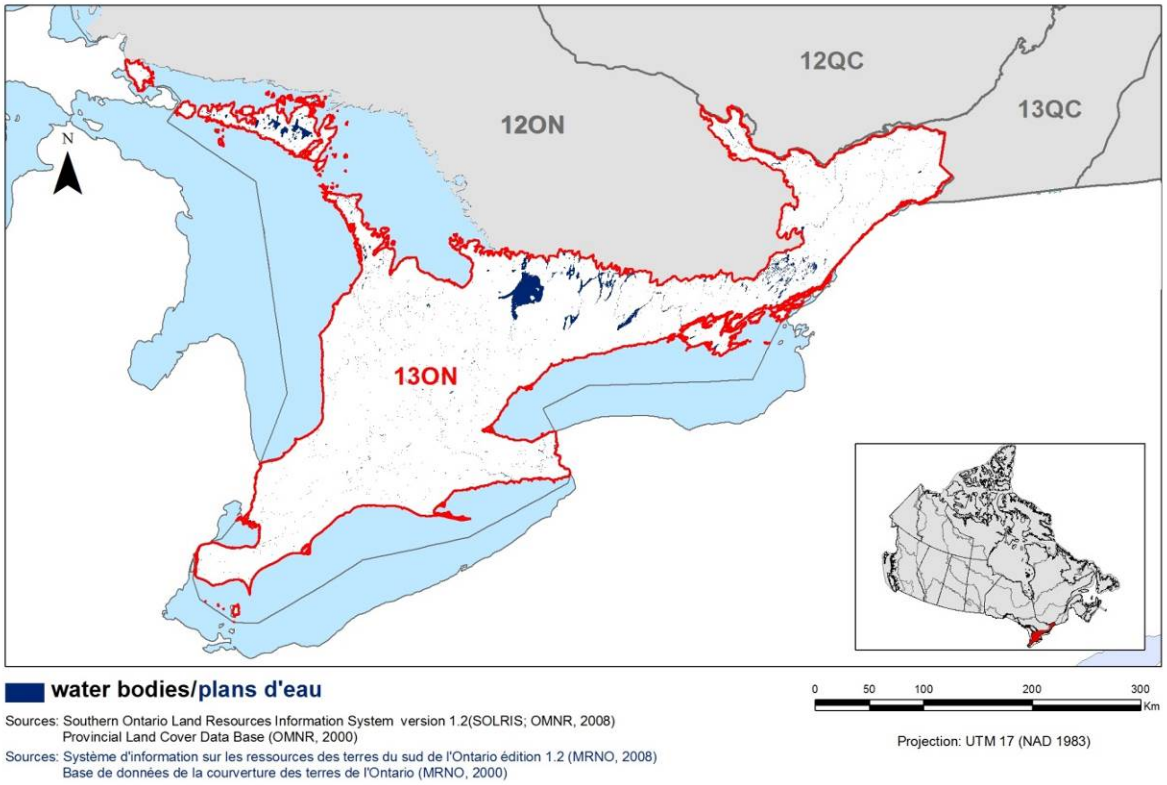

Figure 26. Map of waterbodies in BCR 13 ON.

This habitat type is used extensively by 20 priority species (21%; Table 22). Lakes and rivers are foraging habitat for fish-eating species such as the Belted Kingfisher and Common Loon, while other species such as the Tundra Swan and Southern James Bay Canada Goose seek refuge from predators by roosting on open water during their migrations through the region. Some priority species on this list, for example the Long-tailed Duck and Bonaparte's Gull, winter in the open water of the Great Lakes and Niagara River.

Table 22. Priority species associated with waterbodies in BCR 13 ON, habitat descriptions, population objectives and reasons for priority status.

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Sub-regional Concern[5]	Regional/Sub-regional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
Bald Eagle	Large lakes and rivers	Recovery objective[7]			Y	Y			Y
Belted Kingfisher	Lakes and rivers	Increase				Y			
Bonaparte's Gull	Lakes and rivers	Migrant (no BCR 13-ON population objective)				Y		Y	
Canada Goose (Southern James Bay)	Large lakes; rivers for roosting	Migrant (no BCR 13-ON population objective)				Y		Y	
Canvasback	Large lakes and rivers	Maintain current				Y		Y	
Caspian Tern	Large lakes	Maintain current				Y			
Common Goldeneye	Lakes and rivers (for staging)	Maintain current				Y		Y	
Common Loon	Lakes and rivers	Maintain current				Y		Y	
Common Merganser	Lakes and rivers (for staging)	Maintain current				Y			
Common Tern	Large lakes	Increase				Y		Y	
Great Black-backed Gull	Lakes and rivers	Maintain current				Y			
Horned Grebe (western population)	Lakes and rivers	Migrant (no BCR 13-ON population objective)			Y	Y		Y	

[1] Habitat descriptions, in most cases, follow definitions under the Land Cover Classification System (LCCS; see Kennedy et al. 2012).
[2] Assessed by COSEWIC as E, Endangered; T, Threatened; SC, Special Concern.
[3] Species listed on Schedule 1 of SARA as E, Endangered; T, Threatened; SC, Special Concern.
[4] Species listed as Endangered, Threatened or Special Concern on the SARO List.
[5] Regional refers to BCR-wide (i.e., all jurisdictional data were used for the entire BCR) while sub-regional refers to the Ontario portion of the BCR only (i.e., Ontario BCR data were used).
[6] Only the landbird pillar distinguishes stewardship species from other priority species (see Panjabi et al. 2005).
[7] Species listed on Schedule 1 of SARA and/or SARO, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, the interim population objective for the Bald Eagle in BCR 13 ON is: Assess/Maintain.

Table 22 continued

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Sub-regional Concern[5]	Regional/Sub-regional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
Lesser Scaup	Large lakes for staging	Assess/Maintain				Y		Y	
Little Gull	Lakes and rivers	Migrant (no BCR 13-ON population objective)				Y		Y	
Long-tailed Duck	Large lakes for staging	Assess/Maintain				Y		Y	
Peregrine Falcon *(anatum/tundrius)*	Lakes and rivers	Recovery objective	Y	Y	Y	Y		Y	
Pied-billed Grebe	Small lakes and ponds	Maintain current				Y			
Redhead	Lakes and rivers	Maintain current				Y		Y	
Red-necked Grebe	Large lakes and bays (>2 ha)	Assess/Maintain				Y			
Tundra Swan	Lakes and rivers	Maintain current				Y			

Waterbodies in this densely populated region are heavily used, and disturbance of breeding, staging and foraging birds from human recreation (sub-category 6.1) was identified as a threat of very high magnitude to priority species using lakes and rivers. Excessive disturbance of birds can increase flight time, decrease feeding time, force birds to forage in less preferred habitats and potentially influence their ability to acquire the fat reserves necessary for migration. Furthermore, the disturbance caused by recreational boating can lead to the desertion of nests or abandonment of roosting sites by staging birds. Minimizing or eliminating this disturbance requires the cooperation of the public, and accordingly, actions focus on education, guidelines and other efforts to increase awareness about the effects of disturbance on birds.

Many of these waterbodies have been degraded by urban development, which has been identified as a high-magnitude threat to priority species (threat sub-category 1.1; Fig. 27). In an effort to maintain, enhance or restore water quality and habitat value for priority species, recommended conservation actions range from protecting important aquatic habitats (e.g., through National Marine Conservation Areas) to developing BMPs and avoidance guidelines to minimize aquatic habitat degradation from development (Table 23).

While the Great Lakes can act as a barrier to the spread of terrestrial invasive species, they are a conduit for aquatic non-native invasive species. Zebra mussels (*Dreissena polymorpha*) and Round gobies (*Neogobius melanostromus*), small, bottom-dwelling non-native invasive fish

have been found in all five Great Lakes and have begun to invade inland waters (Ontario Ministry of Natural Resources 2012). In Ontario, Zebra mussels and Round gobies are believed to be linked to outbreaks of Type E botulism in Great Lakes fish and at least 22 species of fish-eating birds (Canadian Cooperative Wildlife Health Centre 2007) and as such have an overall high threat magnitude to priority species in BCR 13 ON (sub-category 8.1). Recommended actions to mitigate the threat of invasive non-native species are similar to those proposed in other habitats and relate to prevention, control, management and monitoring their spread.

Type E botulism toxin is produced by a naturally occurring (native) bacterium (*Clostridium botulinum*) found in lake bottom sediment as harmless spores. However, under certain conditions – a rich nutrient source (such as a dead animal), a complete lack of oxygen and an optimum temperature – the bacterium begins producing the toxin, which then enters the aquatic food chain. The toxin is believed to be passed from Zebra mussels, to Round gobies, to larger predators, resulting in large die-offs of fish and birds (sub-category 8.2). Mussel-feeding diving ducks may acquire the toxin directly, rather than via a fish "vector". Scavengers such as gulls may acquire the toxin through consumption of toxin-containing carcasses, while shorebirds may do so through consumption of toxic invertebrates (Canadian Cooperative Wildlife Health Centre 2007). Outbreaks have occurred on Lake Ontario, Lake Erie, Lake Michigan and Lake Huron affecting fish-eating waterbirds at a significant level (Environment Canada 2013c). Associated recommended research and monitoring actions are described in Table 23.

Degradation of aquatic habitats from nutrient inputs and agricultural and industrial chemicals (Ontario Ministry of the Environment 2009) were also identified as medium overall magnitude threats to priority birds in waterbodies (Fig. 27). Degradation of aquatic habitats by direct and indirect sources of pollutants from industry and agriculture (threat sub-categories 9.3 and 9.2 respectively) poses a significant threat to priority birds across the region. Some persistent, bioaccumulative and toxic substances such as polychlorinated biphenyls (PCBs), pesticides and polybrominated diphenyl ethers (PBDEs), can pose a significant threat to fish-eating birds, but the threshold levels and effects are not entirely understood. Research to better understand these effects in priority species was identified as an important conservation action (Table 23). Other conservation actions focus on identifying and eliminating sources of persistent, bioaccumulative and toxic substances (e.g., mercury, PBDEs) from entering aquatic environments, implementing BMPs to reduce potential risks to aquatic birds and their habitats resulting from agricultural production (e.g., nutrient management), improving habitat quality through maintaining naturally-vegetated riparian areas, promoting the inclusion of effective protection and emergency response measures within environmental policies and regulations to prevent or mitigate oil spills, industry outfalls and other chemical spills, promoting the use of IPM programs to reduce pesticide use in upland agricultural areas as well as monitoring and enforcing compliance with laws, policies and regulations at all levels (Table 23).

Ingestion of toxic lead sinkers and jigs (sub-category 5.4) by waterbirds (e.g., Common Loon) and waterfowl (e.g., Common Merganser) was also assessed as a medium-magnitude threat to

some priority species using waterbodies in BCR 13 ON. Loons and other fish-eating birds ingest lead sinkers when consuming lost bait fish with the line still attached, while others mistake them for food items, such as seeds or shelled invertebrates. The ingestion of a single lead sinker or lead-headed jig is sufficient to expose a loon or other bird to a lethal dose of lead (Scheuhammer et al. 2003). In addition to acute and lethal poisoning, birds with lead poisoning often have physical and behavioural changes that may not be obvious. These changes include loss of balance, inability to fly, trouble feeding, mating, nesting and caring for its young. Strengthening regulations concerning the use of lead fishing tackle is suggested in Table 23.

The emerging potential threat to waterbirds and waterfowl on the Great Lakes and other large waterbodies from the installation of offshore wind power turbines was also considered in BCR 13 ON. Experience at northern European offshore wind energy developments has shown a range of effects on birds including changes to movement or migration patterns, potentially increasing energetic costs; and displacement from important feeding areas (equal to habitat loss; Petersen 2006; Fox et al. 2006; Guillemette and Larsen 2002). Given the relatively recent emergence of this threat in Ontario, and the lack of information (sub-category 12.1) surrounding the delineation of key offshore staging areas for waterfowl in particular, it was not possible to ascertain the scope and severity of this threat. However, recommended actions focus on research and monitoring (e.g., conducting periodic staging surveys in the Great Lakes to identify and monitor important staging areas) in Table 23.

The full list of threats to and information needs (sub-category 12.1) for priority species in the waterbodies of BCR 13 ON as well as the conservation objectives and recommended actions are presented in Table 23.

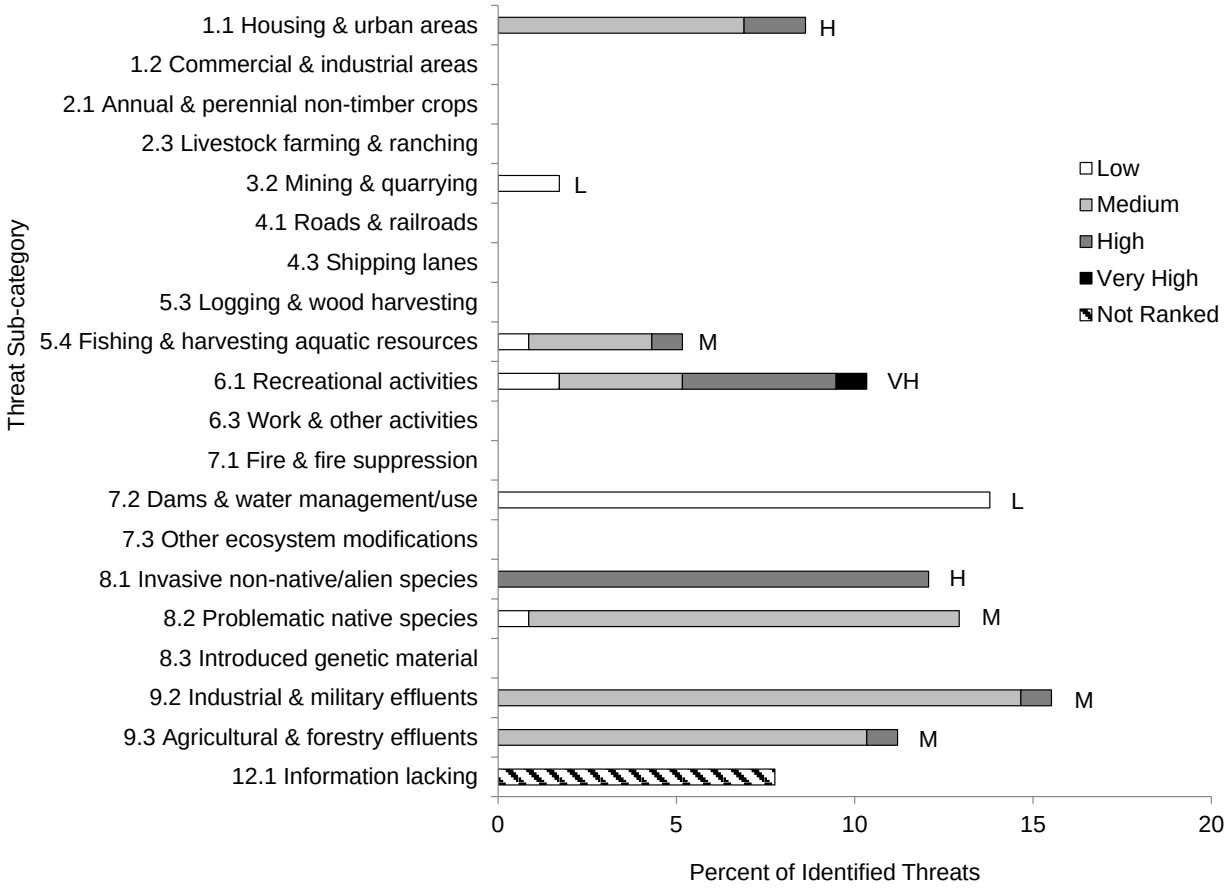

Figure 27. Percent of identified threats to priority species in waterbodies in each threat sub-category. Each bar represents the percent of the total number of threats identified in each threat sub-category in waterbodies habitat (for example, if 100 threats were identified in total for all priority species in waterbodies habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). Threat sub-category 12.1 Information lacking was not ranked. The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category. The overall magnitude of the threat in waterbodies habitat is shown at the end of each bar (also presented in Table 5). Only threats with a magnitude of medium or higher are typically assigned habitat-specific conservation objectives.

Table 23. Threats addressed, conservation objectives, recommended actions and list of priority species affected in waterbodies in BCR 13 ON.
Note: Issues such as climate change are not addressed in this table; instead, they are addressed in the Widespread Issues section.

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
1.1 Housing & urban areas	Degradation of waterbodies due to development	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain, enhance or restore water quality and habitat value	1.1 Site/area protection	Identify and conserve important aquatic habitats (e.g., through National Marine Conservation Areas).	Bald Eagle,[2] Belted Kingfisher, Canvasback, Caspian Tern, Common Goldeneye, Common Loon, Pied-billed Grebe, Redhead, Red-necked Grebe, Tundra Swan
				2.1 Site/area management	Enhance water quality and habitat value by establishing critical protection or buffer zones around breeding/foraging/staging areas.	
				2.3 Habitat and natural process restoration	Both sides of streams should have a minimum 30-metre wide naturally vegetated riparian area to provide and protect aquatic habitat. The provision of highly functional wildlife habitat may require total vegetated riparian widths greater than 30 metres (Environment Canada 2013a).	
				5.3 Private sector standards and codes	Develop BMPs and avoidance guidelines to minimize aquatic habitat degradation from urban development activities.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Bald Eagle

[1] While many priority species may benefit from proposed conservation actions, priority species not mentioned in this table are absent because 1) identified threats in this habitat are of low magnitude, or 2) they are migrants with no threats identified in this habitat.
[2] Species is listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, interim conservation objectives and recommended actions are presented here.

Table 23 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
5.4 Fishing & harvesting aquatic resources	Bycatch in fishing operations	2.4 Reduce incidental mortality	Reduce mortality from fisheries by-catch	5.2 Policies and regulations	Develop BMPs that minimize waterfowl and waterbird bycatch, such as the modification of fishing gear.	Common Loon, Lesser Scaup, Long-tailed Duck
				5.4 Compliance and enforcement	Continue to monitor and enforce compliance with laws, policies and regulations related to fisheries management.	
	Lead poisoning from ingestion of fishing tackle (e.g., lead sinkers)	2.2 Reduce mortality and/or sub-lethal effects from exposure to contaminants	Reduce/eliminate use of lead in outdoor activities	5.2 Policies and regulations	Strengthen regulations concerning the use of lead fishing tackle.	Common Loon, Common Merganser
6.1 Recreational activities	Disturbance to breeding, staging and/or foraging birds due to human recreation and human activity/access	4.1 Reduce disturbance from human activity and recreation	Minimize human disturbance of priority species	2.1 Site/area management	Restrict access to important breeding and/or stopover areas during migration (e.g., limit recreational boating and recommend unobtrusive distances for observing waterbirds).	Canvasback, Caspian Tern, Common Goldeneye, Common Loon, Common Merganser, Common Tern, Lesser Scaup, Pied-billed Grebe, Red-necked Grebe
				2.3 Habitat and natural process restoration	Both sides of streams should have a minimum 30-metre wide naturally vegetated riparian area to provide and protect aquatic habitat. The provision of highly functional wildlife habitat may require total vegetated riparian widths greater than 30 metres (Environment Canada 2013a).	
				4.3 Awareness and communications	Increase public awareness of the crucial role of stopover sites, and detrimental effects of disturbance on breeding, staging and/or foraging birds.	

Table 23 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Peregrine Falcon (*anatum/tundrius*)
8.1 Invasive non-native/alien species	Zebra mussels and round gobies linked to outbreaks of Type E botulism in Great Lakes fish-eating and mussel-eating birds.	3.5 Prevent and control the spread of non-native invasive species	Prevent and control the spread of invasive non-native species	2.2 Invasive/problematic species control	Prevent the introduction and spread of non-native invasive species into aquatic ecosystems (e.g., via ballast water) and develop eradication protocols for coordinated management efforts.	Bald Eagle,[2] Bonaparte's Gull, Canvasback, Caspian Tern, Common Goldeneye, Common Loon, Common Tern, Great Black-backed Gull, Horned Grebe (western population),[2] Lesser Scaup, Long-tailed Duck, Pied-billed Grebe, Redhead, Red-necked Grebe
				4.3 Awareness and communications	Raise public awareness of the need to prevent the introduction and spread of non-native invasive species.	
				5.2 Policies and regulations	Develop and/or strengthen policies or regulatory measures geared to preventing the introduction and spread of non-native invasive species.	
				8.2 Monitoring	Encourage participation in volunteer monitoring efforts (e.g., Invading Species Awareness Program) to help address threats from non-native invasive species on aquatic habitats.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Bald Eagle, Horned Grebe (western population)

Table 23 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
8.2 Problematic native species	Type E botulism can be a major source of mortality and appear episodically in lakes where it is endemic.	7.4. Improve understanding of causes of population declines (mortality)	Monitor outbreaks	8.1 Research	Identify the factors that create outbreaks and evaluate various management procedures (e.g., early carcass removal) to minimize impacts of outbreaks on species.	Bonaparte's Gull, Canvasback, Caspian Tern, Common Goldeneye, Common Loon, Common Tern, Great Black-backed Gull, Horned Grebe (western population),[2] Lesser Scaup, Long-tailed Duck, Pied-billed Grebe, Redhead, Red-necked Grebe
				8.2 Monitoring	Monitor botulism outbreaks and determine the impact of outbreaks on bird populations (e.g., beached bird surveys).	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Bald Eagle, Horned Grebe (western population)
9.2 Industrial & military effluents	Mortality, sub-lethal effects and/or habitat degradation from heavy metals and other environmental contaminants	5.1 Maintain natural food webs and prey sources	Reduce exposure to environmental contaminants	2.3 Habitat and natural process restoration	Both sides of streams should have a minimum 30-metre wide naturally vegetated riparian area to provide and protect aquatic habitat (i.e., minimize changes in water quality); 75% of stream length should be naturally vegetated (Environment Canada 2013a).	Bald Eagle,[2] Belted Kingfisher, Bonaparte's Gull, Caspian Tern, Common Goldeneye, Common Loon, Common Merganser, Common Tern,
				4.3 Awareness and communications	Undertake education and awareness activities regarding the impact of environmental contaminants on birds and their habitats.	

Table 23 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
				5.2 Policies and regulations	Identify and eliminate or reduce sources of persistent, bioaccumulative and toxic substances (e.g., mercury, polybromated diphenyl ether or PBDE) from entering aquatic environments (Ontario Ministry of the Environment 2009). Encourage the inclusion of effective protection and emergency response measures within environmental policies and regulations to prevent or mitigate oil spills, industry outfalls and other chemical spills.	Great Black-backed Gull, Horned Grebe (western population),[2] Lesser Scaup, Little Gull, Long-tailed Duck, Pied-billed Grebe, Redhead, Red-necked Grebe, Tundra Swan
				5.4 Compliance and enforcement	Continue to monitor and enforce compliance with laws, policies and regulations at all levels.	
		7.1 Improve population/demographic monitoring	Assess the effects of contaminants in birds	8.1 Research	Determine population-level effects of environmental contaminants on the vital rates of priority species.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Bald Eagle, Horned Grebe (western population), Peregrine Falcon (*anatum/tundrius*)
9.3 Agricultural & forestry effluents	Mortality, sub-lethal effects, reductions in prey populations, and habitat alteration	5.1 Maintain natural food webs and prey sources	Maintain, restore or improve water quality	2.3 Habitat and natural process restoration	Both sides of streams should have a minimum 30-metre wide naturally vegetated riparian area to provide and protect aquatic habitat (i.e., minimize changes in water quality); 75% of stream length should be naturally vegetated (Environment Canada 2013a).	Bald Eagle,[2] Belted Kingfisher, Common Goldeneye, Common Loon, Common Merganser, Great

Table 23 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
	(e.g., eutrophication) caused by fertilizers and pesticides			5.2 Policies and regulations	Identify and eliminate or reduce sources of persistent, bioaccumulative and toxic (PBTs) substances such as pesticides entering aquatic environments (Ontario Ministry of the Environment 2009).	Blacked-backed Gull, Horned Grebe (western population),[2] Lesser Scaup, Pied-billed Grebe, Redhead, Red-necked Grebe, Tundra Swan
				5.3 Private sector standards and codes	Develop or implement existing BMPs to reduce potential risks to aquatic birds and their habitats resulting from agricultural production (e.g., Ontario Ministry of Agriculture and Rural Affairs Best Management Practices Series at www.omafra.gov.on.ca/english/environment/bmp/series.htm). Promote the use of IPM programs to reduce pesticide use in upland agricultural areas.	
				5.4 Compliance and enforcement	Continue to monitor and enforce compliance with laws, policies and regulations at all levels.	
		7.1 Improve population/ demographic monitoring	Monitor and assess the effects of contaminants in birds	8.1 Research	Determine population-level effects of environmental contaminants on the vital rates of priority species.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Bald Eagle, Horned Grebe (western population), Peregrine Falcon (*anatum/tundrius*)

Table 23 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
12.1 Information lacking	Lack of knowledge – effects of offshore wind power operations on staging waterfowl	7.1 Improve population/ demographic monitoring	Improve understanding of the effects of offshore wind turbines on staging waterfowl	8.1 Research	Determine effects of offshore wind farms and the displacement of birds from staging habitat.	Canada Goose (Southern James Bay Population), Canvasback, Common Goldeneye, Lesser Scaup, Long-tailed Duck, Redhead, Tundra Swan
			Assess offshore population distribution and abundance	8.2 Monitoring	Conduct periodic offshore surveys to determine the distribution and abundance during staging and wintering periods.	
	Lack of knowledge (trend, population size, and/or distribution range)	7.1 Improve population/ demographic monitoring	Improve monitoring efforts to increase reliability of population status/trend	8.2 Monitoring	Evaluate alternative monitoring strategies for filling gaps in coverage for colonial waterbirds.	Bonaparte's Gull, Little Gull

Riparian

Riparian areas occur adjacent to standing or flowing water where the vegetation is influenced by the presence of water and is distinct from adjacent uplands. Riparian areas may be forested, shrubby or bare, depending on site conditions. While there are no available provincial land cover/land use estimates of the total area of riparian habitats in BCR 13 ON, they have been defined here as habitats within 30 m of water, and a map depicting the extent of derived riparian areas has been developed for illustrative purposes (Fig. 28).

Riparian areas are the transition zones between upland and aquatic environments, and form important corridors that link a variety of ecosystems together. These narrow strips along rivers, streams, lakes, wetlands and other bodies of water help maintain water quality, and provide shelter, breeding and foraging areas for birds and other wildlife.

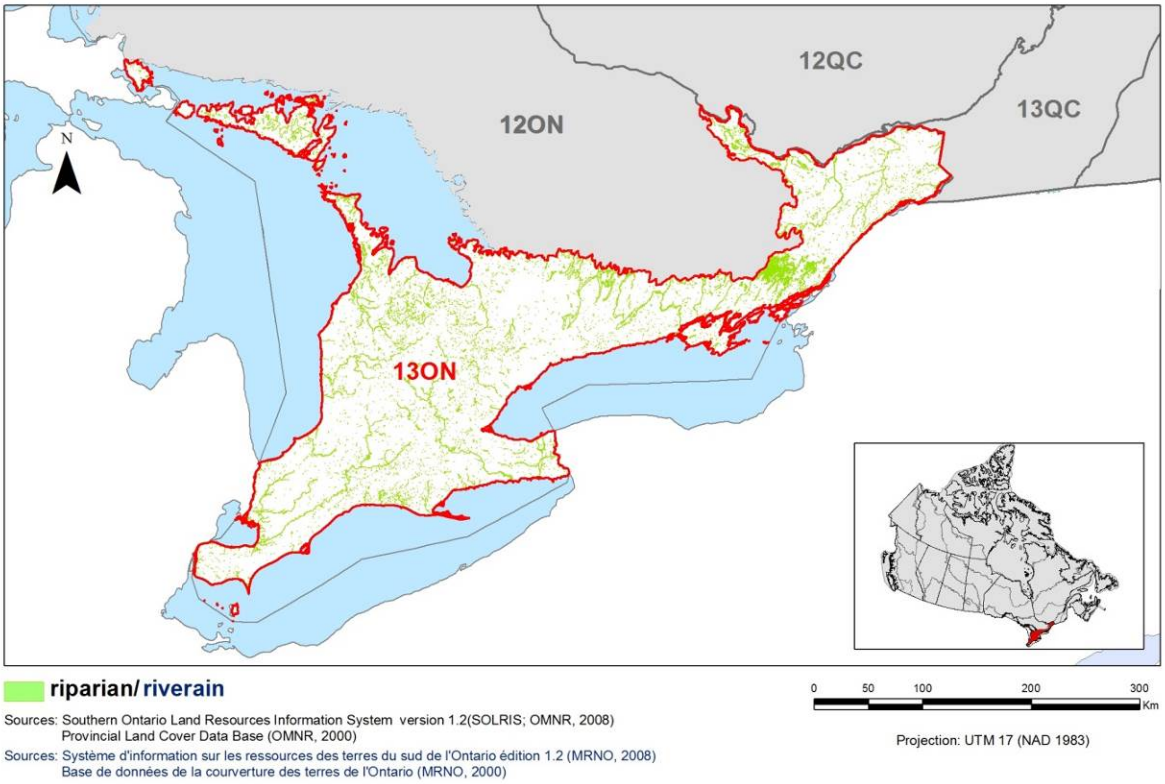

Figure 28. Map of riparian habitats in BCR 13 ON.

Riparian habitats are used extensively by nine priority species in BCR 13 ON (Table 24). These species use the terrestrial habitats for breeding and also forage in or around the aquatic habitats. Consequently, threats to priority species in riparian habitats share elements with other terrestrial and aquatic habitats. However, because of the restricted nature of aquatic habitat types, issues related to habitat loss, degradation and disturbance can be particularly acute.

Table 24. Priority species associated with riparian habitats in BCR 13 ON, habitat descriptions, population objectives and reasons for priority status.

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Sub-regional Concern[5]	Regional/Sub-regional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
Bald Eagle	Riparian mixed forest	Recovery objective[7]			Y	Y			Y
Bank Swallow	Riparian slopes, banks and bluffs	Increase	Y				Y		
Belted Kingfisher	Rivers, riparian banks and bluffs	Increase				Y			
Black-crowned Night-Heron	Rivers (foraging)	Assess/Maintain				Y			
Common Merganser	Riparian mixed forest	Maintain current				Y			
Louisiana Waterthrush	Riparian mixed and deciduous forest	Recovery objective	Y	Y	Y	Y		Y	Y
Northern Rough-winged Swallow	Earthen banks	Increase				Y		Y	
Spotted Sandpiper	Riparian grasslands, river banks	Increase				Y		Y	
Wood Duck	Forested riparian areas	Increase				Y			

Habitat loss from urban development and agricultural intensification (threat sub-categories 1.1, and 2.1; Fig. 29) as well as the loss of mature riparian forest by logging practices (sub-category 5.3) were determined to be high and medium overall magnitude threats to priority species. Maintaining naturally vegetated riparian areas to provide and protect aquatic habitat, retaining important bird features such as cavity nesting trees, and including guidelines for the protection of riparian nesting species in municipal official plans were identified as important conservation actions to protect riparian birds (Table 25).

[1] Habitat descriptions, in most cases, follow definitions under the Land Cover Classification System (LCCS; see Kennedy et al. 2012).
[2] Assessed by COSEWIC as E, Endangered; T, Threatened; SC, Special Concern.
[3] Species listed on Schedule 1 of SARA as E, Endangered; T, Threatened; SC, Special Concern.
[4] Species listed as Endangered, Threatened or Special Concern on the SARO List.
[5] Regional refers to BCR-wide (i.e., all jurisdictional data were used for the entire BCR) while sub-regional refers to the Ontario portion of the BCR only (i.e., Ontario BCR data were used).
[6] Only the landbird group distinguishes stewardship species from other priority species (see Panjabi et al. 2005).
[7] Species listed on Schedule 1 of SARA and/or SARO, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, the interim population objective for the Bald Eagle in BCR 13 ON is: Assess/Maintain.

Human disturbance (sub-category 6.1) related primarily to recreational activities was identified as a threat of high overall magnitude to priority birds in BCR 13 ON. Restricting access to and buffering important riparian nesting areas during the breeding season or stopover areas during migration could be beneficial for priority species that are particularly sensitive to disturbance or those that nest in colonies, such as Bank Swallows or Black-crowned Night-Herons.

Degradation of riparian habitats by direct and indirect sources of pollutants from industry and agriculture poses a significant threat to priority birds in portions of the region where these activities occur. Degradation of riparian habitats from nutrient inputs (e.g., chemical fertilizers and manure), and agricultural pesticides (sub-category 9.3) and industrial chemicals (sub-category 9.2), were identified as medium and high overall magnitude threats to priority species, respectively (Table 25). Conservation actions focus on implementing BMPs to reduce potential risks to aquatic birds and their habitats resulting from agricultural production (e.g., nutrient management), improving habitat quality through maintaining naturally vegetated riparian areas, promoting the inclusion of effective protection and emergency response measures within environmental policies and regulations to prevent or mitigate oil spills, industry outfalls and other chemical spills, promoting the use of IPM programs to reduce pesticide use in upland agricultural areas as well as monitoring and enforcing compliance with laws, policies and regulations at all levels (Table 25).

Livestock access to riparian zones (sub-category 2.3) was identified as a medium overall magnitude threat to priority species, as it can adversely affect riparian plant and animal communities as well as water quality through sediment, bacterial and nutrient loading in rivers and lakes (Abouguendia 2001). The protection of sensitive riparian habitats through land use planning, the provision of buffers between developed/agricultural areas and rivers, and the retention of important bird features such as cavity nesting trees, were identified as important conservation actions to protect riparian birds (Table 25).

Southern Ontario has the highest density of roads of any region in Canada (Ontario Biodiversity Council 2010), and the construction, maintenance and use by vehicles of these networks pose risks to bird populations and the habitats upon which they rely (Kociolek et. al. 2011). In BCR 13 ON, this was assessed as a medium overall threat to priority species in riparian habitats (sub-category 4.1). The effects of roads on wildlife depend on their location, density of road corridors and their level of use. Few natural areas in southwestern and central Ontario are more than 1.5 km from existing roads (Ontario Ministry of Natural Resources 2009). Roads between and within urban centres can have both direct and indirect effects on birds and other wildlife, including individual species disturbance attributed to noise and dust, habitat loss, fragmentation and degradation (loss of suitable nest sites, destruction of nest sites, decline of prey species), indirect mortality from increased predator/prey contact, and increased exposure to invasive species. Recommended riparian habitat conservation actions seek to mitigate the effects of roads through the implementation of BMPs or mitigation guidelines to avoid habitat loss and degradation. The Widespread Issues section of this strategy addresses mortality from collisions with vehicles.

The full list of threats to and information needs (sub-category 12.1) for priority species in riparian habitats of BCR 13 ON as well as the conservation objectives and recommended actions are presented in Table 25.

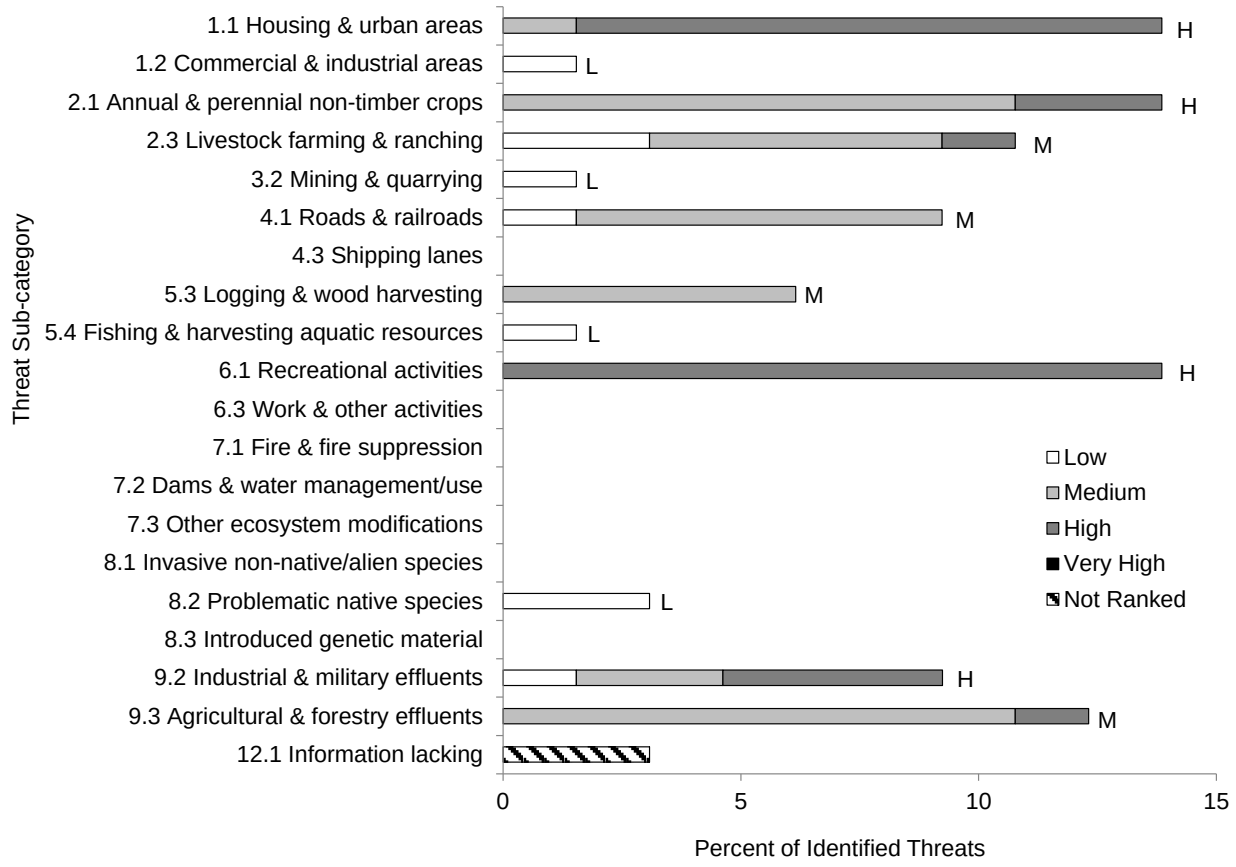

Figure 29. Percent of identified threats to priority species in riparian habitats in each threat sub-category.

Each bar represents the percent of the total number of threats identified in each threat sub-category in riparian habitat (for example, if 100 threats were identified in total for all priority species in riparian habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). Threat sub-category 12.1 Information lacking was not ranked. The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category. The overall magnitude of the threat in riparian habitat is shown at the end of each bar (also presented in Table 5). Only threats with a magnitude of medium or higher are typically assigned habitat-specific conservation objectives.

Table 25. Threats, conservation objectives, recommended actions and list of priority species affected in riparian habitat in BCR 13 ON.
Note: Issues such as mortality from collisions with human-made structures and vehicles, and climate change, are not addressed in this table; instead, they are addressed in the Widespread Issues section.

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
1.1 Housing & urban areas	Loss of riparian areas due to development	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain, enhance or restore quantity, quality and diversity of riparian habitats across the landscape	2.1 Site/area management	Ensure presence of important bird features (e.g., cavity nesting trees, natural vegetation cover, earthen banks) as appropriate to the priority species (e.g., Common Merganser, Wood Duck, Bank Swallow)	Bald Eagle,[2] Bank Swallow, Belted Kingfisher, Black-crowned Night-Heron, Common Merganser, Northern Rough-winged Swallow, Spotted Sandpiper, Wood Duck
				2.3 Habitat and natural process restoration	Both sides of streams should have a minimum 30-metre wide naturally vegetated riparian area (buffer) to provide and protect aquatic habitat. The provision of highly functional wildlife habitat may require total vegetated riparian widths greater than 30 metres (Environment Canada 2013a) 75% of stream length should be naturally vegetated (Environment Canada 2013a). Urbanized watersheds should maintain less than 10% impervious land cover in order to preserve the abundance and biodiversity of aquatic species. Significant impairment in stream water quality and quantity is highly likely above 10% impervious land cover and can often begin before this threshold is reached. In urban systems that are already degraded, a second	

[1] While many priority species may benefit from proposed conservation actions, priority species not mentioned in this table are absent because 1) identified threats in this habitat are of low magnitude, or 2) they are migrants with no threats identified in this habitat.
[2] Species listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, interim conservation objectives and recommended actions are presented here.

Table 25 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
					threshold is likely reached at the 25 to 30% level (Environment Canada 2013a).	
				5.2 Policies and regulations	Include guidelines for the protection of riparian nesting species in BMPs for municipal planning	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Bald Eagle, Louisiana Waterthrush
2.1 Annual & perennial non-timber crops	Loss of riparian areas due to agricultural development/ intensification (e.g., removal of hedgerows, riparian vegetation)	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain, enhance or restore quantity, quality and diversity of riparian habitats across the landscape	2.1 Site/area management	Ensure presence of important bird features (e.g., cavity nesting trees, natural vegetation cover, earthen banks) as appropriate to the priority species (e.g., Common Merganser, Wood Duck, Bank Swallow)	Bald Eagle,[2] Bank Swallow, Belted Kingfisher, Black-crowned Night-Heron, Common Merganser, Northern Rough-winged Swallow, Spotted Sandpiper, Wood Duck
				2.3 Habitat and natural process restoration	Both sides of streams should have a minimum 30-metre wide naturally vegetated riparian area (buffer) to provide and protect aquatic habitat. The provision of highly functional wildlife habitat may require total vegetated riparian widths greater than 30 metres (Environment Canada 2013a) 75% of stream length should be naturally vegetated (Environment Canada 2013a). Urbanized watersheds should maintain less than 10% impervious land cover in order to preserve the abundance and biodiversity of aquatic species. Significant impairment in stream water quality and quantity is highly likely above 10% impervious land cover and can often begin	

Table 25 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
					before this threshold is reached. In urban systems that are already degraded, a second threshold is likely reached at the 25 to 30 percent level (Environment Canada 2013a).	
				5.2 Policies and regulations	Include guidelines for the protection of riparian nesting species in BMPs for municipal planning	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Bald Eagle, Louisiana Waterthrush
2.3 Livestock farming and ranching	Degradation of aquatic riparian habitats from livestock access (e.g., reduced vegetative cover, bacterial, sediment and nutrient loading)	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain, enhance or restore quantity, quality and diversity of riparian habitats across the landscape	2.1 Site/area management	Maintain/restore riparian buffers to reduce erosion and runoff, and provide foraging and nesting habitat for birds.	Bank Swallow, Belted Kingfisher, Northern Rough-winged Swallow, Spotted Sandpiper
				2.3 Habitat and natural process restoration	Restore and enhance aquatic riparian habitats through fencing, grazing management, and planting of native riparian vegetation.	
				5.3 Private sector standards and codes	Restrict livestock access to surface water and provide alternate water sources	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Louisiana Waterthrush

Table 25 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
4.1 Roads & railroads	Habitat loss and degradation from the construction and maintenance of transportation networks	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Reduce/ eliminate habitat loss, fragmentation and/or degradation from the construction and maintenance of road networks and associated infrastructure	5.3 Private sector standards and codes	Develop and/or implement existing BMPs or mitigation guidelines to avoid habitat loss, fragmentation and/or degradation from road construction and maintenance of road networks.	Black-crowned Night-Heron, Common Merganser, Northern Rough-winged Swallow, Spotted Sandpiper, Wood Duck
5.3 Logging and wood harvesting	Loss of mature riparian forest (scarcity of cavities, nesting or perching trees) due to logging.	1.4 Maintain important bird habitat features on the landscape	Restore important bird features in riparian habitat	2.1 Site/area management	Retain important habitat features such as wildlife trees (e.g., stick nests, cavity trees) and downed woody debris (see *A land manager's guide to conserving habitat for forest birds in southern Ontario*, Ontario Ministry of Natural Resources 2011).	Bald Eagle,[2] Belted Kingfisher, Common Merganser, Wood Duck
				2.3 Habitat and natural process restoration	Both sides of streams should have a minimum 30-metre wide naturally vegetated riparian area (buffer) to provide and protect aquatic habitat; 75% of stream length should be naturally vegetated (Environment Canada 2013a).	
				5.2 Policies and regulations	Include guidelines for the protection of riparian nesting species in BMPs for municipal planning.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Bald Eagle

Table 25 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
6.1 Recreational activities	Disturbance to breeding, staging and/or foraging birds due to human recreation and human activity/access	4.1 Reduce disturbance from human activity and recreation	Minimize human disturbance of priority species in riparian habitats	2.1 Site/area management	Restrict access to important breeding and/or stopover areas during migration.	Bald Eagle,[2] Bank Swallow, Belted Kingfisher, Black-crowned Night-Heron, Common Merganser, Northern Rough-winged Swallow, Spotted Sandpiper, Wood Duck
				2.3 Habitat and natural process restoration	Both sides of streams should have a minimum 30-metre wide naturally vegetated riparian area to protect aquatic habitat from disturbance. The provision of highly functional wildlife habitat may require total vegetated riparian widths greater than 30 metres (Environment Canada 2013a).	
				4.3 Awareness and communications	Increase public awareness of the crucial role of stopover sites, and detrimental effects of disturbance on breeding, staging and/or foraging birds.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for a federal/ provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Bald Eagle[2], Louisiana Waterthrush
9.2 Industrial and military effluents	Mortality, sub-lethal effects and/or habitat degradation from heavy metals and other environmental contaminants	1.5 Reduce habitat degradation from contaminants	Maintain, restore or improve riparian habitat quality	2.3 Habitat and natural process restoration	Both sides of streams should have a minimum 30-metre wide naturally vegetated riparian area to provide and protect aquatic habitat (i.e., minimize changes in water quality); 75% of stream length should be naturally vegetated (Environment Canada 2013a).	Bald Eagle,[2] Bank Swallow, Belted Kingfisher, Black-crowned Night-Heron, Common Merganser
				4.3 Awareness and communications	Undertake education and awareness activities regarding the impact of environmental contaminants on birds and their habitats.	
				5.2 Policies and regulations	Work with industry and policy makers to reduce the quantity of toxic chemicals released into the environment	

Table 25 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
					Encourage the inclusion of effective protection and emergency response measures within environmental policies and regulations to prevent or mitigate oil spills, industry outfalls and other chemical spills.	
				5.4 Compliance and enforcement	Continue to monitor and enforce compliance with laws, policies and regulations at all levels.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for a federal/ provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Bald Eagle
9.3 Agricultural & forestry effluents	Mortality, sub-lethal effects, reductions in prey populations, and habitat alteration (e.g., eutrophication) caused by fertilizers and pesticides	5.1 Maintain natural food webs and prey sources	Maintain, restore or improve riparian habitat quality	2.3 Habitat and natural process restoration	Both sides of streams should have a minimum 30-metre wide naturally vegetated riparian area to provide and protect aquatic habitat (i.e., minimize changes in water quality); 75% of stream length should be naturally vegetated (Environment Canada 2013a).	Bald Eagle,[2] Bank Swallow, Belted Kingfisher, Black-crowned Night-Heron, Common Merganser, Spotted Sandpiper, Wood Duck
				4.3 Awareness and communications	Undertake education and awareness activities regarding the impact of environmental contaminants on birds and their habitats.	
				5.2 Policies and regulations	Work with industry and policy-makers to reduce the quantity of toxic chemicals released into the environment	

Table 25 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
				5.3 Private sector standards and codes	Develop or implement existing BMPs to reduce potential risks to aquatic birds and their habitats resulting from agricultural production (e.g., Ontario Ministry of Agriculture and Rural Affairs Best Management Practices Series at www.omafra.gov.on.ca/english/environment/bmp/series.htm). Promote the use of IPM programs to reduce pesticide use in upland agricultural areas.	
				5.4 Compliance and enforcement	Continue to monitor and enforce compliance with laws, policies and regulations at all levels.	
		3.4 Implement recovery strategies for species at risk	Meet the legal requirements for federal/ provincial Species at Risk legislation	3.2 Species recovery	Develop and/or implement species at risk recovery strategies or management plans.	Bald Eagle, Louisiana Waterthrush
12.1 Information Lacking	Lack of information on factors causing population declines	7.4 Improve understanding of causes of population declines	Determine cause(s) of population decline	8.1 Research	Identify factors causing population decline and/or limiting population growth of aerial-foraging insectivores.	Bank Swallow
		7.1 Improve population/ demographic monitoring	Improve population/ demographic monitoring of aerial insectivores	8.2 Monitoring	Encourage submissions of current and historic nest record data to the Ontario Nest Records Scheme/Project NestWatch to improve understanding of changes in productivity.	

Table 25 continued

Threat Sub-category	Threat Addressed	Objective Category	Objective	Action Category	Recommended Actions	Priority Species Affected[1]
	Lack of knowledge (trend, population size, and/or distribution range)	7.1 Improve population/ demographic monitoring	Improve monitoring efforts to increase reliability of population status/trend	8.2 Monitoring	Improve monitoring efforts to increase reliability of population status/trend for colonial nesters not well sampled by the Breeding Bird Survey	

Section 3: Additional Issues

Widespread Issues

Some well-known conservation issues may not be identified in the literature as significant threats to populations of an individual priority species and therefore may not be captured in the threat assessment. However, these issues, while they may or may not be limiting factors for any individual species or population, contribute to avian mortality or decreases in fecundity across many species and thus warrant conservation attention. Usually these issues transcend habitat types and are considered "widespread." Examples of these issues include:

- Collisions with human-made structures (buildings, cars, utility/telecommunications towers and lines)
- Predation by domestic cats
- Pollution/pesticides/oil spills
- Climate change

Because the widespread issues do not fit into the standard presentation format used in the BCR strategies, they are presented separately here. Human-related avian mortality across all sectors was standardized and compared in Calvert et al. (2013).

Collisions

The network of roads, transmission lines, communications towers and human settlements is extensive in BCR 13 ON. Birds in some portions of this region are exposed to a substantial risk of collisions with buildings, vehicles, communications towers and an increasing number of wind turbines.

Buildings

Collisions with glass windows or reflective panels on buildings are believed to be a significant source of bird mortality in Canada. Estimates of mortality from collisions with houses in Canada (including birds using feeders) range from approximately 15.8–30.5 million birds per year (Machtans et al. 2013). Mortality from collisions with buildings of fewer than 12 storeys is estimated at approximately 0.3–11.4 million birds/year, and for all cities in Canada with tall buildings in an urban core, the estimate is 13,000–256,000 birds/year (Machtans et al. 2013). The total estimate of mortality from collisions with buildings in Canada is therefore between 16.1 and 42.2 million birds/year (Machtans et al. 2013).

Data from Canada and the northeastern United States reveal that 163 species of birds of 32 families are known to have been killed by buildings. Some families and species of birds are disproportionately affected by collisions with buildings. *Parulidae* (warblers), *Fringillidae* (sparrows and allies) and *Regulidae* (kinglets) account for 70% of all bird deaths; the species most frequently killed are White-throated Sparrows (13.5% of all reported deaths) Golden-crowned Kinglets (10.2%), Dark-eyed Juncos (6.1%), Ovenbirds (5.3%), and Ruby-crowned

Kinglets (5.3%). The population-level effects of bird mortality from building strikes are unknown. Collisions with buildings were identified as a potential threat to a large number of priority landbirds, but the full extent of this source of mortality in the BCR is poorly understood. See Table 26 for conservation objectives and actions.

Wind Turbines

The 2,955 wind turbines in Canada as of 2011 have drawn considerable attention for their potential to cause mortality to birds and other species (notably bats). Two sources of mortality are typically associated with wind turbines: collisions with the turbines themselves, and the destruction of nests by turbine construction activities during the breeding season. On average, 5.9 birds are killed per turbine per year. Scaling up to a national level, an estimated 16,700 birds (ranging from 13,300–21,600) die from collisions with wind turbines each year (Table 26; Zimmerling et al. 2013).

Some species are particularly vulnerable to collisions with wind turbines, for example raptors flying along a land/water interface. For smaller, more common passerine species (warblers, thrushes, kinglets, etc.), the relatively small number of birds affected does not appear to pose a population-level threat. However, the anticipated proliferation of wind turbines means that we should continue to ensure that turbines are sited to avoid important bird habitats and migration corridors.

In addition to collision mortality, wind turbine construction and installation can result in the loss of habitat for birds. At the 43 wind farms in Canada for which data are available, total habitat loss per turbine is approximately 1.23 ha on average. Based on this average, the predicted total habitat loss for wind farms nationwide is 3,635 ha. Using published estimates of nest densities, the total number of affected nests, not accounting for construction that might occur outside the breeding season, is approximately 5,700 (Zimmerling et al. 2013). See Table 26 for conservation objectives and actions.

Communication Towers

There are currently almost 8,000 communication towers in Canada greater than 60 m high (Longcore et al. 2012), each of which can pose a hazard to birds during migration. Birds are attracted to the lights of communication towers and are killed when they collide with the structures and guy wires. Mortality increases exponentially with tower height, in part because the use of guy wires also increases with tower height. Poor weather also plays a significant role in increasing migrant fatality; foggy and cloudy conditions increase the lit area around towers and block celestial clues used by migrating birds. The result is that birds circle to exhaustion in the halo of artificial light, or collide with each other, the tower or its guy wires (American Bird Conservancy 2012).

Avian mortality at towers is unequally distributed among species and regions, but estimates suggest that over 220,000 birds are killed in Canada each year (Longcore et al. 2012).

Neotropical migrants in the families *Parulidae* (wood-warblers) and *Vireonidae* (vireos) are the species most commonly killed by communication towers. These families include threatened species and many that are of conservation concern in Canada and/or the United States. When considered in concert with mortality at towers in the United States (which is 20 times higher due to the larger number and greater height of towers in the United States), and the mortality from other stationary structures, mortality from collisions with communications towers may negatively affect the population trends of some birds. See Table 26 for conservation objectives and actions.

Power Lines

Birds may be killed by colliding with power lines, or they may be electrocuted. Species with high wing-loading and thus low maneuverability, such as waterfowl, appear particularly at risk for collisions (Bevanger 1998). Electrocutions are most likely for large birds such as raptors and herons, whose bodies are large enough to span the distances between wires and create a short circuit. Raptors' habit of using power poles as perches further increases their risk. However, estimates of total mortality due to collisions and electrocutions can vary widely (Manville 2005), and population-level impacts are difficult to determine. Canadian estimates are that 161,000 – 802,000 birds are killed annually by electrocution, and another 5.3–20.6 million birds are killed each year by colliding with electrical transmission lines (Calvert et al. 2013). See Table 26 for conservation objectives and actions.

Vehicles

There are over 1.4 million km of roads and hundreds of airports in Canada (World Bank Indicators 2012) that are often bordered by fences and vegetation providing convenient places for birds to perch, forage and nest. The paved surfaces can attract birds through the heat they emit, the puddles that form beside roads, and the salt and grit used for de-icing. Current estimates for one- and two-lane paved roads outside of major urban centres in Canada are that between 4.65 and 13.8 million birds are killed annually (Bishop and Brogan 2013).

Bird collisions with cars are influenced by the location of the road, proximity of vegetation and vehicle speed. Raptors and owls that hunt and forage near roads are particularly vulnerable, but many species that forage for grit and road salt or are otherwise attracted to roads have a high likelihood of being hit by vehicles. The population-level effects of this source of mortality are not known. See Table 26 for conservation objectives and actions.

Roads have both direct and indirect effects on birds and other wildlife, including mortality from vehicle strikes, individual species disturbance attributed to noise and dust, habitat loss and degradation (loss of suitable nest sites, destruction of nest sites, decline of prey species), indirect mortality from increased predator/prey contact, and increased exposure to invasive species. Physical effects include accelerating erosion from road surfaces, alteration of surface water flows and the timing of peak flows, erosion during flood events, increased landslides, and loss of soil productivity. For aquatic habitats, roads may introduce barriers to fish migration, cause changes in water temperature and alter stream flow regimes (Global Forest Watch 2000).

Predation by Domestic Cats

Based on the number of pet cats in Canada and published kill rates by cats elsewhere, roughly 204 million birds (range 105–348 million) are killed by domestic and feral cats in Canada each year (Blancher 2013). The broad range on this estimate reflects imprecise information on the average number of bird kills per cat, especially for rural and feral cats, and a lack of information on the number of feral cats (versus owned or pet cats) in Canada.

The birds most susceptible to cat predation are those that nest or forage on or near the ground or spend substantial time in human-dominated landscapes (both rural and urban) where cats are abundant. The proportion of Canada's birds killed by cats is higher if additional cat predation when migrating through, or wintering in, the U.S. is factored in.

Without detailed study of the individual species affected, it is difficult to assess whether mortality caused by cat predation impacts population trends of birds in Canada. Nevertheless, it is likely that many species of birds are potentially vulnerable to population effects at the local scale in southern Canada.

The distribution of mortality from domestic cats reflects, to a large extent, the distribution of the human population. With roughly one third of all Canadians inhabiting BCR 13 ON, it is expected that the mortality from domestic cats in this region is substantial. However, the population level effects of cat predation, the species affected, and the regional or BCR-scale impacts are poorly known. An improved understanding of this potentially significant threat is needed, and this need for improved information is reflected in the suggested conservation actions. In addition, actions to educate the public about the easily avoided mortality of birds from domestic cats and to better understand whether individual species are significantly affected would be of benefit (Table 26).

Pollution

Pollution caused by industrial chemicals, pesticides and heavy metals can have both direct and indirect effects on survival and reproduction in birds. Sometimes the effects of exposure to pollutants are unexpected and do not result in immediate, measurable effects on bird populations (Eeva and Lehikoinen 2000; Franceschini et al. 2008, North American Bird Conservation Initiative, U.S. Committee 2009; Mineau 2010). However, persistent exposure can result in sharp declines in bird populations, as happened with Peregrine Falcons in eastern Canada prior to the ban of the chemical DDT. See Table 26 for conservation objectives and actions.

Pesticides

The most recent estimate suggests that 0.96–4.4 million birds are killed by pesticides annually in Canada (Mineau 2010). Provinces such as Saskatchewan, which have a large agricultural land base, account for the majority of the estimated kill, and pesticides are thought to be an important contributor to the decline in grassland bird species in Canada (Mineau 2010). Pesticides can kill birds rapidly following contact or may have sub-lethal effects such as suppressed immune function and reduced stress response. There may also be indirect effects of

pesticides such as reduction in prey and changes in vegetation that reduce habitat quality. While the use of many toxic pesticides has been eliminated in Canada, migratory birds are still exposed while on wintering grounds in countries where their use is still permitted (Mineau 2010). See Table 26 for conservation objectives and actions.

In BCR 13 ON, pollution was determined to be a threat of high magnitude across all species and habitats, with the greatest threats to priority species in cultivated and managed areas. Modern, intensive agricultural practices require the use of heavy nutrient inputs and pesticide application (e.g., neonicotinoids), and these chemicals were found to threaten a wide variety of priority species either directly, by causing mortality or sub-lethal effects, or indirectly, by affecting the abundance of their invertebrate or small mammal prey.

Toxic Chemicals and Heavy Metals

Toxic organic chemicals and heavy metals released into the environment can also negatively affect bird populations. While some industrial chemicals such as PCBs are regulated, there is concern about new chemicals such as flame retardants (PBDE) that are used in computers, car parts and upholstery, and whose effects on wildlife are largely unknown (Environment Canada 2003). Scavengers experience toxic effects when they ingest lead shotgun pellets or bullet fragments embedded in carcasses of game animals, and loons and other waterbirds are exposed to lead from shotgun pellets, sinkers and jigs that they ingest either while collecting grit for their gizzards or by eating bait fish with line and sinker still attached (Scheuhammer and Norris 1996, Scheuhammer et al. 2003). In some areas, lead poisoning from sinkers and jigs can account for approximately half of the mortality of adult Common Loons on their breeding grounds (Scheuhammer and Norris 1996). Birds are also susceptible to bioaccumulation of other toxic metals such as methylmercury, selenium and others when they consume preys that have been exposed to these substances.

Release of industrial chemicals was considered to have an overall threat of medium magnitude across all priority species and habitats (Fig. 6) in BCR 13 ON, below that for agricultural contaminants. In recent decades, significant progress has been made at reducing the exposure of some waterbirds in the Great Lakes to contaminants (e.g., Pekarik and Weseloh 1998). Challenges still remain, and the effects on bird populations or food webs for many of the “new” persistent organic pollutants remain poorly understood. See Table 26 for conservation objectives and actions.

Oil Pollution

Oil may enter the environment either accidentally, through deliberate dumping, or in contained tailings ponds. It may be a single large event, as occurred in the Gulf of Mexico in 2010, or numerous smaller events. Annual estimates are that between 217,800 and 458,600 birds are killed by ship-source oil spills annually (Calvert et al. 2013). Typically, diving birds are most at risk of oiling; however, any birds that come into contact with oil are vulnerable. Oil can affect birds through direct effects such as hypothermia (resulting from lost waterproofing of feathers following oil contamination), toxicity (from ingesting oil as they preen or by inhaling volatile organic compounds), and indirect effects, such as reduced prey availability and decreased

quality of habitat. While techniques exist to clean and rehabilitate oiled birds, many birds die before, during and after rescue attempts (Brown and Lock 2003).

The shipping trade in the Great Lakes St. Lawrence Seaway system is dominated by mining and agricultural products (80%), with fuel oil and petroleum products accounting for less than 10% of trade (Seaway Corporation 2012). The risk of catastrophic, accidental spills is small, and oil pollution was not identified as a significant population-level threat to any priority species in the region. However, the potential exists for increasing shipments of petroleum products in the future and associated adverse effects of chronic or catastrophic oil discharge. Ongoing enforcement and monitoring of oil discharge is necessary for the protection of birds of the Great Lakes. In addition to the Great Lakes themselves, inland habitats within BCR 13 ON may also be at future risk given the potential for expansion of land-based shipments of petroleum products through southern Ontario such as Enbridge's Eastern Canadian Refinery Access Initiative (see www.enbridge.com/line9). See Table 26 for conservation objectives and actions.

Table 26. General conservation objectives and actions associated with bird mortality from collisions pollution and predation by domestic cats

Table 26 continued

Threats Addressed	Threat Sub-category	Objective	Objective Category	Recommended Actions	Action Category	Example Priority Species Affected
Collision mortality						
Collisions with buildings cause bird mortality.	1.1 Housing and urban areas 1.2 Commercial and industrial areas	Reduce incidental mortality from collisions with windows/ buildings	2.7 Reduce incidental mortality from collisions	Follow BMPs for bird-friendly buildings including using bird-friendly glass, reducing reflection from windows, providing visual markers to enable birds to perceive windows, and reducing light pollution.	2.1 Site/area management 5.3 Private sector standards and codes	All species
Collisions with wind turbines cause bird mortality.	3.3 Renewable energy	Reduce incidental mortality from collisions with wind turbines	2.7 Reduce incidental mortality from collisions.	Follow BMPs for reducing bird mortality when designing and locating wind turbines (see *Wind Turbines and Birds: A Guidance Document for Environmental Assessment*, Environment Canada 2007). Ensure that offshore wind energy developments will not present significant migration barriers. Locate offshore wind energy developments away from seabird breeding colonies and important waterbird foraging areas. Utilize techniques such as radar monitoring to determine pre-construction flight paths and assess the degree to which wind farms present migration barriers, and infrared camera systems to	2.1 Site/area management 5.3 Private sector standards and codes 1.2 Resource and habitat protection 8.2 Monitoring	All species

Table 26 continued

Threats Addressed	Threat Sub-category	Objective	Objective Category	Recommended Actions	Action Category	Example Priority Species Affected
				quantify strike rates.		
Collisions with communications towers cause bird mortality, particularly during migration.	1.2 Commercial and industrial areas	Reduce incidental mortality from collisions with human-made structures	2.7 Reduce incidental mortality from collisions.	Follow BMPs for reducing mortality to birds when constructing new communications towers. Switch off solid lights on existing towers and ensure that remaining lights have a synchronized, complete dark phase. Take steps to ensure that new towers avoid guy wires and minimize height, and avoid topographic locations where migrating birds are likely to be found in abundance. Retrofit existing towers to adhere to as many guidelines as possible.	2.1 Site/area management 5.3 Private sector standards and codes	All species
Collisions with power lines and accidental electrocution cause bird mortality.	4.2 Utility and service lines	Reduce mortality from collisions with utility lines/ transmission towers	2.7 Reduce incidental mortality from collisions.	In high-risk areas, retrofit power lines so that the risk of electrocution of raptors is minimized. In new developments, locate transmission lines underground. Use markers or paint to increase visibility of power lines in high-strike areas. Avoid siting lines over or near wetlands.	2.1 Site/area management	Waterfowl, Herons, Raptors

Table 26 continued

Threats Addressed	Threat Sub-category	Objective	Objective Category	Recommended Actions	Action Category	Example Priority Species Affected
Collisions with vehicles cause bird mortality.	4.1 Roads and railroads	Reduce mortality from collisions with vehicles	2.7 Reduce incidental mortality from collisions.	Erect road signs or speed bumps to lower vehicle speeds where bird activity is frequent. Remove plants that are food sources for birds from roadsides and medians. Landscape along roads using taller trees and bushes to cause birds to fly higher. Encourage the use of salt management plans to avoid unnecessary use of particulate salt (a bird attractant) on roads. Avoid locating roads in valuable bird habitat.	2.1 Site/area management 1.1 Site/area protection	American Kestrel, Bald Eagle, Barn Owl, Barn Swallow, Common Nighthawk, Killdeer, Eastern Whip-poor-will, Eastern Kingbird, Red-headed Woodpecker, Short-eared Owl
Population effects of collisions are unknown.	12.1 Information lacking	Improve understanding of population effects of mortality from collisions	7.4 Improve understanding of causes of population declines.	Assess the biological importance of bird kills from all sources of collisions.	8.1 Research	All species
Environmental contaminants						
Mortality, sub-lethal effects, reductions in prey populations and habitat alteration caused by exposure to/use of pesticides.	9.3 Agricultural & forestry effluents	Reduce mortality and sub-lethal effects of pesticides on birds Reduce the effects of pesticides on prey species	2.1 Reduce mortality and/or sub-lethal effects from pesticide use. 5.1 Maintain natural food webs and prey sources.	Substantially reduce the use of pesticides in Canada. Where elimination is not possible, they should be used as part of an integrated pest management system. Improve regulation of pesticides in Canada to reduce bird mortality.	5.2 Policies and regulations 5.3 Private sector standards and codes	**Direct or indirect poisoning by pesticides:** Bald Eagle, Peregrine Falcon (*anatum/tundrius*), Northern Rough-winged Swallow, Bank Swallow, Barn Swallow, Chimney Swift, Killdeer,

Table 26 continued

Threats Addressed	Threat Sub-category	Objective	Objective Category	Recommended Actions	Action Category	Example Priority Species Affected
						Bobolink **Reductions in prey due to pesticide use:** Barn Swallow (Aerial Insectivores), Black Tern, Common Nighthawk
Mortality from ingestion of lead shot or tackle.	5.1 Hunting & collecting terrestrial animals 5.4 Fishing & harvesting aquatic resources	Reduce mortality and sub-lethal effects of lead shot and fishing tackle on birds	2.2 Reduce mortality and/or sub-lethal effects from exposure to contaminants.	Work with hunters, anglers and industry to eliminate the exposure of birds to shot, sinkers and jigs made of lead. Enforce the use of non-toxic shot in waterfowl hunting, and encourage adoption of non-toxic alternatives in target shooting, upland game bird hunting, and fishing.	4.3 Awareness and communications 5.4 Compliance and enforcement	Bald Eagle, Common Loon, Green-winged Teal, Lesser Scaup
Mortality from heavy metals and other contaminants.	9.2 Industrial & military effluents	Reduce mortality from heavy metals and other contaminants	2.2 Reduce mortality and/or sub-lethal effects from exposure to contaminants.	Work with industry and policy makers to reduce the quantity of heavy metals and other contaminants released into the environment.	5.3 Private sector standards and codes 5.2 Policies and regulations	**Heavy metals:** Common Goldeneye, Common Loon, Common Merganser **PCBs:** Bald Eagle, Common Goldeneye **Other contaminants:** Horned Grebe (western population), Peregrine Falcon (*anatum/tundrius*)

Table 26 continued

Threats Addressed	Threat Sub-category	Objective	Objective Category	Recommended Actions	Action Category	Example Priority Species Affected
Mortality of waterbirds from oil pollution.	9. Pollution	Reduce mortality from oil pollution	2.3 Reduce mortality and/or sublethal effects of oil pollution. 5.1 Maintain natural food webs and prey sources.	Improve monitoring and enforcement capacity to reduce chronic oil pollution from illegal dumping of bilge waste and cleaning of oil tanks. Improve education/outreach to make sure that the oil industry and its regulators are aware of the potential impacts on birds and take measures to prevent exposure of birds to oil.	5.4 Compliance and enforcement 4.3 Awareness and communications	**Lethal and sublethal effect of oil exposure:** Common Goldeneye, Common Loon, Lesser Scaup, Red Knot (*rufa*)
Population effects of pollution are unknown.	12.1 information lacking	Improve understanding of population effects of pollution	7.4 Improve understanding of causes of population declines.	Evaluate the effects of PBDEs and other chemicals on vital rates in birds. Evaluate the extent to which pesticides are reducing prey availability for aerial insectivores. Improve the ability to monitor and understand the effects of contaminant concentrations in birds. Continue to acquire information on oiling of waterbirds through programs like Birds Oiled at Sea.	8.1 Research 8.2 Monitoring	**PBDE exposure; effects unknown:** Peregrine Falcon (*anatum/tundrius*)
Predation by domestic cats						
Predation by domestic and feral cats.	8.1 Invasive non-native/alien	Reduce mortality from domestic and feral cats	2.4 Reduce incidental mortality.	Implement a “Cats Indoors!” Campaign following the guidelines of the American Bird Conservancy	5.3 Private sector standards and codes	Ground nesting or ground foraging species; species

Table 26 continued

Threats Addressed	Threat Sub-category	Objective	Objective Category	Recommended Actions	Action Category	Example Priority Species Affected
	species			(http://www.abcbirds.org/abcprograms/policy/cats/index.html). Work to reduce feral cat overpopulation through cat control regulations.	5.2 Policies and regulations	attracted to feeders; species inhabiting rural, suburban or urban areas
Population effects of cat predation are unknown.	12.1 Information lacking	Improve understanding of population effects of cat predation	7.4 Improve understanding of causes of population declines.	Evaluate which species are most vulnerable to cat predation. Investigate the population-level effects of cat predation through better monitoring of kill rates and the number of feral cats. Continue to monitor bird populations so changes in numbers and distributions can be identified and management of cats can be altered to reflect these changes. Conduct effectiveness monitoring to evaluate if mitigation activities are achieving the desired results.	8.1 Research 8.2 Monitoring	Ground nesting or ground foraging species; species attracted to feeders; species inhabiting rural, suburban or urban areas

Climate Change

The effects of climate change are already measurable in many bird habitats and have resulted in range shifts and changes in the timing of migration and breeding in some species (National Audubon Society 2009; North American Bird Conservation Initiative, U.S. Committee 2009). Birds in all habitats will be affected by climate change. The most vulnerable are predicted to be those that are dependent on oceanic ecosystems and those found in coastal, island, grassland, arctic and alpine habitats (North American Bird Conservation Initiative, U.S. Committee 2010). Changing climate may also facilitate the spread of disease, the introduction of new predators and the invasion of non-native species that alter habitat structure and community composition (North American Bird Conservation Initiative, U.S. Committee 2009; Faaborg et al. 2010). See Tables 27 and 28 for a summary of effects of climate change and conservation objectives.

A recent exercise used bioclimatic modelling to predict changes in bird species ranges based on anticipated climate change for different time periods and under different emissions scenarios (Lawler et al. unpubl.; Lawler et al. 2009). Bioclimatic models use statistical associations between the current range of a species and a suite of climate variables to predict future ranges under new climate conditions. The study focused on priority bird species currently found within Bird Conservation Planning Units in Canada. The results suggest that bird species turnover in Canada will be highest in northern BCRs as species ranges continue to shift northward in the coming decades (Fig. 30). In BCR 13 ON, the model predicts a gain of 9 species and a loss of 35 species for a total turnover (species gains + species losses) of 23%.

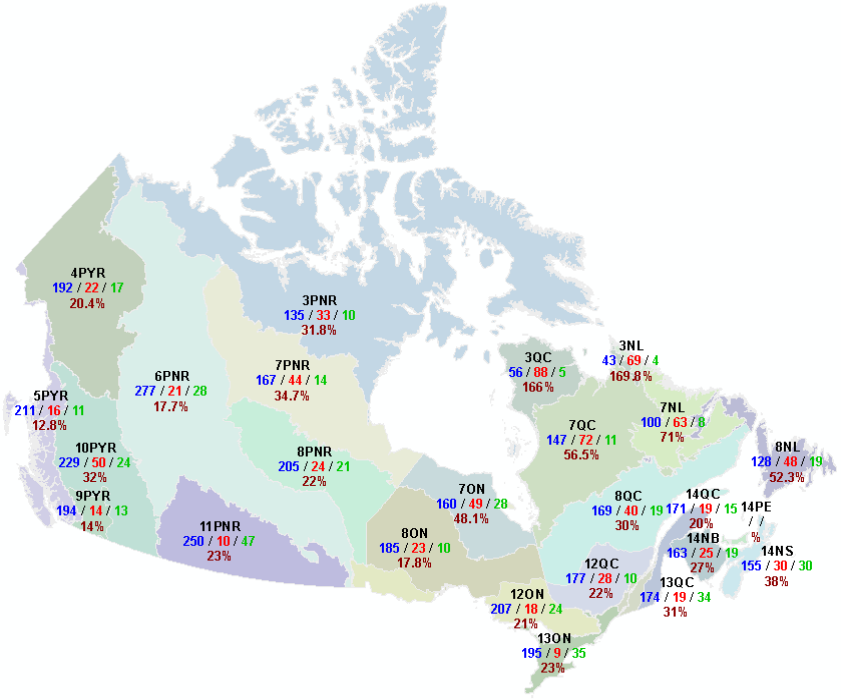

Figure 30. Number of species analyzed (blue), gained (red), lost (green) and the percent turnover (reddish brown) by Bird Conservation Sub-region.

The observed changes in climate have been less pronounced in BCR 13 ON in comparison to more northerly BCRs, such as BCR 7 ON (Environment Canada 2013d). Still, the changes have already resulted in measurable habitat and ecological change. A substantial reduction in ice cover on the Great Lakes through the late 1990s and early 21st century led to increased evaporation and a substantial and troubling drop in water levels (up to 1.3 m). Recent years of heavy ice cover have reversed this trend to some extent (Wang et al. 2010), but water surface temperatures remain elevated, and summertime evaporation has more than doubled since 1980 in Lakes Michigan and Huron (Hanrahan et al. 2010). These climate-related changes in ice cover, water levels and temperature may have profound effects on the migration and annual distribution of waterfowl populations (i.e., delayed or decreased migration to more southern latitudes; Brook et al. 2009), fish populations upon which many priority bird species prey (Jones et al. 2006), the regulation of invasive species (Hellmann et al. 2008), and may adversely affect plant diversity and habitat value of wetlands along the shores of the Great Lakes (Mortsch 1998).

Future climate effects may be pronounced in the upland habitats of BCR 13 ON as well. Climate modelling suggests that the conditions currently prevailing in ecoregion 6E (i.e., the northern portion of BCR 13 ON) could migrate as far north as the coast of Lake Superior by 2100 (McKenney et al. 2010; Ontario Biodiversity Council 2011). These rapid shifts in climate conditions will have consequences for the habitat found here, and could outpace the ability of trees and other plant species, for example, to keep pace with this rate of shift in their preferred climatic conditions (McKenney et al. 2010).

The global scale of predicted climate effects means that conditions encountered elsewhere in the range of BCR 13 ON's priority species must also be considered. Those species breeding to the north and migrating through the region face the consequences of the accelerated climate and habitat change observed at high latitudes (ACIA 2005), such as the potential drying of moist tundra or inundation of key coastal staging habitats in BCR 7 ON. To the south, sea-level rise may threaten the wintering habitats used by shorebirds (Galbraith et al. 2002), and populations of neotropical landbirds may be affected by changing climate and productivity on their wintering grounds (Wilson et al. 2011).

The highly complex interactions among ecosystem components and among the various stages in birds' annual cycles make precise predictions difficult. However, although uncertainty remains, it is clear that climate change and its associated habitat effects could significantly affect birds and other wildlife in BCR 13 ON (Table 27). Still, to maintain healthy bird populations in the face of a changing climate, conservation must be carefully planned and must be implemented so as to buffer birds from the negative effects of climate change wherever possible (Faaborg et al. 2010).

Table 27. Examples of the current and anticipated effects of climate change on bird populations in Canada and some affected bird species.

Note: The species shown here do not represent an exhaustive list, but instead provide examples of species where the effects of climate change have been suggested or documented.

Potential and Realized Effects of Climate Change	Examples of Species Affected
Mismatch between peak hatch and peak food abundance	Olive-sided Flycatcher, Black-bellied Plover, Lesser Scaup
Extended breeding season	Canada Goose, Wood Thrush
Habitat loss as a result of ecosystem changes (e.g., advances in treeline)	Yellow Rail, Least Bittern, Black Tern
Increase in severe weather events	Aerial Insectivores
Introduction of new predators and competitors	Common Tern, Caspian Tern
Changes in Great Lakes temperature affect marine productivity and food webs	Terns, Gulls

Table 28. Proposed conservation objectives and actions to address climate change.

Threats Addressed	Threat Sub-category	Objective	Objective Category	Recommended Actions	Action Category	Priority Species Affected
Climate change affects habitat and negatively affects survival and productivity of birds	11.1 Habitat shifting and alteration	Reduce greenhouse gas emissions	6.1 Support efforts to reduce greenhouse gas emissions	Support efforts to reduce greenhouse gas emissions.	5.2 Policies and regulations	All
		Mitigate the effects of climate change on bird habitat	6.2 Manage for habitat resilience as climate changes	Manage for habitat resilience to allow ecosystems to adapt despite disturbances and changing conditions. Minimize anthropogenic stressors (such as development or pollution) to help maintain resilience.	1.1 Site/area protection	
				Manage buffer areas and the matrix between protected areas to enhance movement of species across the landscape.	2.1 Site/area management	
				Manage ecosystems to maximize carbon storage and sequestration while simultaneously enhancing bird habitat.		
				Incorporate predicted shifts in habitat into landscape level plans (e.g., when establishing protected areas ensure the maintenance of north-south corridors to facilitate northward range shifts of bird species).	5.2 Policies and regulations	
Population-level effects of climate change are unknown	12.1 Information lacking	Improve understanding of climate change on	7.5 Improve understanding of potential effects of	Evaluate which species are most vulnerable to climate change and how to reduce climate change effects on those species.	8.1 Research	All

Table 28 continued

Threats Addressed	Threat Sub-category	Objective	Objective Category	Recommended Actions	Action Category	Priority Species Affected
		birds and their habitats	climate change	Investigate the cumulative effects of climate change. Investigate behavioural responses to climate change (such as range shifts, changes in demographic rates, and changes in timing of breeding and migration) through long-term studies. Continue to monitor bird populations so changes in numbers and distributions can be identified. Undertake monitoring to evaluate the effectiveness of mitigation activities.	8.2 Monitoring	

Research and Population Monitoring Needs

Population Monitoring

An estimate of population trend for each species is necessary for the development of elements 1 and 3 (Species Assessment and Population Objectives). However, there are many species for which we are currently unable to estimate a population trend (PT) score. These species were typically assigned a PT score of 3 and an associated population objective of "assess/maintain." The inability to estimate a PT score may be the result of a lack of monitoring data for the BCR as a whole or may be because information about certain species are not well captured by common monitoring techniques. To be able to effectively evaluate species believed to be of conservation concern, and to track those not yet of concern for future changes in status, we require more comprehensive monitoring that enables us to generate population trends for all species of birds in Canada. However, it is important to note that for some species, population trends are better understood at scales larger or smaller than the BCR unit, and lack of BCR-scale population trend data should not preclude acting to conserve these species.

Given that BCR 13 ON is heavily populated and road access is good, coverage of bird surveys here is satisfactory in comparison to many other regions in the country. Volunteer-based surveys such as the Breeding Bird Survey and Ontario Breeding Bird Atlas have good participation, and a variety of targeted surveys (e.g., the Eastern Waterfowl Survey, Great Lakes Decadal Waterbird Census, Ontario Marsh Monitoring Program) provide additional monitoring data for species not well covered by other surveys. Still, there are a number of gaps in monitoring information that could be filled with targeted surveys or enhancement of existing surveys. Table 29 provides some suggestions for how these gaps might be filled for the priority species of BCR 13 ON.

A recent Environment Canada review (Avian Monitoring Review Steering Committee 2012) of avian monitoring programs in Canada made the following recommendations for each of the four main species groups:

Landbirds

- develop options for on-the-ground monitoring across boreal Canada;
- evaluate the ability of migration monitoring and checklist surveys to contribute to Environment Canada's monitoring needs; and
- evaluate the feasibility and cost-effectiveness of improving demographic monitoring to help understand causes of population change.

Shorebirds

- develop more reliable sampling methods for counting shorebirds in migration to address concerns about bias; and
- increase Latin American involvement in monitoring shorebirds on the wintering grounds, including Red Knot.

Waterbirds

- evaluate alternative strategies for filling gaps in coverage for both colonial waterbirds and marsh birds;
- consider both costs and potential reduction in risks; and
- carry out any necessary pilot work to evaluate options.

Waterfowl

- develop strategies to reduce expenditures on the prairie and eastern waterfowl breeding surveys, while retaining acceptable precision in population estimates; and
- review the information needs and expenditures for arctic goose and duck banding programs

Table 29. Species group, monitoring methods and examples of potential priority species in BCR 13 ON for which there are currently not sufficient data to produce a reliable estimate of the demographic trend across the BCR.

Group	Potential Monitoring Methods	Examples of Priority Species
Landbirds	Increase the coverage of the Breeding Bird Survey or perform specific surveys of rare, discrete or cryptic birds whose populations are not well known.	Bank Swallow, Common Nighthawk, Eastern Whip-poor-will
Aerial insectivores	For species with a clumped distribution, conduct regular counts (e.g., Chimney Swift roosts; Bank Swallow colonies). Initial surveys may be needed to find the breeding areas, colonies or roosts. Implement or extend targeted twilight surveys for the Common Nighthawk and Eastern Whip-poor-will. These surveys could be based on the Nightjar Survey Network model (Center for Conservation Biology 2012).	Eastern Whip-poor-will, Common Nighthawk, Bank Swallow, Barn Swallow, Northern Rough-winged Swallow, Chimney Swift
Diurnal raptors	Sparsely distributed raptors that are not well represented by regular survey efforts such as the Breeding Bird Survey require targeted, species-specific monitoring efforts.	Peregrine Falcon (*anatum/tundrius*), Bald Eagle, Northern Harrier, Short-eared Owl
Shorebirds	Continue to monitor harvest rates of the Wilson's Snipe and American Woodcock for species management. Maintain the North American Woodcock Singing-ground Survey. Maintain the Ontario Shorebird Survey in order to monitor the abundance and distribution of shorebirds during the spring and fall migration.	American Woodcock, Piping Plover (*circumcintus*), Black-bellied Plover, Wilson's Snipe
Inland waterbirds	Support, refine and expand marsh-bird monitoring programs to improve population status and trend reliability.	Rails, Common Gallinule, Least Bittern

Table 29 continued

Group	Potential Monitoring Methods	Examples of Priority Species
Waterfowl	Maintain banding programs for priority species to monitor harvest rate for priority species, document movements, to quantify survival and obtain indicators of reproductive success. Maintain breeding waterfowl survey programs to track abundance and distribution for population status and harvest management	All Priority Breeding Waterfowl Species
	Conduct periodic surveys to identify and monitor importance of Great Lakes staging areas to relevant species.	Black Scoter, Surf Scoter, White-winged Scoter, Greater Scaup, Lesser Scaup, Long-tailed Duck, Common Merganser, Common Goldeneye
	Maintain mid-winter waterfowl monitoring in the Lower Great Lakes to document changes in abundance and distribution related to short and long-term climate change.	American Black Duck

Research

The focus of this section is to outline the main areas where a lack of information hindered the ability to understand conservation needs and make recommendations for suitable conservation actions. Some species or habitat-specific research and monitoring recommendations are made in Section 2 of this strategy (by habitat). Research objectives presented here are bigger picture questions and not necessarily a schedule of studies that are required to determine the needs of individual species. These include the following (in no particular order):

- Research on species at risk to understand regional biology, status and (potentially) trends, and the relationship of national trends and populations to local data.
- Research to understand and reverse the causes of population declines (e.g., aerial insectivores).
- Research to determine specific population connectivity and migration routes between breeding and wintering areas, using techniques such as genetic analysis, stable isotopes and geolocators.
- Research on nuisance species if management actions are not yet apparent or require validation.
- Determine the most significant parameters (e.g., season-specific survival, productivity) in the annual cycle of priority waterfowl species to guide monitoring and conservation actions.
- Determine what local factors (e.g., habitat features, food sources) affect nesting habitat selection and breeding success of priority waterfowl species.
- Research to determine specific impacts of development activities (e.g., mining, offshore wind development) on birds to properly understand the local and cumulative effects of these activities.

- Research to determine the population-level significance of bird mortality from collisions with anthropogenic structures of all types and predation by domestic cats. Identify particularly vulnerable species.
- Where they do not already exist, conduct research to support the development of sector-specific BMPs documents, with an emphasis on bird and biodiversity conservation. Monitor adherence to these BMPs and assess their effectiveness.
- Continue to engage in and support climate change research with respect to:
  - alteration and loss of coastal habitat and inland water level changes, particularly Great lakes coastal wetlands, beach/dunes and mud/sand flats; and effects on priority species
  - alteration and loss of terrestrial habitats, particularly shifting forest types
  - range expansion or contraction of priority bird species

Habitat loss is among the most important conservation issues in BCR 13 ON, and a number of the research needs are identified below that seek to quantify habitat supply and distribution, identify key habitats for priority species, determine threshold amounts or conditions for habitat, or understand the relationship between habitat management and birds' population responses. Although it is clear that significant habitat loss has occurred in BCR 13 ON, for many species of birds in Canada, limiting factors are poorly understood so that population trends cannot be explicitly linked to amount or condition of breeding habitat. Improving our understanding of the link between habitat and population status is a prerequisite for effective management.

- Improve and verify land cover and/or habitat mapping based upon the best possible remote sensing techniques, available imagery and ancillary datasets. Develop more accurate habitat classifications and associated habitat models, ensuring accuracy assessments are performed for these products.
- Map land cover changes that have occurred across the BCR between the baseline time periods established in BCR strategies and the current day in order to correlate habitat loss with species declines and assess the main types of habitat transitions that have occurred (e.g., wetland to urban development, old growth to managed forest, etc.).
- Combine up-to-date land cover information, additional data on bird densities, and detailed bird-habitat relationships for all priority species to allow for the calculation of quantitative habitat targets and to directly link conservation and population objectives.

Undertaking research will facilitate improvements to future iterations of BCR strategies, focus future implementation, and will also enable the development of new tools for conservation.

Threats Outside Canada

Many bird species found in Canada spend a large portion of their life cycle outside of the country (Fig. 31). These species face threats while they are outside Canada; in fact, threats to some migratory species may be most severe outside of the breeding season (Calvert et al. 2009). Of the 97 priority species in BCR 13 ON, 71 (73%) migrate to spend part of their annual life cycle outside Canada.

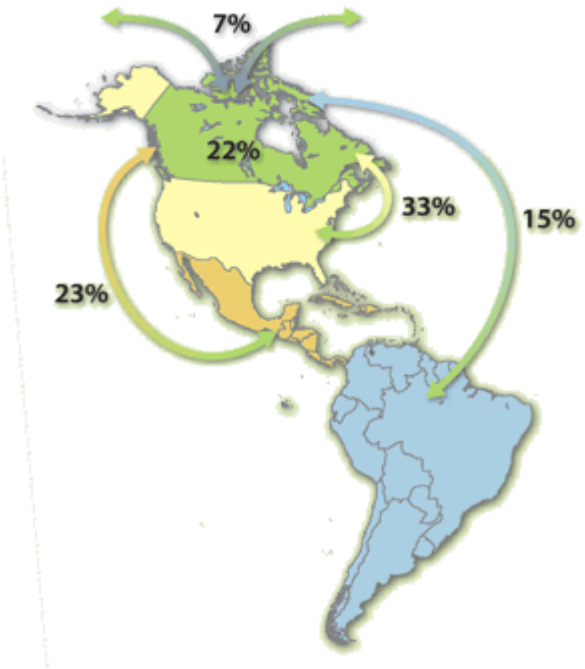

Figure 31. Percent of Canadian breeding birds that migrate to regions outside of Canada for part of their life cycle (North American Bird Conservation Initiative Canada 2012).

Similar to the assessment of threats facing priority species within Canada, we conducted a literature review to identify threats facing priority species while they are outside Canada. A lack of data was a pervasive issue for this exercise. For many species, little is known about threats they face during migration or while on their wintering grounds. Indeed, for some species, their wintering ranges and habitat use are only poorly known, if at all. There is also little information linking specific wintering areas to particular breeding populations, making it difficult to connect declines in breeding populations to potential problems on the wintering grounds. In addition, what data exist on wintering migrant species are heavily biased towards work done in the United States, and little research is available from Mexico, and Central and South America. While many of the threats identified in the United States likely affect species throughout their range, unique issues outside of the United States may have been missed. An absence of threats in a region may reflect that the necessary research has not yet been conducted (or may not be published in English). Because information on bird distributions during the non-breeding season

is limited, we were unable to assess the scope and severity of threats to priority species while they are outside of Canada.

Regardless, some information is available to inform conservation work outside Canada (Fig. 32). Priority birds from BCR 13 ON face the loss or degradation of key migration and wintering habitats. The primary sources of habitat loss and degradation are conversion of wetlands, grasslands and coastal areas as a result of residential and commercial development (threat sub-categories 1.1 and 1.2), conversion and degradation of habitat for cropland and livestock (threat sub-categories 2.1 and 2.3), and logging and wood harvesting (threat sub-category 5.3). The threat of loss and degradation of stopover or overwinter habitat is greater for species that have relatively small and concentrated wintering ranges. Shorebirds such as the Semipalmated Sandpiper are particularly vulnerable when large numbers of individuals are concentrated in a handful of key migratory stopover sites (e.g., Delaware Bay). The loss or degradation of these sites could have devastating impacts on the species.

In addition to habitat loss, priority birds from BCR 13 ON are also affected by increased mortality from human sources during migration and over-wintering. Collisions with structures such as TV towers were frequently reported (threat sub-category 1.2). Many priority bird species are affected by hunting or pest control (threat sub-category 5.1), and several priority birds from BCR 13 ON are subject to lead poisoning (threat sub-category 5.1). Other sources of lethal and sub-lethal impacts to priority birds from BCR 13 ON include exposure to industrial contaminants such as oil pollution and heavy metals (threat sub-category 9.2) and agricultural pesticides (threat sub-category 9.3).

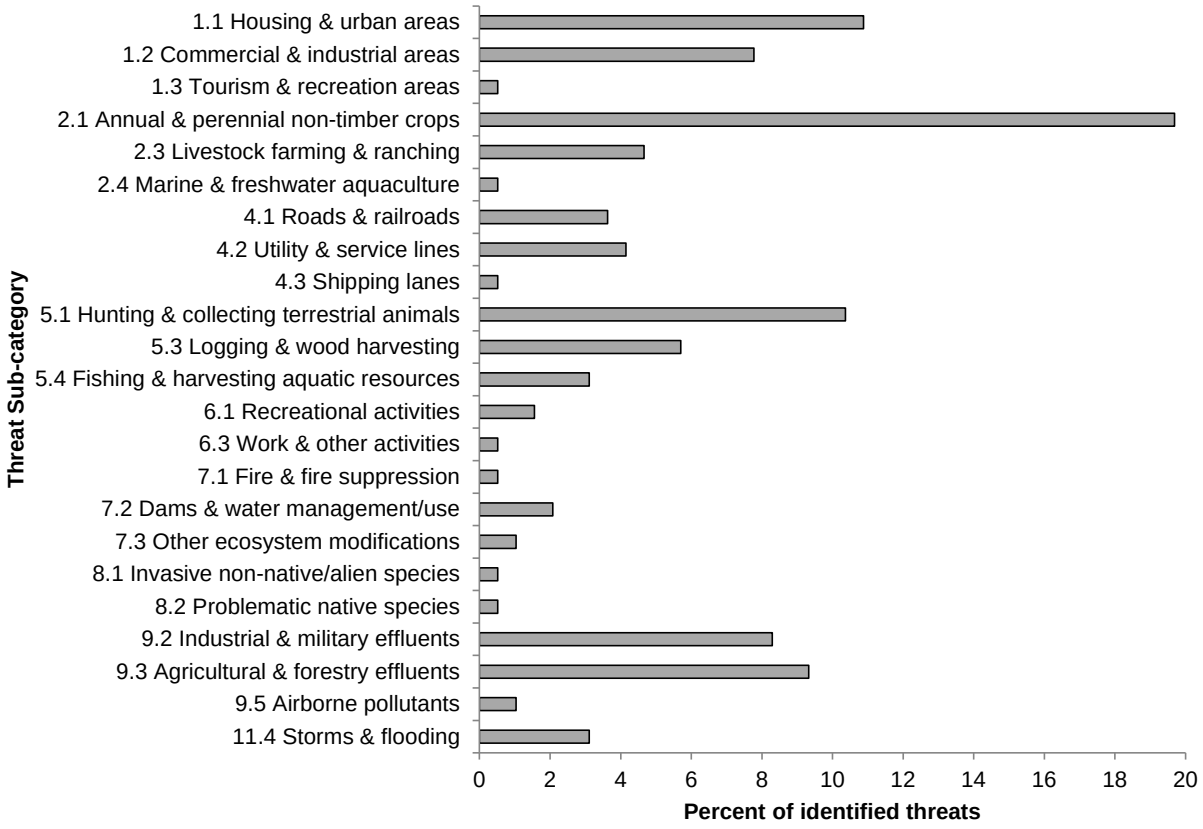

Figure 32. Percent of identified threats to BCR 13 ON priority species while they are outside of Canada, by threat sub-category.

Note: Magnitudes could not be assigned for threats outside of Canada due to lack of information on the scope and severity of threats considered.

Next Steps

The primary aims of BCR strategies are to present Environment Canada's priorities with respect to migratory bird conservation, and to provide a comprehensive overview of the conservation needs of bird populations to practitioners who may then undertake activities that promote bird conservation in Canada and internationally. Users from all levels of government, Aboriginal communities, the private sector, academia, NGOs and citizens will benefit from the information. BCR strategies can be used in many different ways depending on the needs of the user, who may focus on one or more of the elements of the strategy to guide their conservation projects.

BCR strategies will be updated periodically. Errors, omissions and additional sources of information may be provided to Environment Canada at any time for inclusion in subsequent versions.

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Appendix 1

List of All Bird species occurring in BCR 13 Ontario

Table A1. Complete list of species in BCR 13 ON, when they are in the BCR (breeding, migrant, winter) and their priority status.

Common Name	Scientific Name	Bird Group	Breeding	Migrant	Wintering	Priority
Acadian Flycatcher	*Empidonax virescens*	Landbird	Y			Y
Alder Flycatcher	*Empidonax alnorum*	Landbird	Y			
American Crow	*Corvus brachyrhynchos*	Landbird	Y		Y	
American Goldfinch	*Spinus tristis*	Landbird	Y		Y	
American Kestrel	*Falco sparverius*	Landbird	Y		Y	Y
American Pipit	*Anthus rubescens*	Landbird		Y		
American Redstart	*Setophaga ruticilla*	Landbird	Y			
American Robin	*Turdus migratorius*	Landbird	Y		Y	
American Three-toed Woodpecker	*Picoides dorsalis*	Landbird			Y	
American Tree Sparrow	*Spizella arborea*	Landbird			Y	
Bald Eagle	*Haliaeetus leucocephalus*	Landbird	Y		Y	Y
Baltimore Oriole	*Icterus galbula*	Landbird	Y			Y
Bank Swallow	*Riparia riparia*	Landbird	Y			Y
Barn Owl	*Tyto alba*	Landbird	Y			Y
Barn Swallow	*Hirundo rustica*	Landbird	Y			Y
Barred Owl	*Strix varia*	Landbird	Y	Y	Y	
Bay-breasted Warbler	*Setophaga castanea*	Landbird	Y			
Belted Kingfisher	*Megaceryle alcyon*	Landbird	Y		Y	Y
Black-and-white Warbler	*Mniotilta varia*	Landbird	Y			
Black-backed Woodpecker	*Picoides arcticus*	Landbird	Y			
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Landbird	Y			Y
Blackburnian Warbler	*Setophaga fusca*	Landbird	Y			
Black-capped Chickadee	*Poecile atricapillus*	Landbird	Y	Y	Y	
Blackpoll Warbler	*Setophaga striata*	Landbird		Y		
Black-throated Blue Warbler	*Setophaga caerulescens*	Landbird	Y			
Black-throated Green Warbler	*Setophaga virens*	Landbird	Y			

Table A1 continued

Common Name	Scientific Name	Bird Group	Breeding	Migrant	Wintering	Priority
Blue Jay	*Cyanocitta cristata*	Landbird	Y		Y	
Blue-gray Gnatcatcher	*Polioptila caerulea*	Landbird	Y			
Blue-headed Vireo	*Vireo solitarius*	Landbird	Y			
Blue-winged Warbler	*Vermivora cyanoptera*	Landbird	Y			Y
Bobolink	*Dolichonyx oryzivorus*	Landbird	Y			Y
Bohemian Waxwing	*Bombycilla garrulus*	Landbird			Y	
Boreal Owl	*Aegolius funereus*	Landbird			Y	
Brewer's Blackbird	*Euphagus cyanocephalus*	Landbird	Y			
Broad-winged Hawk	*Buteo platypterus*	Landbird	Y			
Brown Creeper	*Certhia americana*	Landbird	Y		Y	
Brown Thrasher	*Toxostoma rufum*	Landbird	Y		Y	Y
Brown-headed Cowbird	*Molothrus ater*	Landbird	Y		Y	
Canada Warbler	*Cardellina canadensis*	Landbird	Y			Y
Cape May Warbler	*Setophaga tigrina*	Landbird	Y			
Carolina Wren	*Thryothorus ludovicianus*	Landbird	Y	Y	Y	
Cedar Waxwing	*Bombycilla cedrorum*	Landbird	Y		Y	
Cerulean Warbler	*Setophaga cerulea*	Landbird	Y			Y
Chestnut-sided Warbler	*Setophaga pensylvanica*	Landbird	Y			
Chimney Swift	*Chaetura pelagica*	Landbird	Y			Y
Chipping Sparrow	*Spizella passerina*	Landbird	Y			
Clay-colored Sparrow	*Spizella pallida*	Landbird	Y			
Cliff Swallow	*Petrochelidon pyrrhonota*	Landbird	Y			
Common Grackle	*Quiscalus quiscula*	Landbird	Y		Y	
Common Nighthawk	*Chordeiles minor*	Landbird	Y			Y
Common Raven	*Corvus corax*	Landbird	Y	Y	Y	
Common Redpoll	*Acanthis flammea*	Landbird			Y	
Common Yellowthroat	*Geothlypis trichas*	Landbird	Y			
Connecticut Warbler	*Oporornis agilis*	Landbird		Y		
Cooper's Hawk	*Accipiter cooperii*	Landbird	Y		Y	
Dark-eyed Junco	*Junco hyemalis*	Landbird	Y		Y	
Downy Woodpecker	*Picoides pubescens*	Landbird	Y	Y	Y	

Table A1 continued

Common Name	Scientific Name	Bird Group	Breeding	Migrant	Wintering	Priority
Eastern Bluebird	*Sialia sialis*	Landbird	Y			
Eastern Kingbird	*Tyrannus tyrannus*	Landbird	Y			Y
Eastern Meadowlark	*Sturnella magna*	Landbird	Y			Y
Eastern Phoebe	*Sayornis phoebe*	Landbird	Y			
Eastern Screech-Owl	*Megascops asio*	Landbird	Y	Y	Y	
Eastern Towhee	*Pipilo erythrophthalmus*	Landbird	Y		Y	Y
Eastern Whip-poor-will	*Antrostomus vociferus*	Landbird	Y			Y
Eastern Wood-Pewee	*Contopus virens*	Landbird	Y			Y
European Starling	*Sturnus vulgaris*	Landbird	Y		Y	
Evening Grosbeak	*Coccothraustes vespertinus*	Landbird	Y		Y	
Field Sparrow	*Spizella pusilla*	Landbird	Y		Y	Y
Fox Sparrow	*Passerella iliaca*	Landbird		Y		
Golden Eagle	*Aquila chrysaetos*	Landbird		Y		
Golden-crowned Kinglet	*Regulus satrapa*	Landbird	Y		Y	
Golden-winged Warbler	*Vermivora chrysoptera*	Landbird	Y			Y
Grasshopper Sparrow	*Ammodramus savannarum*	Landbird	Y			Y
Gray Catbird	*Dumetella carolinensis*	Landbird	Y			
Gray Jay	*Perisoreus canadensis*	Landbird	Y			
Gray Partridge	*Perdix perdix*	Landbird	Y	Y	Y	
Great Crested Flycatcher	*Myiarchus crinitus*	Landbird	Y			
Great Gray Owl	*Strix nebulosa*	Landbird			Y	
Great Horned Owl	*Bubo virginianus*	Landbird	Y	Y	Y	
Hairy Woodpecker	*Picoides villosus*	Landbird	Y	Y	Y	
Henslow's Sparrow	*Ammodramus henslowii*	Landbird	Y			Y
Hermit Thrush	*Catharus guttatus*	Landbird	Y			
Hoary Redpoll	*Acanthis hornemanni*	Landbird			Y	
Hooded Warbler	*Setophaga citrina*	Landbird	Y			Y
Horned Lark	*Eremophila alpestris*	Landbird	Y		Y	
House Finch	*Haemorhous mexicanus*	Landbird	Y		Y	
House Sparrow	*Passer domesticus*	Landbird	Y	Y	Y	
House Wren	*Troglodytes aedon*	Landbird	Y			

Table A1 continued

Common Name	Scientific Name	Bird Group	Breeding	Migrant	Wintering	Priority
Indigo Bunting	*Passerina cyanea*	Landbird	Y			
Kentucky Warbler	*Geothlypis formosa*	Landbird	Y			
Kirtland's Warbler	*Setophaga kirtlandii*	Landbird	Y			Y
Lapland Longspur	*Calcarius lapponicus*	Landbird			Y	
Le Conte's Sparrow	*Ammodramus leconteii*	Landbird	Y			
Least Flycatcher	*Empidonax minimus*	Landbird	Y			
Lincoln's Sparrow	*Melospiza lincolnii*	Landbird	Y			
Loggerhead Shrike (migrans)	*Lanius ludovicianus migrans*	Landbird	Y			Y
Long-eared Owl	*Asio otus*	Landbird	Y		Y	
Louisiana Waterthrush	*Parkesia motacilla*	Landbird	Y			Y
Magnolia Warbler	*Setophaga magnolia*	Landbird	Y			
Marsh Wren	*Cistothorus palustris*	Landbird	Y			
Merlin	*Falco columbarius*	Landbird	Y		Y	
Mourning Dove	*Zenaida macroura*	Landbird	Y		Y	
Mourning Warbler	*Geothlypis philadelphia*	Landbird	Y			
Nashville Warbler	*Oreothlypis ruficapilla*	Landbird	Y			
Northern Bobwhite	*Colinus virginianus*	Landbird	Y	Y	Y	Y
Northern Cardinal	*Cardinalis cardinalis*	Landbird	Y	Y	Y	
Northern Flicker	*Colaptes auratus*	Landbird	Y		Y	Y
Northern Goshawk	*Accipiter gentilis*	Landbird	Y		Y	
Northern Harrier	*Circus cyaneus*	Landbird	Y		Y	Y
Northern Hawk Owl	*Surnia ulula*	Landbird	Y			
Northern Mockingbird	*Mimus polyglottos*	Landbird	Y	Y	Y	
Northern Parula	*Setophaga americana*	Landbird	Y			
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	Landbird	Y			Y
Northern Saw-whet Owl	*Aegolius acadicus*	Landbird	Y		Y	
Northern Shrike	*Lanius excubitor*	Landbird			Y	
Northern Waterthrush	*Parkesia noveboracensis*	Landbird	Y			
Olive-sided Flycatcher	*Contopus cooperi*	Landbird	Y			Y
Orange-crowned Warbler	*Oreothlypis celata*	Landbird		Y		
Orchard Oriole	*Icterus spurius*	Landbird	Y			

Table A1 continued

Common Name	Scientific Name	Bird Group	Breeding	Migrant	Wintering	Priority
Osprey	*Pandion haliaetus*	Landbird	Y			
Ovenbird	*Seiurus aurocapilla*	Landbird	Y			
Palm Warbler	*Setophaga palmarum*	Landbird	Y			
Peregrine Falcon (anatum/tundrius)	*Falco peregrinus anatum/tundrius*	Landbird	Y		Y	Y
Philadelphia Vireo	*Vireo philadelphicus*	Landbird	Y			
Pileated Woodpecker	*Dryocopus pileatus*	Landbird	Y	Y	Y	
Pine Grosbeak	*Pinicola enucleator*	Landbird			Y	
Pine Siskin	*Spinus pinus*	Landbird	Y		Y	
Pine Warbler	*Setophaga pinus*	Landbird	Y			
Prairie Warbler	*Setophaga discolor*	Landbird	Y			Y
Prothonotary Warbler	*Protonotaria citrea*	Landbird	Y			Y
Purple Finch	*Haemorhous purpureus*	Landbird	Y		Y	
Purple Martin	*Progne subis*	Landbird	Y			Y
Red Crossbill	*Loxia curvirostra*	Landbird	Y		Y	
Red-bellied Woodpecker	*Melanerpes carolinus*	Landbird	Y	Y	Y	
Red-breasted Nuthatch	*Sitta canadensis*	Landbird	Y		Y	
Red-eyed Vireo	*Vireo olivaceus*	Landbird	Y			
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Landbird	Y			Y
Red-shouldered Hawk	*Buteo lineatus*	Landbird	Y			Y
Red-tailed Hawk	*Buteo jamaicensis*	Landbird	Y		Y	
Red-winged Blackbird	*Agelaius phoeniceus*	Landbird	Y		Y	
Ring-necked Pheasant	*Phasianus colchicus*	Landbird	Y	Y	Y	
Rock Pigeon	*Columba livia*	Landbird	Y	Y	Y	
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	Landbird	Y			Y
Rough-legged Hawk	*Buteo lagopus*	Landbird			Y	
Ruby-crowned Kinglet	*Regulus calendula*	Landbird	Y			
Ruby-throated Hummingbird	*Archilochus colubris*	Landbird	Y			
Ruffed Grouse	*Bonasa umbellus*	Landbird	Y	Y	Y	
Rusty Blackbird	*Euphagus carolinus*	Landbird		Y	Y	
Savannah Sparrow	*Passerculus sandwichensis*	Landbird	Y			Y
Scarlet Tanager	*Piranga olivacea*	Landbird	Y			

Table A1 continued

Common Name	Scientific Name	Bird Group	Breeding	Migrant	Wintering	Priority
Sedge Wren	*Cistothorus platensis*	Landbird	Y			
Sharp-shinned Hawk	*Accipiter striatus*	Landbird	Y		Y	
Short-eared Owl	*Asio flammeus*	Landbird	Y		Y	Y
Snow Bunting	*Plectrophenax nivalis*	Landbird			Y	
Snowy Owl	*Bubo scandiacus*	Landbird			Y	
Song Sparrow	*Melospiza melodia*	Landbird	Y		Y	
Swainson's Thrush	*Catharus ustulatus*	Landbird	Y			
Swamp Sparrow	*Melospiza georgiana*	Landbird	Y		Y	
Tennessee Warbler	*Oreothlypis peregrina*	Landbird	Y			
Tree Swallow	*Tachycineta bicolor*	Landbird	Y			
Tufted Titmouse	*Baeolophus bicolor*	Landbird	Y	Y	Y	
Turkey Vulture	*Cathartes aura*	Landbird	Y			
Veery	*Catharus fuscescens*	Landbird	Y			
Vesper Sparrow	*Pooecetes gramineus*	Landbird	Y			Y
Warbling Vireo	*Vireo gilvus*	Landbird	Y			
Western Meadowlark	*Sturnella neglecta*	Landbird	Y			
White-breasted Nuthatch	*Sitta carolinensis*	Landbird	Y	Y	Y	
White-crowned Sparrow	*Zonotrichia leucophrys*	Landbird		Y		
White-eyed Vireo	*Vireo griseus*	Landbird	Y			
White-throated Sparrow	*Zonotrichia albicollis*	Landbird	Y		Y	
White-winged Crossbill	*Loxia leucoptera*	Landbird	Y		Y	
Wild Turkey	*Meleagris gallopavo*	Landbird	Y	Y	Y	
Willow Flycatcher	*Empidonax traillii*	Landbird	Y			
Wilson's Warbler	*Cardellina pusilla*	Landbird	Y			
Winter Wren	*Troglodytes hiemalis*	Landbird	Y		Y	
Wood Thrush	*Hylocichla mustelina*	Landbird	Y			Y
Yellow Warbler	*Setophaga petechia*	Landbird	Y			
Yellow-bellied Flycatcher	*Empidonax flaviventris*	Landbird	Y			
Yellow-bellied Sapsucker	*Sphyrapicus varius*	Landbird	Y			
Yellow-billed Cuckoo	*Coccyzus americanus*	Landbird	Y			
Yellow-breasted Chat (virens)	*Icteria virens virens*	Landbird	Y			Y

Table A1 continued

Common Name	Scientific Name	Bird Group	Breeding	Migrant	Wintering	Priority
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	Landbird	Y			
Yellow-rumped Warbler	*Setophaga coronata*	Landbird	Y		Y	
Yellow-throated Vireo	*Vireo flavifrons*	Landbird	Y			
American Golden-Plover	*Pluvialis dominica*	Shorebird		Y		Y
American Woodcock	*Scolopax minor*	Shorebird	Y			Y
Baird's Sandpiper	*Calidris bairdii*	Shorebird		Y		
Black-bellied Plover	*Pluvialis squatarola*	Shorebird		Y		Y
Buff-breasted Sandpiper	*Tryngites subruficollis*	Shorebird		Y		Y
Dunlin	*Calidris alpina*	Shorebird		Y		
Eskimo Curlew	*Numenius borealis*	Shorebird		Y		
Greater Yellowlegs	*Tringa melanoleuca*	Shorebird		Y		
Hudsonian Godwit	*Limosa haemastica*	Shorebird		Y		
Killdeer	*Charadrius vociferus*	Shorebird	Y			Y
Least Sandpiper	*Calidris minutilla*	Shorebird		Y		
Lesser Yellowlegs	*Tringa flavipes*	Shorebird		Y		
Long-billed Dowitcher	*Limnodromus scolopaceus*	Shorebird		Y		
Marbled Godwit	*Limosa fedoa*	Shorebird		Y		
Pectoral Sandpiper	*Calidris melanotos*	Shorebird		Y		
Piping Plover (*circumcinctus*)	*Charadrius melodus circumcinctus*	Shorebird	Y			Y
Purple Sandpiper	*Calidris maritima*	Shorebird		Y		
Red Knot (*rufa*)	*Calidris canutus rufa*	Shorebird		Y		Y
Red-necked Phalarope	*Phalaropus lobatus*	Shorebird		Y		
Ruddy Turnstone	*Arenaria interpres*	Shorebird		Y		
Sanderling	*Calidris alba*	Shorebird		Y		
Semipalmated Plover	*Charadrius semipalmatus*	Shorebird		Y		
Semipalmated Sandpiper	*Calidris pusilla*	Shorebird		Y		Y
Short-billed Dowitcher	*Limnodromus griseus*	Shorebird		Y		
Solitary Sandpiper	*Tringa solitaria*	Shorebird		Y		
Spotted Sandpiper	*Actitis macularius*	Shorebird	Y			Y
Stilt Sandpiper	*Calidris himantopus*	Shorebird		Y		
Upland Sandpiper	*Bartramia longicauda*	Shorebird	Y			Y

Table A1 continued

Common Name	Scientific Name	Bird Group	Breeding	Migrant	Wintering	Priority
Whimbrel	*Numenius phaeopus*	Shorebird		Y		
White-rumped Sandpiper	*Calidris fuscicollis*	Shorebird		Y		
Wilson's Phalarope	*Phalaropus tricolor*	Shorebird	Y			
Wilson's Snipe	*Gallinago delicata*	Shorebird	Y			Y
American Bittern	*Botaurus lentiginosus*	Waterbird	Y			Y
American Coot	*Fulica americana*	Waterbird	Y			Y
Black Tern	*Chlidonias niger*	Waterbird	Y			Y
Black-crowned Night-Heron	*Nycticorax nycticorax*	Waterbird	Y			Y
Bonaparte's Gull	*Chroicocephalus philadelphia*	Waterbird		Y	Y	Y
Caspian Tern	*Hydroprogne caspia*	Waterbird	Y			Y
Common Gallinule	*Gallinula galeata*	Waterbird	Y			Y
Common Loon	*Gavia immer*	Waterbird	Y			Y
Common Tern	*Sterna hirundo*	Waterbird	Y			Y
Double-crested Cormorant	*Phalacrocorax auritus*	Waterbird	Y		Y	
Forster's Tern	*Sterna forsteri*	Waterbird	Y			Y
Glaucous Gull	*Larus hyperboreus*	Waterbird			Y	
Great Black-backed Gull	*Larus marinus*	Waterbird	Y		Y	Y
Great Blue Heron	*Ardea herodias*	Waterbird	Y		Y	Y
Great Egret	*Ardea alba*	Waterbird	Y			Y
Green Heron	*Butorides virescens*	Waterbird	Y			Y
Herring Gull	*Larus argentatus*	Waterbird	Y		Y	
Horned Grebe (western population)	*Podiceps auritus*	Waterbird		Y	Y	Y
Iceland Gull	*Larus glaucoides*	Waterbird			Y	
King Rail	*Rallus elegans*	Waterbird	Y			Y
Least Bittern	*Ixobrychus exilis*	Waterbird	Y			Y
Lesser Black-backed Gull	*Larus fuscus*	Waterbird		Y	Y	
Little Gull	*Hydrocoloeus minutus*	Waterbird	Y		Y	Y
Pied-billed Grebe	*Podilymbus podiceps*	Waterbird	Y			Y
Red-necked Grebe	*Podiceps grisegena*	Waterbird		Y		Y
Red-throated Loon	*Gavia stellata*	Waterbird			Y	
Ring-billed Gull	*Larus delawarensis*	Waterbird	Y		Y	

Table A1 continued

Common Name	Scientific Name	Bird Group	Breeding	Migrant	Wintering	Priority
Sandhill Crane	*Grus canadensis*	Waterbird	Y			Y
Sora	*Porzana carolina*	Waterbird	Y			Y
Virginia Rail	*Rallus limicola*	Waterbird	Y			Y
Yellow Rail	*Coturnicops noveboracensis*	Waterbird	Y			Y
American Black Duck	*Anas rubripes*	Waterfowl	Y		Y	Y
American Wigeon	*Anas americana*	Waterfowl	Y			
Black Scoter	*Melanitta americana*	Waterfowl		Y		
Blue-winged Teal	*Anas discors*	Waterfowl	Y			Y
Brant	*Branta bernicla*	Waterfowl		Y		
Bufflehead	*Bucephala albeola*	Waterfowl		Y		
Cackling Goose	*Branta hutchinsii*	Waterfowl		Y		
Canada Goose (Southern James Bay)	*Branta canadensis*	Waterfowl		Y		Y
Canada Goose (Eastern – Temperate breeding)	*Branta canadensis*	Waterfowl	Y	Y	Y	Y
Canvasback	*Aythya valisineria*	Waterfowl		Y	Y	Y
Common Goldeneye	*Bucephala clangula*	Waterfowl		Y	Y	Y
Common Merganser	*Mergus merganser*	Waterfowl	Y		Y	Y
Gadwall	*Anas strepera*	Waterfowl	Y			
Greater Scaup	*Aythya marila*	Waterfowl		Y		
Green-winged Teal	*Anas crecca*	Waterfowl	Y			Y
Hooded Merganser	*Lophodytes cucullatus*	Waterfowl	Y			
King Eider	*Somateria spectabilis*	Waterfowl		Y		
Lesser Scaup	*Aythya affinis*	Waterfowl		Y	Y	Y
Long-tailed Duck	*Clangula hyemalis*	Waterfowl		Y	Y	Y
Mallard	*Anas platyrhynchos*	Waterfowl	Y		Y	Y
Mute Swan	*Cygnus olor*	Waterfowl	Y			Y
Northern Pintail	*Anas acuta*	Waterfowl	Y			
Northern Shoveler	*Anas clypeata*	Waterfowl	Y			
Red-breasted Merganser	*Mergus serrator*	Waterfowl	Y			
Redhead	*Aythya americana*	Waterfowl	Y		Y	Y
Ring-necked Duck	*Aythya collaris*	Waterfowl	Y			Y
Ruddy Duck	*Oxyura jamaicensis*	Waterfowl	Y			

Table A1 continued

Common Name	Scientific Name	Bird Group	Breeding	Migrant	Wintering	Priority
Snow Goose	*Chen caerulescens*	Waterfowl		Y		
Surf Scoter	*Melanitta perspicillata*	Waterfowl		Y		
Trumpeter Swan	*Cygnus buccinator*	Waterfowl	Y			
Tundra Swan	*Cygnus columbianus*	Waterfowl		Y	Y	Y
White-winged Scoter	*Melanitta fusca*	Waterfowl		Y		
Wood Duck	*Aix sponsa*	Waterfowl	Y			Y

Appendix 2

General Methodology for Compiling the six Standard Elements

Each strategy includes six required elements to conform to the national standard. An extensive manual (Kennedy et al. 2012) provides methods and other guidance for completing each element. The six elements provide an objective means of moving towards multi-species conservation efforts that are targeted to species and issues of highest priority. The six elements are:

1) identifying priority species – to focus conservation attention on species of conservation concern and those most representative of the region
2) attributing priority species to habitat classes – a tool for identifying habitats of conservation interest and a means of organizing and presenting information
3) setting population objectives for priority species – an assessment of current population status compared to the desired status, and a means of measuring conservation success
4) assessing and ranking threats – identifies the relative importance of issues affecting populations of priority species within the planning area as well as outside Canada (i.e., throughout their lifecycle)
5) setting conservation objectives – outlines the overall conservation goals in response to identified threats and information needs; also a means of measuring accomplishments
6) proposing recommended actions – strategies to begin on-the-ground conservation to help achieve conservation objectives

The first four elements apply to individual priority species, and together comprise an assessment of the status of priority species and the threats they face. The last two elements integrate information across species to create a vision for conservation implementation both within Canada and in countries that host priority species during migration and the non-breeding season.

Element 1: Species Assessment to Identify Priority Species

The Bird Conservation Strategies identify "priority species" from all regularly occurring bird species in each sub-region. The priority species approach allows management attention and limited resources to focus on those species with particular conservation importance, ecological significance and/or management need. The species assessment processes used are derived from standard assessment protocols developed by the four major bird conservation initiatives[1].

The species assessment process applies quantitative rule sets to biological data for factors such as:

- population size,
- breeding and non-breeding distribution,

[1] Partners in Flight (landbirds), Wings Over Water (waterbirds), Canadian Shorebird Conservation Plan (shorebirds), NAWMP (waterfowl).

- population trend,
- breeding and non-breeding threats, and
- regional density and abundance

The assessment is applied to individual bird species and ranks each species in terms of its biological vulnerability and population status. The assessments can be used to assign sub-regional (i.e., provincial section of a BCR), regional (BCR) and continental conservation priorities among birds.

For landbirds in BCR 13 ON, species were included on the priority species list if they are considered to be a Continental Concern, Regional Concern, Continental Stewardship, Regional Stewardship, Management Interest and/or a Species at Risk in the Ontario Partners in Flight Plan (2008). In some cases, additions or exclusions were made to the list based on CWS expert opinion (M. Cadman, pers. comm. 2012).

Shorebirds that had been identified as high or medium priority in the Ontario Shorebird Conservation Plan (OSCP; Ross et al. 2003) were included in the all-bird priority list, with some changes made by more recent expert opinion (K. Ross, C. Friis pers. comm. 2011). Shorebird species noted as low priority in the OSCP were generally excluded from the priority species list for BCR 13 ON.

Priority waterbird species were those that were designated as Tier 1 or Tier 2 in the Ontario Waterbird Conservation Plan (Zeran et. al. unpubl.), with some changes made based on more recent expert opinion (D. Moore, C. Weseloh, P. Hubert, pers. comm. 2011).

For waterfowl, species that were identified within the Ontario Eastern Habitat Joint Venture Implementation Plan as being a high priority breeding or non-breeding within BCR 13 ON were added to the all-bird priority species list (Ontario Eastern Habitat Joint Venture 2007). Similarly, species considered by NAWMP (NAWMP Plan Committee 2004) to have breeding or non-breeding needs of Moderately High, High, or Highest for Waterfowl Conservation Region 13 were added. In some cases, additions and exclusions were made to the priority lists based on more recent CWS expert opinion (J. Hughes, S. Meyer, S. Badzinski, pers. comm. 2011).

Provincial and/or federal species at risk occurring in BCR 13 ON were also identified as priority species (current to November 2013).

Element 2: Habitats Important to Priority Species

Identifying the broad habitat requirements for each priority species in the breeding and non-breeding season allows species with shared habitat-based conservation issues or actions to be grouped. If many priority species associated with the same habitat class face similar conservation issues, then conservation action in that habitat class may support populations of several priority species. In most cases, all habitat associations identified in the literature are listed for individual species. Habitat associations do not indicate relative use, suitability ratings or rankings, or selection or avoidance; this could be a useful exercise to undertake in the future.

In order to link with other national and international land classification schemes and to capture the range of habitat types across Canada, habitat classes for all priority species are based, at the coarsest level, on the hierarchical approach of the international Land Cover Classification System developed by the United Nations Food and Agriculture Organization (Food and Agriculture Organization 2000) and are referred to as BCR habitat classes in Table 1. In BCR 13 ON, two data sets were used to derive the extent of available BCR habitats. The Southern Ontario Land Resource Information System (SOLRIS) version 1.2 released April 2008 provides a comprehensive land cover/land use inventory of southern Ontario's natural, rural and urban areas (OMNR 2008b). SOLRIS follows a standardized approach for ecosystem description, inventory and interpretation known as Ecological Land Classification (Lee et al. 1998), and covers the majority of the BCR. Provincial land cover data were used to fill the information gaps for Manitoulin and North Channel Islands. Species are often assigned to more than one of these coarse habitat classes. Finer-scale habitat attributes and the surrounding landscape context were also captured when possible to better guide the development of specific conservation objectives and actions. For BCR 13 ON, habitat associations and descriptions were defined for priority species based largely on information in the Ontario Breeding Bird Atlas (Cadman et al. 2007), the Birds of North America Online (Cornell Lab of Ornithology 2013) and other relevant sources (Sandilands 2005; 2010).

Element 3: Population Objectives for Priority Species

A central component of effective conservation planning is setting clear objectives that can be measured and evaluated. Bird Conservation Strategies set objectives based upon the conservation philosophies of national and continental bird initiatives, including the North American Bird Conservation Initiative (NABCI), that support conserving the distribution, diversity and abundance of birds throughout their historical ranges. The baselines for population objectives used in this planning exercise (those existing during the late 1960s, 1970s and 1990s for eastern waterfowl) reflect population levels prior to widespread declines. Most of the four bird conservation initiatives under the umbrella of NABCI have adopted the same baselines at the continental and national scale (waterfowl, shorebirds and landbirds; national and continental waterbird plans have not yet set population objectives). Some regions in the current planning effort have adjusted baselines to reflect the start of systematic monitoring. The ultimate measure of conservation success will be the extent to which population objectives have been reached. Progress towards population objectives will be regularly assessed as part of an adaptive management approach.

Population objectives for all bird groups are based on a quantitative or qualitative assessment of species' population trends. If the population trend for a species is unknown, the objective is usually to "assess and maintain" the population, and a monitoring objective is set. Harvested waterfowl and many stewardship species may already be at desired population levels and are thus given an objective of "maintain current." For any species listed under SARA or under provincial/territorial endangered species legislation, Bird Conservation Strategies set objectives to "recovery objective" and defer to population objectives in available Recovery Strategies and Management Plans for these species. If recovery documents are not yet available, interim

objectives are noted, and set using the same approach as for the other priority species within that bird group. Once recovery objectives are available, they will replace the interim objectives identified in this strategy.

Landbirds

Population objectives for landbirds (other than those at risk) were based on objectives published in the Ontario Partners in Flight (2008) plan, which were derived primarily from Breeding Bird Survey estimates. The objectives presented for landbirds in this strategy differ somewhat from those presented in the continental landbird plan (Rich et al. 2004). Current levels of landbird abundance, distribution and habitat availability were used as the point of reference for setting objectives. This benchmark differs from that used in the Partners in Flight North American landbird plan, which takes the late 1960s as the benchmark. In southern Ontario, current conditions are considered a better point of reference than the late 1960s for two reasons: 1) Many of the changes in landbird populations and habitats in this region over the past 35-40 years reflect a long-term shift towards more natural conditions (i.e., increase in forest cover since 1920); and 2) given the current landscape and future land-use projections for this region, attempting to "roll back the clock" for all species and habitats to a particular time period (35 years, 100 years, pre-settlement conditions) is neither achievable nor reasonable.

Shorebirds

Population objectives were not set for shorebird species that do not breed in BCR 13 ON. Objectives for these more northerly breeding species are provided in plans for other BCRs (notably BCR 3). Among the six species that do breed in the region, the American Woodcock is a harvested species and surveyed by a dedicated monitoring program that provides a sound basis for development of population objectives (Kelley et al. 2008). The objective for this species reflects a return to 1970s levels. The Piping Plover (*circumcinctus*) is a Species at Risk, and detailed population and distribution objectives are provided in recovery documents. For the remaining four species, there are no established national population objectives. The qualitative objectives provided here reflect a reversal of the trends observed in the best available monitoring data (Breeding Bird Survey, Ontario Breeding Bird Atlas or Ontario Shorebird Survey).

Waterfowl

Population objectives for most breeding waterfowl were taken from the Ontario Eastern Habitat Joint Venture Implementation Plan (2007; Bolduc et al. 2008). For BCR 13 ON, objectives for most species were set equal to repeated high population estimates from the Southern Ontario Waterfowl Plot Survey during the 1998–2005 period. Objectives for Mallard, American Black Duck, Blue-winged Teal and Wood Duck were set at 5% above these baseline values. The population goal for Temperate-breeding Canada Geese is to maintain the population size between 40,000 and 80,000 indicated breeding pairs based on a four-year average as measured by the Southern Ontario Waterfowl Plot Survey (Environment Canada, in prep.). The population of non-native invasive Mute Swans in Ontario continues to increase, based on analyzed data collected by the internationally coordinated Mid-summer Mute Swan

survey. Quantitative population targets have not been set for Mute Swans at time of writing; however, given the threats this species poses to native wildlife, ecosystems and people, the objective was set to "decrease."

In contrast to other species groups, population goals were established for migrant waterfowl, based on decadal aerial coastal surveys of the lower Great Lakes. Setting objectives for migrant waterfowl recognizes both the importance of migratory staging habitat to waterfowl and the importance of migrant waterfowl to society. No objective was set for the Southern James Bay population of Canada Geese, which are impossible to differentiate from temperate breeders during routine aerial surveys.

Waterbirds

Population objectives for waterbirds were based on observed population trends (Zeran et al. unpubl.) and/or the species' conservation status (e.g., listed as a Species at Risk or ranked as provincially rare), as described in Table A2. Regionally specific population trend data from the Ontario Breeding Bird Atlas, the Ontario Breeding Bird Survey, the Ontario Marsh Monitoring Program and the Great Lakes Colonial Waterbird Monitoring Surveys (decadal and annual surveys) were used where available.

Table A2. Relationship between waterbird population trend assessment and BCR Strategy population objectives.

Population Trend and/or Conservation Status	BCR 13 ON Strategy Population Objective
Biologically significant population decline	Increase
Apparent population decline	Maintain current
Apparent population decline AND S4-S5[1]	Assess/Maintain
Apparently stable population	Maintain current
Apparent population increase	Maintain current
Apparently stable population OR Apparent population increase AND S1-S3[1]	Assess/Maintain
Biologically significant population increase	Maintain current OR Decrease

[1] Provincial (or regional) ranks are used by the Natural Heritage Information Centre to set protection priorities for rare species and natural communities. These ranks convey the degree of rarity of the species or community at the regional level and are not legal designations. S1 Critically imperiled – in the nation or state/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 Imperiled – in the nation or state/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 nation or state/province. S3 Vulnerable — in the nation or state/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 nation or state/province.

Table A2 continued

Population Trend and/or Conservation Status	BCR 13 ON Strategy Population Objective
Information Lacking or Information unreliable/Unknown	Assess/Maintain
Species at Risk (endangered or threatened)	Recovery objective

Element 4: Threat Assessment for Priority Species

Bird population trends are driven by factors that affect reproduction and/or survival during any point in the annual cycle. Threats that can reduce survival include, for example, reduced food availability at migratory stopovers or exposure to toxic compounds. Examples of threats that can reduce reproductive success may include high levels of nest predation or reduced quality or quantity of breeding habitat.

The threats assessment exercise included three main steps:

1. Conducting a literature review to itemize past, current and future threats for each priority species and classifying the threats following a standardized classification scheme (Salafsky et al. 2008).
2. Ranking the magnitude of threats for priority species following a standardized protocol (Kennedy et al. 2012).
3. Preparing a set of threat profiles for the BCR sub-region, for broad habitat categories.

Each threat was categorized following the IUCN-CMP threat classification scheme (Salafsky et al. 2008) with the addition of categories to capture species for which we lack information. Only threats stemming from human activity were included in the threats assessment because they can be mitigated; natural processes that prevent populations from expanding beyond a given level were considered and noted, but no actions beyond research and/or monitoring were developed. Threats were ranked by assessing the scope (the proportion of the species' range within the sub-region that is affected by the threat) and severity (the relative impact that the threat poses to the viability of the species' populations) of the threat. The scores for scope and severity were combined to determine an overall magnitude of low, medium, high or very high. These magnitudes were then rolled up by threat categories and sub-categories across habitat types (see Kennedy et al. 2012 for details on this process). The threats roll-up allows for comparison of the relative magnitude of the threats among threat categories and habitat types. The scoring and ranking of threats not only helps to determine which threats contribute most to population declines in individual species, but also allows us to focus attention on the threats with the greatest effects on suites of species or in broad habitat classes.

The threats assessment only considered threats believed to have a population-level effect on priority species. As a result, issues that have low-level but widespread impacts on multiple species were not flagged. Similarly, issues for which the magnitude of the threat is largely unknown, but which have the potential to impact multiple species, are also often not captured in the threats assessment. These issues include collisions with human-made structures,

predation by domestic cats, pollution due to atmospheric deposition of contaminants or chronic or accidental oil discharge, and habitat alteration or other issues related to climate change. Although the biological impact of these issues on each priority species is difficult to assess, they merit attention in conservation plans because of the large numbers of birds affected in many regions of Canada. They have incorporated them in a separate section on "widespread issues."

For this strategy, threats were identified through literature reviews, including the existing bird conservation plans for BCR 13 ON: landbirds – Ontario Partners in Flight (2008); waterfowl – Ontario Eastern Habitat Joint Venture (2007); waterbirds – Zeran et al. (unpublished); shorebirds – Ross et al. (2003) and local expert opinion Wedeles and Mainguy (2010). Supplementary data from Cadman et al. (2007), Poole (2009), Sandilands (2005; 2010), COSEWIC species assessments and species accounts from the Birds of North America Online (Cornell Lab of Ornithology 2013) were also used. Published recovery documents were consulted to compile threats for species listed under the federal SARA or Ontario's *Endangered Species Act 2007*. Each threat was categorized following the IUCN threat classification scheme. Only threats stemming from human activity were included in the threats assessment because they can be mitigated; natural processes that prevent populations from expanding beyond a given level were considered and noted, but no actions beyond research and/or monitoring were developed.

In BCR 13 ON, category 12 "Other direct threats" and sub-category 12.1 "Information lacking" was used to identify priority species that lack adequate biological or demographic information required for population conservation and management. Using this category in this manner facilitated the development of targeted research and monitoring conservation actions to address knowledge gaps for these species, but unlike the other threats, they were not ranked.

Element 5: Conservation Objectives

Overall, conservation objectives represent the desired conditions, within the sub-region that will collectively contribute to achieving population objectives. Objectives may also outline the research or monitoring needed to improve the understanding of species declines and how to best take action.

Currently, most conservation objectives are measurable using qualitative categories (e.g., decrease, maintain, increase) that will allow an evaluation of implementation progress, but they are not linked quantitatively to population objectives. Implementation that incorporates an active adaptive management process is an underlying principle of this conservation effort and will allow for future evaluation of whether or not reaching conservation objectives contributed to achieving population objectives.

Whenever possible, conservation objectives benefit multiple species, and/or respond to more than one threat. However, where necessary, they focus on the specific requirements of a single species.

Conservation objectives generally fall into one of two broad categories:

- habitat objectives within the BCR sub-region (the quantity, quality and configuration of priority habitats)
- non-habitat objectives within the BCR sub-region (minimizing mortality by reducing predation, conducting education and outreach to reduce human disturbance, etc.)

Ideally, habitat objectives would reflect the type, amount and location of habitat necessary to support population levels of priority species outlined in the population objectives. Currently, there is a lack of data and tools at the BCR scale to develop these specific quantitative objectives. Threats-based objectives present the direction of change required to move toward the population objectives using the best available information and knowledge of ecosystem management strategies within broad habitat types.

Element 6: Recommended Actions

Recommended conservation actions are the strategies required to achieve conservation objectives. Recommended actions are usually made at the strategic level rather than being highly detailed and prescriptive. Actions were classified following the IUCN-CMP classification of conservation actions (Salafsky et al. 2008) with the addition of categories to address research and monitoring needs. When possible, more detailed recommendations can be included, for example if BMPs, ecosystem plans or multiple recovery documents are available for a sub-region. However, actions should be detailed enough to provide initial guidance for implementation.

The objectives for research, monitoring and widespread issues may not have actions associated with them. These issues are often so multi-faceted that actions are best designed in consultation with partners and subject-matter experts. Implementation teams will be better positioned to address these complex issues, drawing input from various stakeholders.

Recommended actions defer to or support those provided in recovery documents for species at risk at the federal, provincial or territorial level, but because these strategies are directed at multiple species, actions are usually more general than those developed for individual species. For more detailed recommendations for species at risk, readers should consult recovery documents.

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