Environment Canada Environnement Canada

Bird Conservation Strategy for Bird Conservation Region 8 in Prairie and Northern Region: Boreal Softwood Shield

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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 migrant birds. Input to the strategies from Environment Canada's conservation partners is as essential as their collaboration in implementing their recommendations.

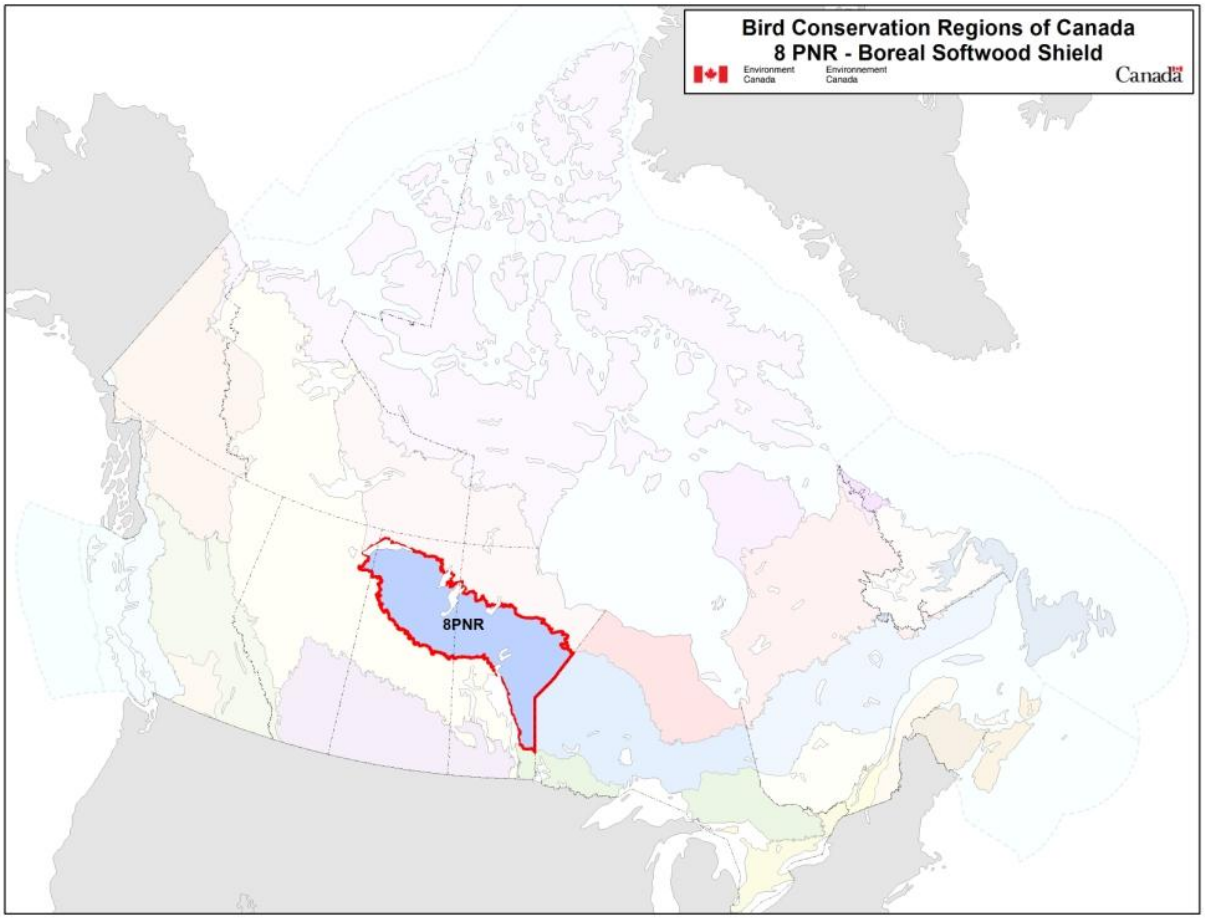
Environment Canada has developed national standards for strategies to ensure consistency of approach across BCRs. Bird Conservation Strategies will provide the context from which specific implementation plans can be developed for each BCR, building on the programs currently in place through Joint Ventures 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*.

Acknowledgements

Jean-Michel DeVink was the main author 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. K. Calon, W. Fleming, T.J. Habib, K.C. Hannah, E. Kuczynski, C.L. Mahon, and K. St. Laurent conducted all of the initial work to refine species priority lists, assess objectives and threats and research habitat associations as well as producing the first draft of the plan and populating the database. However, work of this scope cannot be accomplished without the contribution of other colleagues who provided or validated technical information, commented on earlier draft versions of the strategy, and supported the planning process, and our thanks are extended to everyone who helped with the completion of this strategy.

Bird Conservation Strategy for Bird Conservation Region 8 in Prairie and Northern Region: Boreal Softwood Shield



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Executive Summary

The Prairie and Northern Region (PNR) portion of Bird Conservation Region 8 (BCR 8) comprises the western portion of the Boreal Shield, which is the largest ecozone in Canada. The Boreal Shield covers 18.2% of Canada's land surface. It extends from the northeast corner of Alberta to Labrador; however, BCR 8 PNR includes the portion of the Boreal Shield in Manitoba, Saskatchewan and Alberta. It is bordered by the Boreal Taiga Plains Ecozone to the south and west and the Taiga Shield and Hudson Plains Ecozones to the north.

Rusty Blackbird Photo: © Dick Daniels

The topography of the PNR portion of the Boreal Shield is characterized by rolling hills, and glacial till is the predominant parent material. Topographic depressions lack permeability, and lakes, ponds, bogs and fens commonly occupy these areas. Forest is the predominant land cover (88.2%). Latitudes range from 49°N in the southeast to almost 60°N in the northwest, which results in a wide range in temperatures and species composition. Boreal forest comprises the majority of the BCR, which is characterized by coniferous trees including white (*Picea glauca*) and black spruce (*Picea mariana*), tamarack (*Larix laricina*), balsam fir (*Abies balsamea*), and jack pine (*Pinus banksiana*). Balsam poplar (*Populus balsamifera*), trembling aspen (*Populus tremuloides*) and white birch (*Betula paryrifera*) are the primary deciduous trees, which become increasingly common in the southern portion of the ecozone. Temperate forests are present in the southern portion of the Boreal Shield from Manitoba to the east, where there are a greater number of trees intolerant to extreme cold, including birch, maple, poplar and some pine species.

Within BCR 8 PNR, 215 species of birds are known to occur, and of these 67 have been identified as priority species based on their distribution and abundance, their threats, their federal and provincial status, their inclusion in regional and continental conservation/ stewardship plans or based on expert opinion. Of the 4 bird groups (landbirds, shorebirds, waterbirds and waterfowl), landbirds are most represented with 152 of the 215 species in the region. Quantitative population trends for landbirds were based on Breeding Bird Survey (BBS) data wherever possible, but not all species are surveyed adequately, and geographic extent is limited due to survey design and the remoteness of BCR 8 PNR.

Wetlands are some of the most important habitat for birds in this region. More priority species (39, or 60%) are found in wetlands than any other habitat type, and one third of the priority species that are considered at risk in BCR 8 PNR use this cover type. Forests (deciduous,

coniferous and mixed) as well as shrubs/early successional habitats and waterbodies are also widely used by priority species in BCR 8 PNR.

The predominant natural disturbance in the western Boreal Shield is wildfire, but disturbances from windthrow and insect outbreaks become more common in the southern portions of this region. Anthropogenic disturbance is still limited in the western Boreal Shield compared with other BCRs in Canada but is increasing. Mining operations, forest harvesting, dams and reservoirs, and their associated infrastructure (e.g., roads) comprise some of the low-level threats to ecological integrity of the area. Mining is the primary industry in northern Saskatchewan, mostly for uranium and gold. Long-range transport of pollutants and ecosystem acidification, including impacts on food availability, are possible consequences of oil sands development upwind of the region and may pose a threat in future. While agriculture has been limited as a result of the cool climate and shallow soils of the Boreal Shield, logging contributes to the economic history of the region. Conversely, recreation and tourism industries, which exist due to the abundance of fish and wildlife resources in the region, have very localized impacts and instead may promote habitat retention by placing direct economic value on functional ecosystems.

Climate change is also predicted to have broad impacts across BCR 8 PNR in future. Climate change has potentially affected forest disturbance and succession patterns, and may pose greater threats to habitat and food availability in the future. Wetland habitats may be particularly at risk, as climate change modelling predicts that wetlands in BCR 8 PNR will be subject to considerable drying. Projections over the coming century predict exacerbated population declines for waterfowl such as scoters and Lesser Scaup, and landbirds such as Olive-sided Flycatcher and Rusty Blackbird. Overall, however, predictions are wide-ranging, with some species increasing and others decreasing at varying rates, suggesting a greater role for individual species management in future. Identification and protection of refugia that will remain relatively stable through a dynamic, shifting climate may facilitate population adaptation.

Inadequate monitoring information is a pervasive issue in BCR 8 PNR: for 57% of priority species it was not possible to assign a quantitative population objective. Landbirds and waterbirds appear to have the largest information gaps in BCR 8 PNR, with many priority species in these groups assigned the population objective of “Assess/Maintain” (18 of 28 landbird species; 9 of 14 waterbird species). While there is more information available for the assessment of population objectives for shorebirds and waterfowl species, significant information gaps remain. However, some population information is available. For 29% of priority species, the evidence of population decline was sufficient to suggest a target for population increase of either 50 or 100%.

Overall, the majority of recommended conservation actions in BCR 8 PNR, an area of primarily Crown lands, fall under the category of Law and Policy, with particular emphasis on the development and implementation of beneficial management practices to avoid, minimize and mitigate the impact of human activities on habitats commonly used by priority bird species. Land management, such as the reintroduction of natural fire regimes to forests and protection

of key habitats, is also recommended. Increasing public awareness of priority species and their needs is also recommended, as is research to address important gaps in knowledge.

Lesser Scaup Photo: © Davefoc

Overall, BCR 8 PNR remains relatively intact when compared with many other regions more affected by anthropogenic disturbances, and the magnitude of most threats throughout this region is currently low. This presents an opportunity to assess this BCR for protection and preservation of ecological features and processes that are unique and/or important to this region, currently and in future. Achieving conservation successes in this region, through the implementation of recommended conservation actions contained within this strategy and others, will require broad collaboration among provincial and federal governments, industry, Aboriginal peoples and other interested parties.

Introduction: Bird Conservation Strategies

Context

This document is one of a suite of Bird Conservation Region Strategies (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 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,[1] waterbirds,[2] shorebirds[3] and landbirds[4]) 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 bird 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 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.

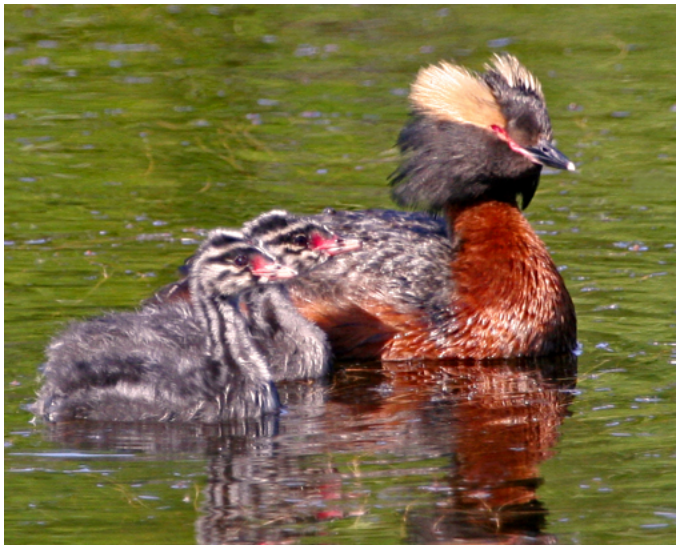
[1] NAWMP Plan Committee 2004.
[2] Milko et al. 2003.
[3] Donaldson et al. 2000.
[4] Rich et al. 2004.

Strategy Structure

Section 1 of this strategy presents general information about the BCR and the subregion, with an overview of the six elements[5] 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 subregion. 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 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.

[5] 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 8



Horned Grebe Photo: © Donna Dewhurst

The Prairie and Northern Region (PNR) portion of BCR 8 comprises the western portion of the Boreal Shield, which is the largest ecozone in Canada. The Boreal Shield covers 18.2% of Canada's land surface (Conservation Areas Reporting and Tracking System 2009). It extends from the northeast corner of Alberta to Labrador, with the PNR portion of BCR 8 including the portion of the Boreal Shield west of the Manitoba/Ontario border. It is bordered by the Boreal Taiga Plains Ecozone to the south and west and the Taiga Shield and Hudson Plains Ecozones to the north (Fig. 1).

Topography is characterized by rolling hills, and glacial till is the predominant parent material (Geological Survey of Canada 1995). Topographic depressions lack permeability, and lakes, ponds, bogs and fens commonly occupy these areas. Forest is the predominant land cover (88.2%).

Latitudes range from 49°N in the southeast to almost 60°N in the northwest, which results in a wide range in temperatures and species composition. Boreal forest comprises the majority of the BCR (Fig. 1), which is characterized by coniferous trees including white (*Picea glauca*) and black spruce (*Picea mariana*), balsam fir (*Abies balsamea*), and jack pine (*Pinus banksiana*). Balsam poplar (*Populus balsamifera*), trembling aspen (*Populus tremuloides*) and white birch (*Betula paryrifera*) are the primary deciduous trees, which become increasingly common in the southern portion of the ecozone. Temperate forests are present in the southern portion of the Boreal Shield from Manitoba to the east, where there are a greater number of trees intolerant to extreme cold, including birch, maple, poplar and pine species (Ecological Stratification Working Group 1995).

The predominant natural disturbance in the western Boreal Shield is wildfire, while windthrow and insect outbreaks are more common in the southern portions. Anthropogenic disturbance is still limited in the western Boreal Shield but is increasing. Climate change has potentially affected forest disturbance and succession patterns, and may pose a greater threat to habitats in the future.

Mining operations, forest harvesting, dams and reservoirs, and their associated infrastructure (e.g., roads) have potential to affect the ecological integrity of the area. Mining is the primary industry in northern Saskatchewan, mostly for uranium and gold. Oil sands developments are located to the west of the Boreal Shield in BCR 6. However, concern about air pollution

contributing to ecosystem acidification is growing with the development of oil sands projects upwind of the region.

Logging occurs in parts of the region, while agriculture has been limited as a result of the cool climate and shallow soils of the Boreal Shield. Recreation and tourism industries exist due to the abundance of fish and wildlife resources in the region, but have very localized impacts.

There are currently a small number of protected areas within BCR 8 PNR (Fig. 2), which provide limited habitat protection for priority species conservation. Just prior to publishing this strategy, the creation of a large new ecological reserve was announced in Saskatchewan. The Pink Lake Representative Area Ecological Reserve, located 160 km north of LaRonge, will add an additional 3660 square kilometres of protected area to this region.

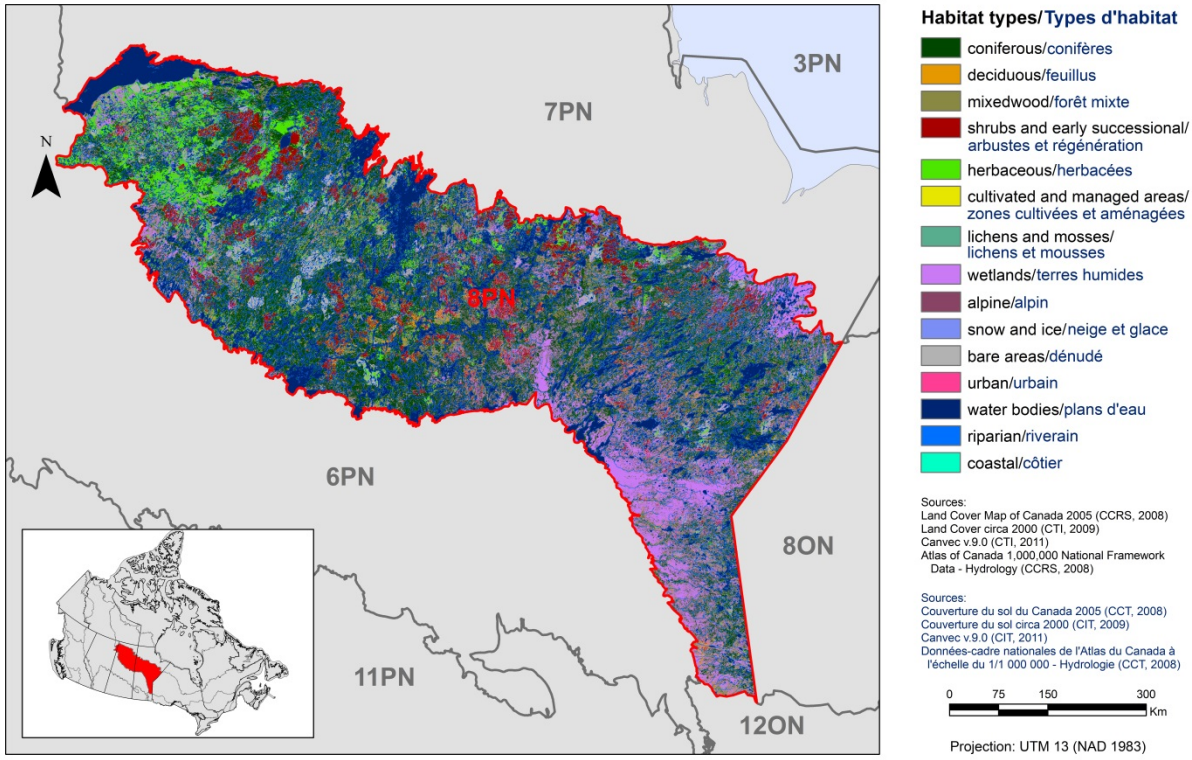


Figure 1. Landcover in BCR 8 PNR.

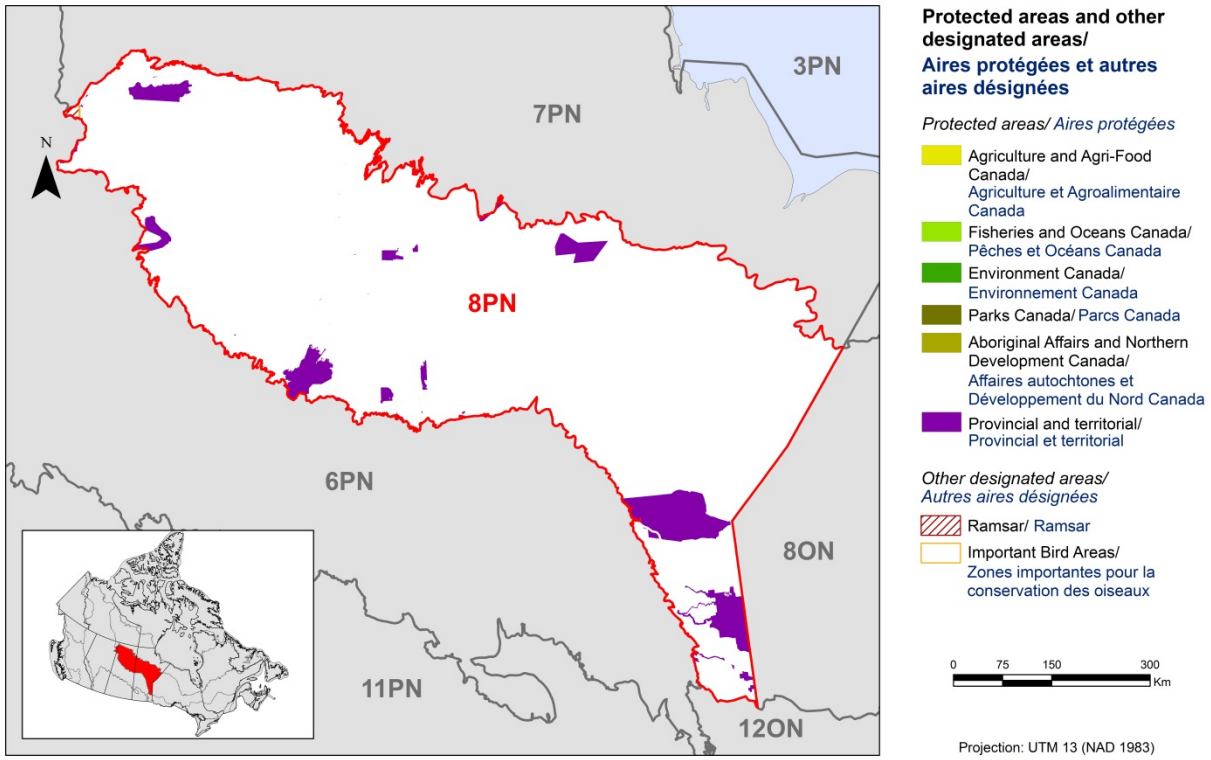


Figure 2. Map of protected and designated areas in BCR 8 PNR.

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 subregion (see Appendix 1). Species that are vulnerable due to population size, distribution, population trend, abundance and threats are included 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 subregion; 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 but 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).

The purpose of the prioritization exercise is to focus implementation efforts on the issues of greatest significance for Canadian avifauna. Table 1 provides a full list of all priority species and their reason for inclusion. Tables 2 and 3 summarize the number of priority species in BCR 8 PNR Boreal Softwood Shield by bird group and by the reason for priority status.

Within BCR 8 PNR, 215 species of birds are known to occur, and of these, 67 have been identified as priority species based on their distribution and abundance, their threats, their federal and provincial status, their inclusion in regional and continental conservation/ stewardship plans or based on expert opinion (Table 1). Of the 4 bird groups (landbirds, shorebirds, waterbirds and waterfowl), landbirds comprise 152 of the 215 species in the region. While they represent 57% of all priority species, only 25% of the landbirds present were identified as priority species (Table 2). Both shorebirds and waterbirds had half or more of their species listed as priority (Table 2), but the lower number of species means that they represent a much smaller proportion of the total list. Priority landbirds were identified primarily as Stewardship species using continental methods with regional data or because of General Status (GS) ranks, while priority shorebirds, waterbirds and waterfowl were identified largely through continental or regional bird group plans (Table 3).

Table 1. Priority species in BCR 8 PNR, population objective and the reason for priority status.

Species	Bird Group	Population Trend Score[1]	Population Objective	Reason for Priority Status							
				SARA[2]	COSEWIC[3]	Provincial Status[4]	Cont./Reg. Concern[5]	Stewardship[6]	NAWMP[7]	GS[8]	Expert Opinion[9]
Alder Flycatcher	Landbirds	4	Increase 50%					Y			
American Three-toed Woodpecker	Landbirds	3	Assess/Maintain							Y	
Barn Swallow	Landbirds	4	Increase 50%		T						
Barred Owl	Landbirds	3	Assess/Maintain			SC (AB)				Y	
Bay-breasted Warbler	Landbirds	4	Assess/Maintain							Y	
Black-and-white Warbler	Landbirds	3	Assess/Maintain					Y			
Black-backed Woodpecker	Landbirds	3	Assess/Maintain					Y		Y	
Brown Creeper	Landbirds	3	Assess/Maintain							Y	
Canada Warbler	Landbirds	4	Recovery Objective[10]	T	T						
Cape May Warbler	Landbirds	3	Assess/Maintain					Y		Y	
Chestnut-sided Warbler	Landbirds	4	Increase 50%					Y			

[1] Where multiple population trend scores were available (e.g. continental, regional, etc.), we report the highest.
[2] Species listed on Schedule 1 of the *Species at Risk Act* (SARA) as E, Endangered; T, Threatened; SC, Special Concern (Species at Risk Public Registry).
[3] Assessed by COSEWIC (Committee on the Status of Endangered Wildlife in Canada) as: E, Endangered; T, Threatened; SC, Special Concern.
[4] Provincial Status = species legally protected under provincial/territorial legislation as E, Endangered; T, Threatened; SC, Special Concern:
Alberta's *Wildlife Act* www.srd.alberta.ca/fishwildlife/speciesatrisk/SpeciesSummaries/SpeciesAtRiskFactSheets.aspx;
Saskatchewan's *The Wildlife Act* www.environment.gov.sk.ca/wildspeciesatrisk;
Manitoba's *The Endangered Species Act* www.gov.mb.ca/conservation/wildlife/sar/sarlist.html.
[5] Cont./Reg. Concern = Continental or Regional Conservation Concern; species of concern identified by bird group protocols using continental (shorebirds and waterbirds) or BCR-specific (landbirds) data.
[6] Stewardship = landbirds identified as stewardship species using BCR-specific data.
[7] NAWMP = North American Waterfowl Management Plan (2004); the regional breeding or non-breeding need in Waterfowl Conservation Region 8.1 (where both values were available, we report the highest; waterfowl only).
[8] GS = species with a provincial/territorial General Status rank ≤3 (At Risk, May Be At Risk or Sensitive).
[9] Expert Opinion = species added based on expert knowledge.
[10] The species is listed under SARA, but its recovery documents have not yet been finalized.

Table 1 continued

Species	Bird Group	Population Trend Score[1]	Population Objective	Reason for Priority Status							
				SARA[2]	COSEWIC[3]	Provincial Status[4]	Cont./Reg. Concern[5]	Stewardship[6]	NAWMP[7]	GS[8]	Expert Opinion[9]
Chimney Swift	Landbirds	4	Recovery Objective[10]	T	T					Y	
Common Nighthawk	Landbirds	4	Recovery Objective[10]	T	T					Y	
Common Yellowthroat	Landbirds	4	Increase 50%							Y	
Connecticut Warbler	Landbirds	4	Increase 50%				Y				
Eastern Phoebe	Landbirds	3	Assess/Maintain							Y	
Eastern Whip-poor-will	Landbirds	4	Recovery Objective[10]	T	T						
Evening Grosbeak	Landbirds	4	Assess/Maintain					Y			
Great Gray Owl	Landbirds	3	Assess/Maintain							Y	
Least Flycatcher	Landbirds	4	Assess/Maintain							Y	
Mourning Warbler	Landbirds	4	Assess/Maintain					Y			
Nashville Warbler	Landbirds	3	Assess/Maintain					Y			
Northern Flicker	Landbirds	4	Increase 50%					Y			
Northern Hawk Owl	Landbirds	3	Assess/Maintain							Y	
Olive-sided Flycatcher	Landbirds	5	Recovery Objective[10]	T	T						
Ovenbird	Landbirds	3	Assess/Maintain					Y			
Peregrine Falcon (*anatum/tundrius*)	Landbirds	3	Assess/Maintain	SC	SC	T (AB), E (MB)				Y	
Pileated Woodpecker	Landbirds	3	Assess/Maintain							Y	
Pine Grosbeak	Landbirds	3	Assess/Maintain							Y	
Purple Finch	Landbirds	4	Increase 50%				Y				
Ruffed Grouse	Landbirds	4	Assess/Maintain					Y			
Rusty Blackbird	Landbirds	5	Assess/Maintain	SC	SC					Y	
Sedge Wren	Landbirds	3	Assess/Maintain								Y
Short-eared Owl	Landbirds	5	Assess/Maintain	SC	SC					Y	
Swamp Sparrow	Landbirds	3	Assess/Maintain					Y			
White-winged Crossbill	Landbirds	3	Assess/Maintain							Y	
Yellow-bellied Flycatcher	Landbirds	3	Assess/Maintain					Y			

Table 1 continued

Species	Bird Group	Population Trend Score[1]	Population Objective	Reason for Priority Status							
				SARA[2]	COSEWIC[3]	Provincial Status[4]	Cont./Reg. Concern[5]	Stewardship[6]	NAWMP[7]	GS[8]	Expert Opinion[9]
Yellow-bellied Sapsucker	Landbirds	4	Increase 50%					Y			
Killdeer	Shorebirds	5	Increase 50%				Y				
Lesser Yellowlegs	Shorebirds	5	Increase 100%				Y				
Red-necked Phalarope	Shorebirds	4	Migrant (No pop. objective)				Y				
Short-billed Dowitcher	Shorebirds	5	Increase 100%				Y			Y	
Solitary Sandpiper	Shorebirds	3	Increase 50%				Y				
Wilson's Snipe	Shorebirds	5	Increase 100%				Y				
American Bittern	Waterbirds	4	Increase 50%				Y			Y	
American White Pelican	Waterbirds	3	Assess/Maintain				Y			Y	
Black Tern	Waterbirds	5	Increase 100%				Y				
Bonaparte's Gull	Waterbirds	3	Assess/Maintain				Y				
California Gull	Waterbirds	3	Assess/Maintain				Y				
Caspian Tern	Waterbirds	2	Assess/Maintain							Y	Y
Common Loon	Waterbirds	3	Assess/Maintain				Y				
Common Tern	Waterbirds	3	Assess/Maintain				Y				
Herring Gull	Waterbirds	4	Increase 50%				Y				
Horned Grebe (western population)	Waterbirds	4	Increase 100%		SC		Y			Y	
Pied-billed Grebe	Waterbirds	3	Assess/Maintain							Y	
Sora	Waterbirds	3	Assess/Maintain				Y			Y	
Virginia Rail	Waterbirds	3	Assess/Maintain				Y				
Yellow Rail	Waterbirds	3	Assess/Maintain	SC	SC		Y			Y	
American Wigeon	Waterfowl	4	Increase 50%				Y		Mod. High		
Bufflehead	Waterfowl	1	Assess/Maintain				Y		Mod. High		
Common Goldeneye	Waterfowl	2	Assess/Maintain				Y		High		
Green-winged Teal	Waterfowl	2	Assess/Maintain				Y		Mod. High	Y	
Lesser Scaup	Waterfowl	4	Increase 50%				Y		High	Y	
Mallard	Waterfowl	3	Assess/Maintain				Y		High		
Ring-necked Duck	Waterfowl	1	Assess/Maintain				Y		High		
Surf Scoter	Waterfowl	3	Increase 50%				Y		Mod. High		

Table 1 continued

Species	Bird Group	Population Trend Score[1]	Population Objective	Reason for Priority Status							
				SARA[2]	COSEWIC[3]	Provincial Status[4]	Cont./Reg. Concern[5]	Stewardship[6]	NAWMP[7]	GS[8]	Expert Opinion[9]
White-winged Scoter	Waterfowl	3	Increase 50%				Y		Mod. High	Y	

Table 2. Summary of priority species, by bird group, in BCR 8 PNR.

Bird Group	Total Species	Total Priority Species	Percent Listed as Priority	Percent of Priority List
Landbird	152	38	25%	57%
Shorebird	12	6	50%	9%
Waterbird	24	14	58%	21%
Waterfowl	27	9	33%	13%
Total	215	67	31%	100%

Table 3. Number of priority species in BCR 8 PNR by reason for priority status.

Reason for Priority Listing[1]	Landbirds	Shorebirds	Waterbirds	Waterfowl
Federal SARA listed[2]	7	0	1	0
COSEWIC[3]	9	0	2	0
Provincially listed[4]	2	0	0	0
Continental/Regional Concern[5]	2	6	12	9
Stewardship[6]	14	0	0	0
NAWMP[7]	0	0	0	9
GS[8]	19	1	7	3
Expert Opinion[9]	1	0	1	0

[1] A single species can be on the priority list for more than one reason. Note that not all reasons for inclusion apply to every bird group (indicated by "-").
[2] Species listed on Schedule 1 of the *Species at Risk Act* (SARA) as Endangered, Threatened or Special Concern.
[3] COSEWIC indicates species assessed by the Committee on the Status of Endangered Wildlife in Canada as Endangered, Threatened or Special Concern.
[4] Provincial Status = species legally protected under provincial/territorial legislation: Alberta's *Wildlife Act* www.srd.alberta.ca/fishwildlife/speciesatrisk/SpeciesSummaries/SpeciesAtRiskFactSheets.aspx; Saskatchewan's *The Wildlife Act* www.environment.gov.sk.ca/wildspeciesatrisk; Manitoba's *The Endangered Species Act* www.gov.mb.ca/conservation/wildlife/sar/sarlist.html.
[5] Cont./Reg. Concern = Continental or Regional Conservation Concern; species of concern identified by bird group protocols using continental (shorebirds and waterbirds) or BCR-specific (landbirds) data.
[6] Stewardship = landbirds identified as stewardship species using BCR-specific data.
[7] NAWMP = North American Waterfowl Management Plan (2004); the regional breeding or non-breeding need in Waterfowl Conservation Region 8.1 (where both values were available, we report the highest; waterfowl only).
[8] GS = species with a provincial/territorial General Status rank ≤3 (At Risk, May Be At Risk or Sensitive).
[9] Expert Opinion = species added based on expert knowledge.

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 Agricultural Organization 2000) to categorize habitats, and species were often assigned to more than one habitat class.

Within BCR 8 PNR, the most important habitat type for priority species are wetlands, followed by the various woody habitat types (mixed wood, deciduous, coniferous, shrub/early successional; Fig. 3). These habitat types are also of particular importance for targeted conservation actions, as they will have the greatest potential benefit for priority species.

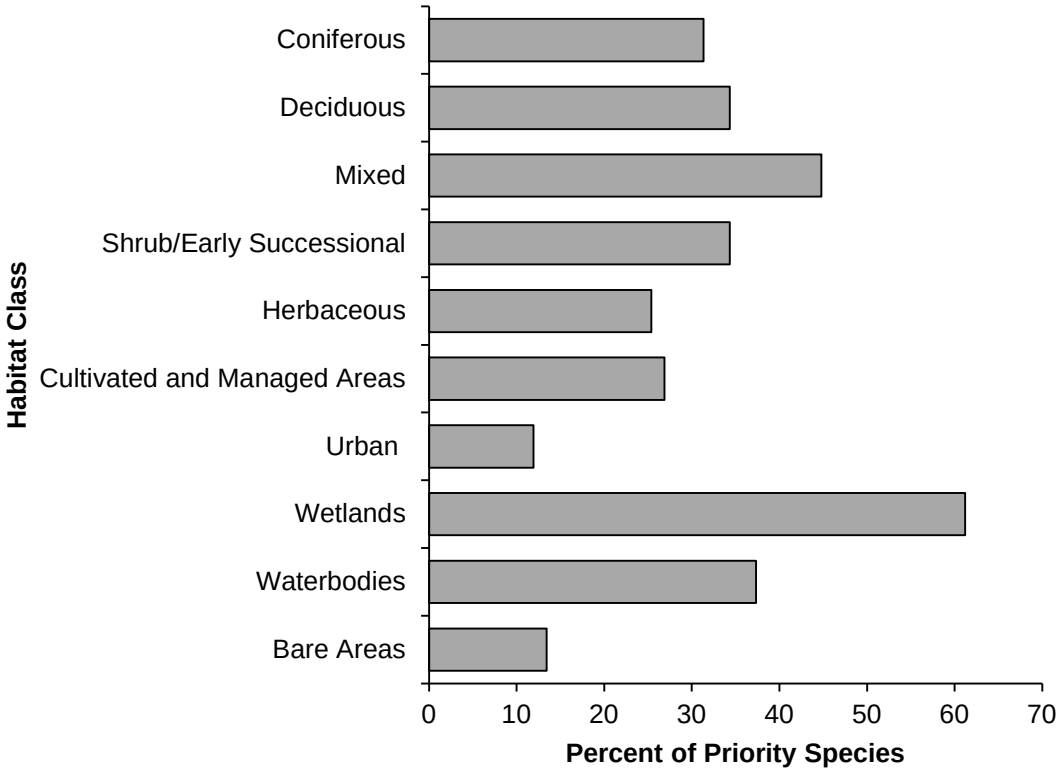


Figure 3. Percent of priority species that are associated with each habitat class in BCR 8 PNR.

Element 3: Population Objectives

Canada Warbler Photo: © William H. Majoros

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 the *Species at Risk Act* (SARA) or under provincial/territorial endangered species legislation, Bird Conservation Strategies defer to population objectives in available Recovery Strategies and Management Plans. The ultimate measure of conservation success will be the extent to which population objectives have been reached over the next 40 years. Population objectives do not currently factor in feasibility of achievement, but are held as a standard against which to measure progress.

The majority of species within BCR 8 PNR had a population objective of "assess/maintain," reflecting both the general lack of information about many species within this BCR, and that many populations within the region are currently at desired population levels because of a relatively pristine landscape with few threats and impacts (Fig. 4). There are 11 species (mostly landbirds) that have been assessed by COSEWIC as at risk, 9 of which are listed on Schedule 1 of SARA. Recovery planning initiatives are ongoing for these listed species. Roughly one-third of the species had population objectives to increase by 50% or 100%, which were proportionally distributed amongst the 4 bird groups. Most species with objectives to increase populations were migratory in nature and are likely limited by factors found outside BCR 8 PNR. Conservation actions should be prioritized according to potential benefits for species whose population objectives are to increase their abundance.

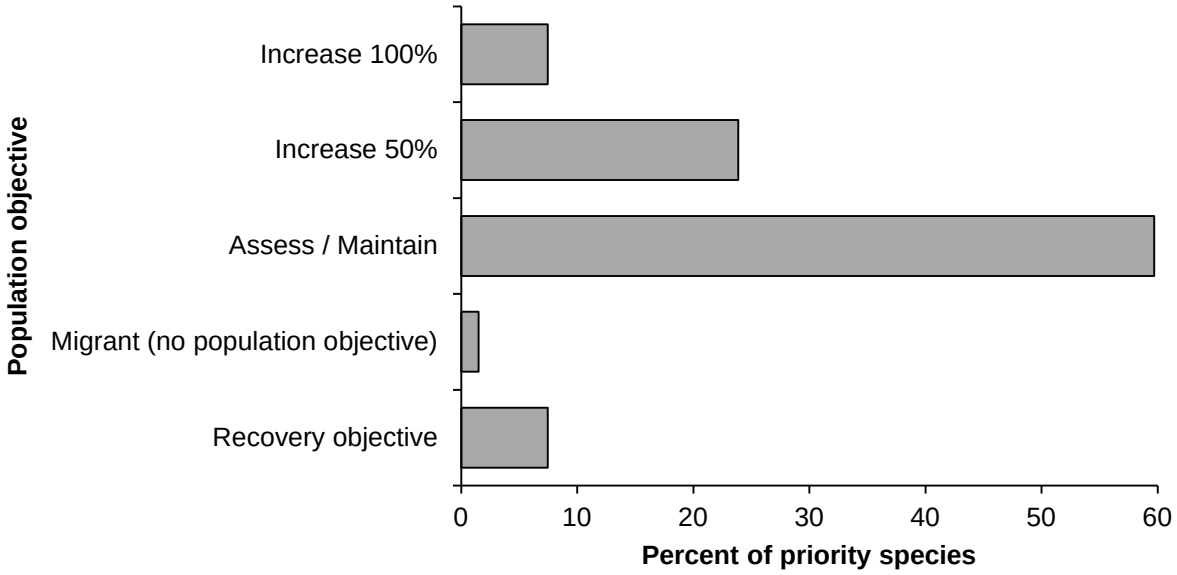


Figure 4. Percent of priority species that are associated with each population objective category in BCR 8 PNR.

Element 4: Threat Assessment for Priority Species

The threats assessment process (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 subregion 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 (such as predation by domestic cats or climate change) 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. We have incorporated them in a separate section on Widespread Issues, but, unlike other threats, they are not ranked.

Overall, the threats identified for priority species in this BCR were of low magnitude at both the threat category and threat sub-category levels (Fig. 5; Table 4). This reflects the relatively pristine state of this region due to its remoteness and lack of human habitation and disturbance. Logging and wood harvesting activities (threat sub-category 5.3) represented the most frequently identified threat to priority species, due to the extent of forests and the large scale of forestry activities in BCR 8 PNR; however, none of the threats in this sub-category had sufficient impacts to priority species to be given a threat magnitude above low. While control of superabundant food sources associated with these forests, such as spruce budworm outbreaks, can represent an issue for some bird populations, there are no extensive spray programs within BCR 8 PNR.

Numerous industrial developments within and outside BCR 8 PNR release environmental contaminants, including effluents and airborne pollutants, but these do not currently constitute a threat to bird populations here. Early signs of increasing ecosystem acidification of PNR BCR 8 have been documented in the western extent due to long-range transport of pollutants from oil sands development upwind of the region (Jeffries et al. 2010, Government of Saskatchewan 2013, Turcotte et al. in prep.). Acidification can alter the structure and function of aquatic and terrestrial ecosystems and has been previously linked to decreases in calcium availability and invertebrate abundance, both of which can impact on bird populations and communities (Hames et al. 2002, Pabian and Brittingham 2011, Pabian and Brittingham 2012), and thus pollution as a threat (sub-category 9.5 Airborne Pollutants) merits reassessment in future updates.

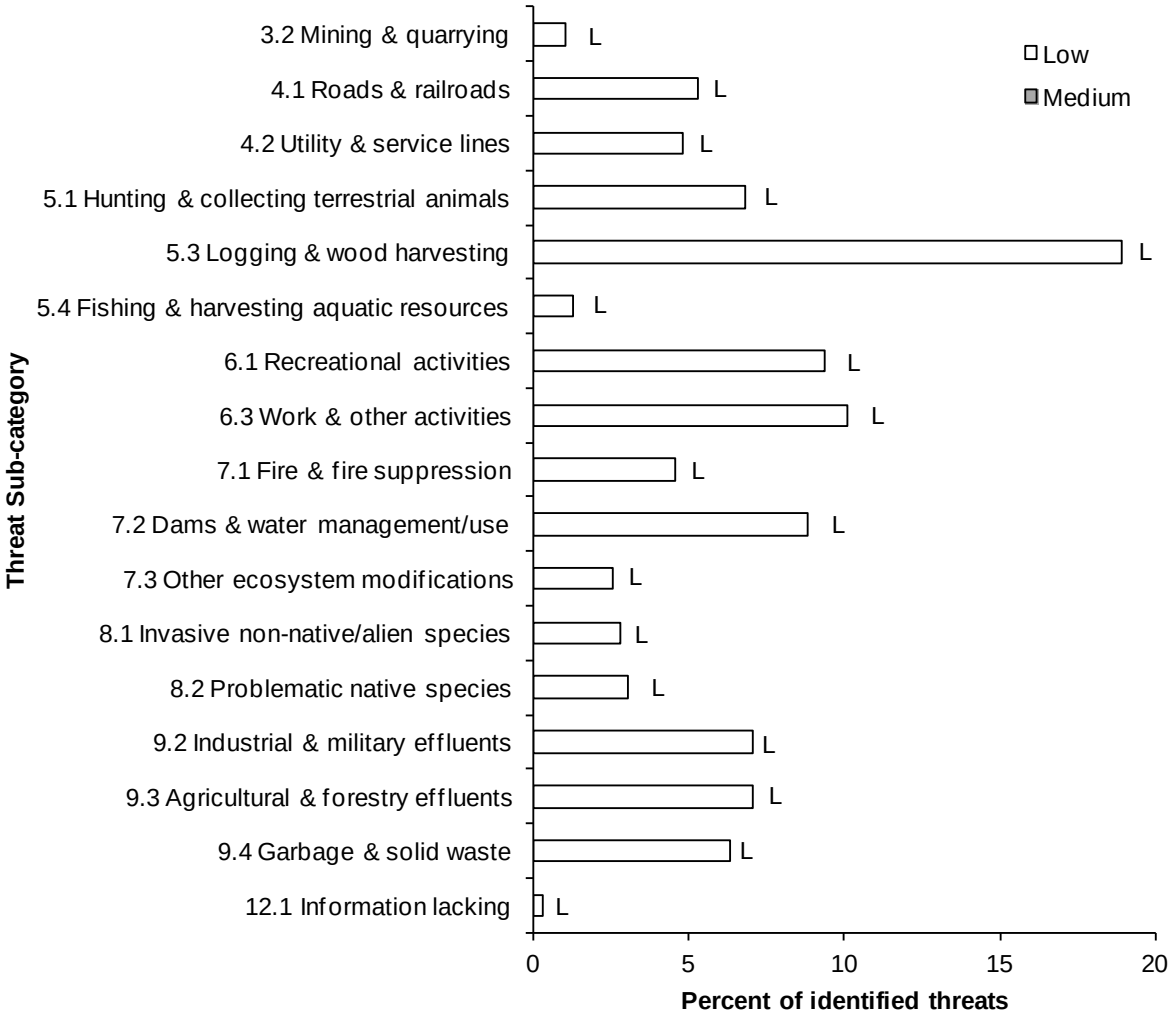


Figure 5. Percent of identified threats to priority species within BCR 8 PNR by threat sub-category.
Each bar represents the percent of the total number of threats identified in each threat sub-category in BCR 8 PNR (for example, if 100 threats were identified in total for all priority species in BCR 8 PNR, and 10 of those threats were in the category 6.3 Work & other activities, the bar on the graph would represent this as 10%). Shading in the bars (M = medium and L = low) represents the rolled-up magnitude of all threats in each threat sub-category in the BCR. (See Appendix 2 for details on how magnitude was assessed.)

Table 4. Relative magnitude of identified threats to priority species within BCR 8 PNR by threat category and broad habitat class.

Overall ranks were generated through a roll-up procedure described in Kennedy et al. (2012). L and M represent Low and Medium Magnitude threats, respectively. Blank cells indicate that no priority species had threats identified in the threat category/habitat combination.

Threat category	Habitat class										
	Coniferous	Deciduous	Mixed Wood	Shrubs/Early Successional	Herbaceous	Cultivated and Managed Areas	Urban	Wetlands	Waterbodies	Bare Areas	Overall Magnitude
Overall	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	
3. Energy Production & Mining	L		L	L		L					**L**
4. Transportation & Service Corridors	L	L	L	L	L	L	L	L	L	L	**L**
5. Biological Resource Use	L	L	L	L	L			L	L	L	**L**
6. Human Intrusions & Disturbance	L	L	L	L	L	L	L	L	L	L	**L**
7. Natural System Modifications	L	L	L	L	L	L	L	L	L	L	**L**
8. Invasive & Other Problematic Species & Genes	L	L	L	L		L		L	L		**L**
9. Pollution	L	L	L	L	L	L	L	L	L	L	**L**
12. Other Direct Threats								L			**L**

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

Element 5: Conservation Objectives

Wilson's Snipe Photo: © Cephas

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 8 PNR, no threats identified for individual species were assessed at a magnitude of "medium" or greater. Therefore no specific conservation objectives or associated actions are presented, as per Kennedy et al. (2012).

Element 6: Recommended Actions

Recommended actions indicate on-the-ground activities that will help to achieve the conservation objectives (Fig. 7). 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, but will usually be more general than those developed for individual species.

California Gull Photo: © Alan Vernon

For BCR 8 PNR no threats identified for individual species were assessed at a magnitude of "medium" or greater. Therefore no specific conservation objectives or associated actions were developed as per Kennedy et al. (2012). Many of the threats facing priority bird species in BCR 8 PNR are not well understood; this may be due to inadequate monitoring for most species, which leads to uncertainty in BCR population trends, or a lack of evidence establishing causative relationships between human activities and population declines.

These knowledge gaps will often be best addressed using an adaptive management approach, which iteratively employs management actions as scientific experiments to test specific hypotheses to inform future management decisions (Walters et al. 1992). As the dominant habitat types within BCR 8 PNR are forests, beneficial management practices for forest ecosystems will help to maintain breeding habitat for many bird species.

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 8 PNR. 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. Some species do not appear in the threats table because their low-level threats have not been assigned objectives or actions and/or identified threats are addressed in the Widespread Issues section of the strategy.

Coniferous

BCR 8 PNR contains a large coniferous forest component, including large areas of black and white spruce forests, black spruce and tamarack forests in peatland areas throughout the north and central regions, and jack pine in well-drained upland soils throughout the BCR (Fig. 6). White spruce forests and jack pine stands in upland soils are both decreasing in abundance due to forest industry focus on these species. A combination of fire, insect, water level and disease disturbances are the principal natural processes that have shaped the structure of this habitat across the landscape by maintaining a wide variety of stand ages throughout the region. However, modern fire suppression, coupled with forest harvest, is changing historical forest dynamics and altering forest age- and spatial-structure. Non-merchantable coniferous forest such as black spruce found in bogs are becoming older on average, while merchantable timber such as white spruce and jack pine are becoming truncated to a younger age-distribution relative to pre-industrial forestry periods. As forest harvesting of softwoods (i.e., conifers) replaces fire disturbance as the main disturbance on the landscape, increased abundance of trembling aspen occurs prematurely in many areas, making it difficult for softwoods to regenerate.

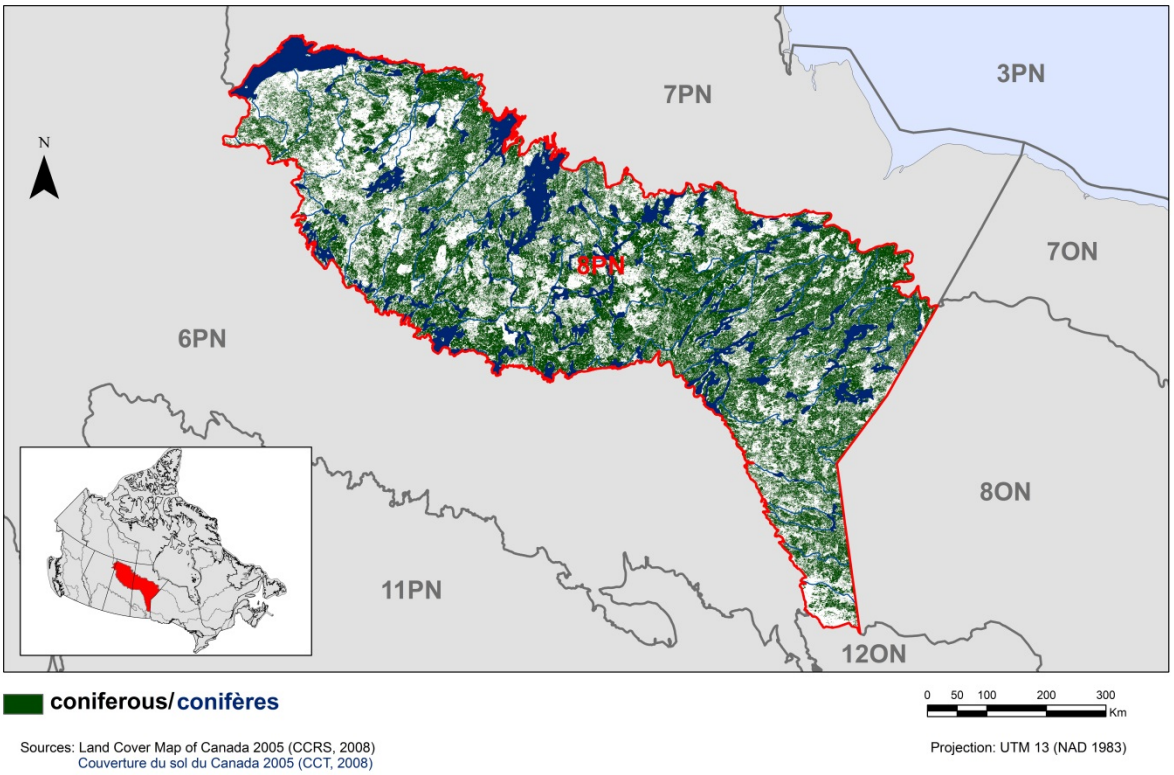


Figure 6. Map of coniferous forest in BCR 8 PNR.

There are 21 priority species that use coniferous forests, primarily landbirds, 5 of which meet the criteria for stewardship species. The majority of species considered here are listed based on their provincial GS ranks (Table 5).

There were no medium or higher magnitude threats identified for priority species in coniferous forests in BCR 8 PNR (Fig. 7), and therefore no conservation objectives or actions were listed. The low-level threats in this habitat are primarily related to habitat loss from logging and wood harvesting (threat sub-category 5.3), as well as the loss of burned forest habitat to due fire suppression (sub-category 7.1). In the near future, jack pine stands could be affected by mountain pine beetle infestations, which are currently moving east into Alberta's forests from British Columbia; this potential threat has not been addressed here, as it has not yet occurred in this subregion (Government of Saskatchewan, 2013).

Table 5. Priority species that use coniferous habitat, regional habitat sub-class, important habitat features, population objectives and reason for priority status in BCR 8 PNR.

Priority Species	Regional Habitat Sub-class	Important Habitat Features	Population Objective	Reason for Priority Status[1]					
				At Risk	CC	S	GS	NAWMP	Ex
American Three-toed Woodpecker	Mature to old-growth; recently disturbed (especially by fire)	Dead/dying trees & snags	Assess/Maintain				Y		
Bay-breasted Warbler	Old to old-growth; recently disturbed (especially by fire)	Spruce budworm specialist	Assess/Maintain				Y		
Black-backed Woodpecker	Old to old-growth; recently disturbed (especially by fire)	Dead/dying trees & snags	Assess/Maintain			Y	Y		
Bonaparte's Gull	Bog, fen and conifer swamp	Wetlands	Assess/Maintain		Y				
Brown Creeper	Old to old-growth	Dead/dying trees & snags	Assess/Maintain				Y		
Bufflehead	All types near water	Secondary cavities; abandoned nests of other species	Assess/Maintain		Y			Y	
Cape May Warbler	Mature to old-growth	Tall spruce trees; mossy understory; spruce budworm specialist	Assess/Maintain			Y	Y		
Common Goldeneye	All types near water	Snags; cavities	Assess/Maintain		Y			Y	
Evening Grosbeak	All types		Assess/Maintain			Y			
Great Gray Owl	All types	Abandoned nests of other species; bogs/marshes/meadows nearby	Assess/Maintain				Y		
Lesser Yellowlegs	All types near water	Wetlands	Increase 100%		Y				
Northern Hawk Owl	All types; recently disturbed (fire)	Natural/secondary cavities; snags; bogs/marshes nearby	Assess/Maintain				Y		
Pileated Woodpecker	Old to old-growth white spruce	Snags	Assess/Maintain				Y		
Pine Grosbeak	All types		Assess/Maintain				Y		

[1] Reasons for inclusion in the priority species list are as follows. At Risk: the species is assessed by COSEWIC, listed on SARA, or listed provincially (AB, SK, MB) as either Endangered, Threatened or Special Concern; CC: the species meets conservation concern criteria for its bird group; S: the species meets stewardship criteria (landbirds only); GS: the species has a provincial General Status rank of At Risk, May Be At Risk or Sensitive; NAWMP: the species has NAWMP priority of Moderate-High, High or Highest in the BCR (waterfowl only); Ex: the species was included based on expert opinion.

Table 5 continued

Priority Species	Regional Habitat Sub-class	Important Habitat Features	Population Objective	Reason for Priority Status[1]					
				At Risk	CC	S	GS	NAWMP	Ex
Olive-sided Flycatcher	All types		Recovery Objective[2]	Y					
Purple Finch	Mature to old-growth		Increase 50%		Y				
Rusty Blackbird	All types	Wetlands nearby	Assess/Maintain	Y			Y		
Short-billed Dowitcher	Boreal-taiga transition; black spruce	Wetlands	Increase 100%		Y		Y		
White-winged Crossbill	Mature to old-growth	Seed crops	Assess/Maintain				Y		
Yellow-bellied Flycatcher	Mature to old-growth	Bog, fen and conifer swamp	Assess/Maintain			Y			
Yellow-bellied Sapsucker	Old to old-growth		Increase 50%			Y			

[2] The species is listed under SARA, but its recovery documents have not yet been finalized.

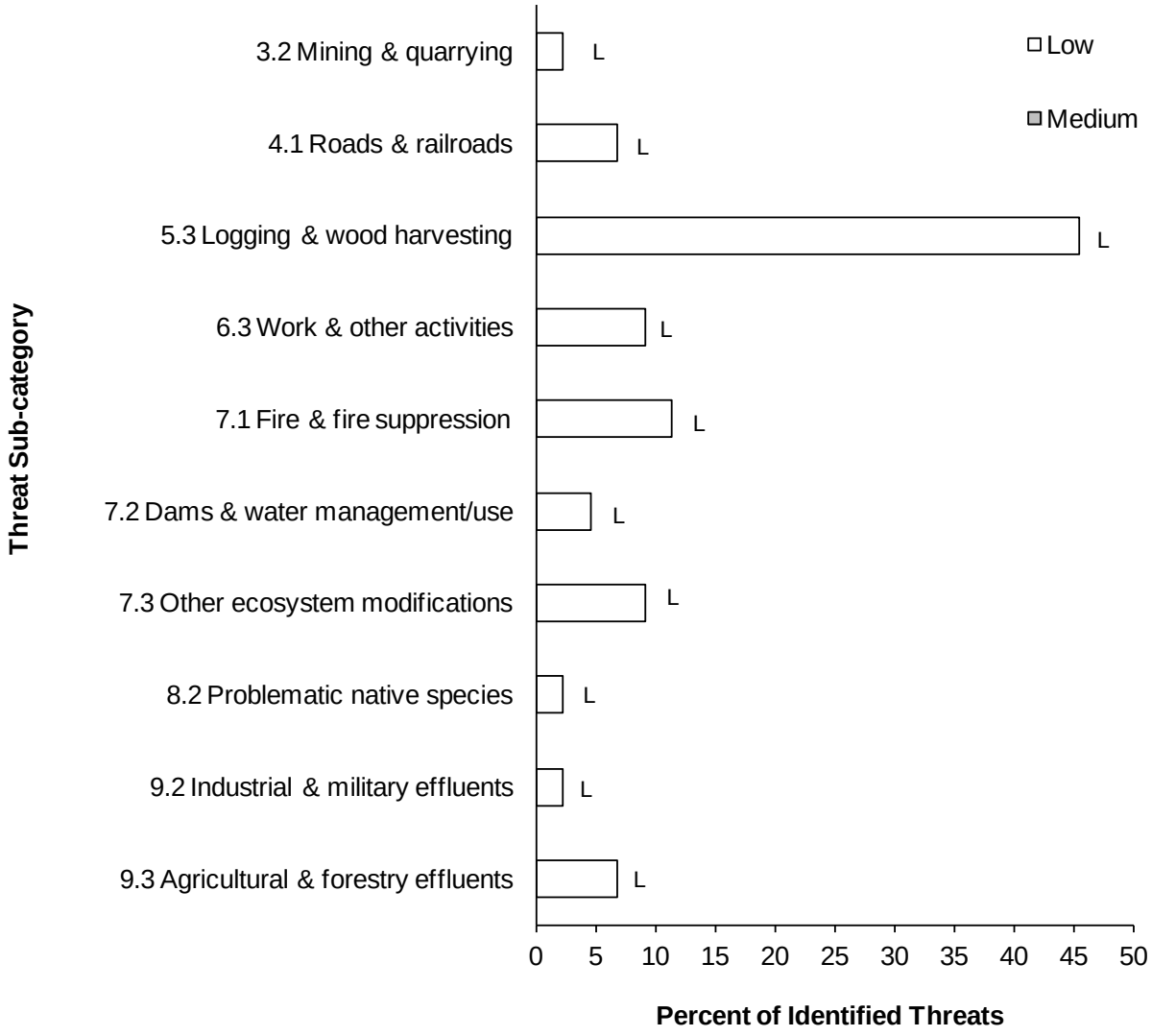


Figure 7. Percent of identified threats to priority species in coniferous habitat in each threat sub-category for BCR 8 PNR.

Each bar represents the percent of the total number of threats identified in each threat sub-category in coniferous habitat (for example, if 100 threats were identified in total for all priority species in coniferous habitat, and 10 of those threats were in the category 6.3 Work & other activities, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L) and Medium (M) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked M for one species and L for another; the shading illustrates the proportion of L and M rankings in the sub-category). The overall magnitude of the sub-threat in coniferous habitat is shown at the end of each bar (also presented in Table 4, Relative magnitude of identified threats to priority species within BCR 8 PNR by threat category and broad habitat class).

Note: Threats of all magnitudes are included, although low-ranked threats affecting only a single species were not assigned conservation objectives or recommended actions.

Deciduous

Great Grey Owl Photo: © Tony Hisgett

Deciduous trees occur throughout BCR 8 PNR; however, pure deciduous forests are primarily found in the transitional area along the southern border of the Boreal Shield Ecozone, and in early/mid-seral stage stands recently disturbed by forestry or fire. Other deciduous forests include the pure balsam poplar stands associated with river flood plains and lakes throughout the BCR (Fig. 8).

Twenty-three priority species have associations with deciduous habitat in BCR 8 PNR. Most of these species are landbirds; however, some are associated with wetland areas. The primary reason for the priority status of these species is their provincial general status rank (Table 6), although three priority species are federally listed species at risk. These priority species use a broad range of sub-habitats within deciduous forests, with many showing preference for specific understory characteristics (e.g., Canada Warbler) or specific nesting cavity requirements (e.g., Bufflehead).

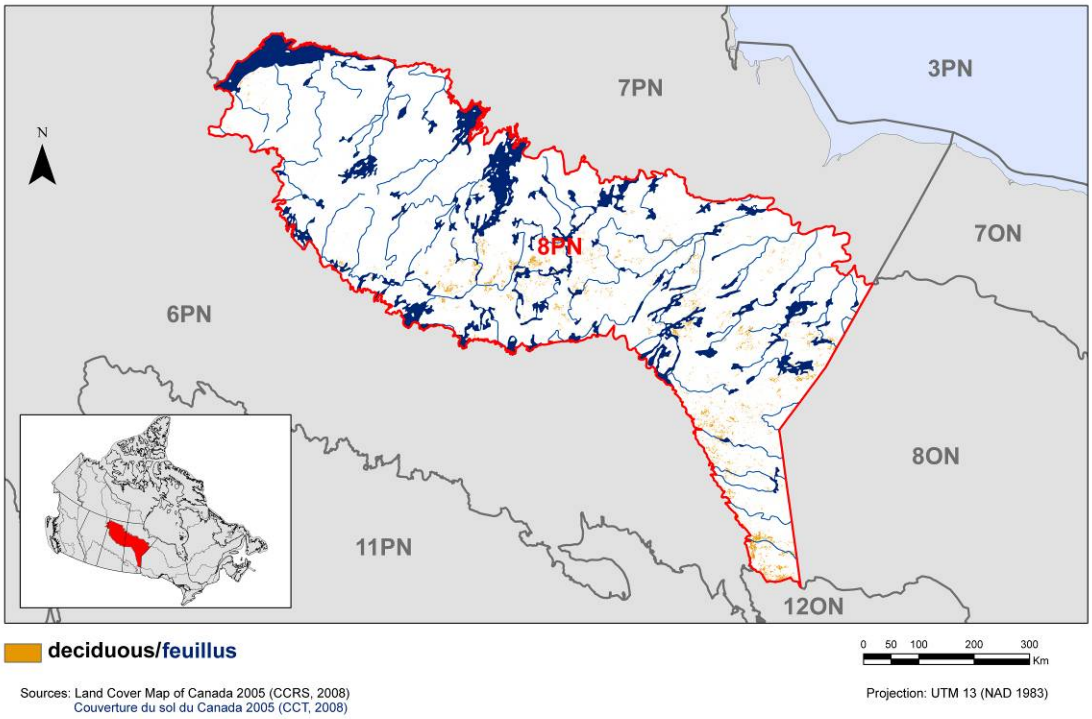


Figure 8. Map of deciduous forest in BCR 8 PNR.

SARA-listed species for which specific recovery objectives are being drafted are primarily found in the eastern portion of the aspen parkland (e.g., Chimney Swift and Eastern Whip-poor-will), where better information is available to monitor population status (i.e., greater density of Breeding Bird Survey [BBS] routes, greater levels of development and monitoring).

There were no medium or higher magnitude threats identified for priority species in deciduous forests in BCR 8 PNR (Fig. 9), and therefore no conservation objectives or actions were listed. However, the most important management consideration for species within deciduous forests is the maintenance of large contiguous areas of aspen forest of differing ages and understory where possible. This is reflected in the more than 30% of threats classified in threat sub-category 5.3 (Logging and Wood Harvesting) (Fig. 9). Management of pulp resources in order to maintain a diversity of stand ages is vital. Increasing the area of deciduous stands in the agricultural districts at the southern fringes of the BCR may be a useful conservation initiative.

The sub-lethal toxic effects from the pesticides used in forestry (sub-category 9.3) were also identified as a common, low threat in deciduous habitat. This threat is discussed in detail in the Widespread Issues section of the strategy.

Table 6. Priority species that use deciduous habitat, regional habitat sub-class, important habitat features, population objectives and reason for priority status.

Priority Species	Regional Habitat Sub-class	Important Habitat Features	Population Objective	Reason for Priority Status[1]					
				At Risk	CC	S	GS	NAWMP	Ex
Alder Flycatcher	Young to mature	Dense shrub	Increase 50%			Y			
Bay-breasted Warbler	Old	Spruce budworm specialist	Assess/Maintain				Y		
Black-and-white Warbler	Mature to old-growth		Assess/Maintain			Y			
Bufflehead	Poplar/aspen	Abandoned Northern Flicker nests	Assess/Maintain		Y			Y	
Canada Warbler	All types	Dense understory, poorly drained, slope	Recovery Objective[2]	Y					
Chestnut-sided Warbler	Young to mature	Dense shrub	Increase 50%			Y			
Chimney Swift	Old-growth	Chimneys/cavities for nest sites and communal roosts	Recovery Objective[2]	Y			Y		
Common Goldeneye	Aspen	Cavities, wetlands	Assess/Maintain		Y			Y	
Common Yellowthroat	Mature	Dense understory, typically near water	Increase 50%				Y		
Connecticut Warbler	Mature to old-growth		Increase 50%		Y				
Eastern Phoebe	Young aspen	Natural/human-made overhang for nest site	Assess/Maintain				Y		
Eastern Whip-poor-will	Early- to mid-successional	Open understory	Recovery Objective[2]	Y					
Green-winged Teal	Aspen	Near water	Assess/Maintain		Y		Y	Y	
Least Flycatcher	Young to old-growth	Dense shrub	Assess/Maintain				Y		
Lesser Yellowlegs	All types near water	Wetlands	Increase 100%		Y				
Mourning Warbler	Young to old-growth	Dense shrub understory	Assess/Maintain			Y			

[1] Reasons for inclusion in the priority species list are as follows. At Risk: the species is assessed by COSEWIC, listed on SARA, or listed provincially (AB, SK, MB) as either Endangered, Threatened or Special Concern; CC: the species meets conservation concern criteria for its bird group; S: the species meets stewardship criteria (landbirds only); GS: the species has a provincial General Status rank of At Risk, May Be At Risk or Sensitive; NAWMP: the species has NAWMP priority of Moderate-High, High or Highest in the BCR (waterfowl only); Ex: the species was included based on expert opinion.

[2] The species is listed under SARA, but its recovery documents have not yet been finalized.

Table 6 continued

Priority Species	Regional Habitat Sub-class	Important Habitat Features	Population Objective	Reason for Priority Status[1]					
				At Risk	CC	S	GS	NAWMP	Ex
Nashville Warbler	Young to mature deciduous forest; second-growth and mature forest with shrubby understory		Assess/Maintain			Y			
Northern Flicker	Large dead/dying trees	Dead/dying trees & snags	Increase 50%			Y			
Ovenbird	Mature		Assess/Maintain			Y			
Pileated Woodpecker	Old to old-growth	Snags	Assess/Maintain				Y		
Purple Finch	Young to mature		Increase 50%		Y				
Ruffed Grouse	Young to old	Drumming log; small clearings	Assess/Maintain			Y			
Yellow-bellied Sapsucker	Young to old-growth		Increase 50%			Y			

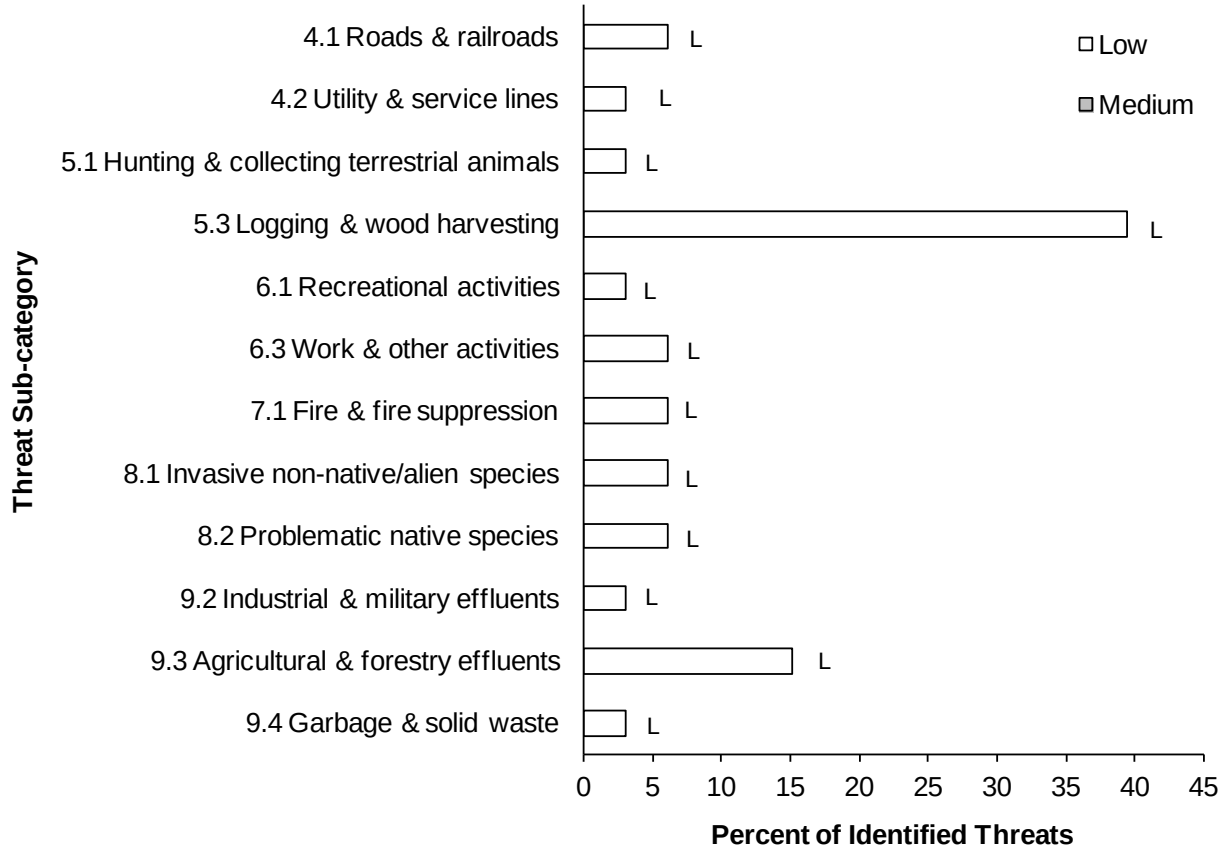


Figure 9. Percent of identified threats to priority species in deciduous habitat in each threat sub-category for BCR 8 PNR.

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 forests, and 10 of those threats were in the category 6.3 Work & other activities, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L) and Medium (M) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked M for one species and L for another; the shading illustrates the proportion of L and M rankings in the sub-category). The overall magnitude of the sub-threat in deciduous habitat is shown at the end of each bar (also presented in Table 4, Relative magnitude of identified threats to priority species within BCR 8 PNR by threat category and broad habitat class).

Note: Threats of all magnitudes are included, although low-ranked threats affecting only a single species were not assigned conservation objectives or recommended actions.

Mixed Wood

Mixed wood forests are defined as forests or woodlands characterized by a mixture of coniferous and deciduous species. Mixed wood habitats occur throughout BCR 8 PNR, typically dispersed within more extensive coniferous forest wherever disturbance or soils have allowed a substantial deciduous component to develop (Fig. 10).

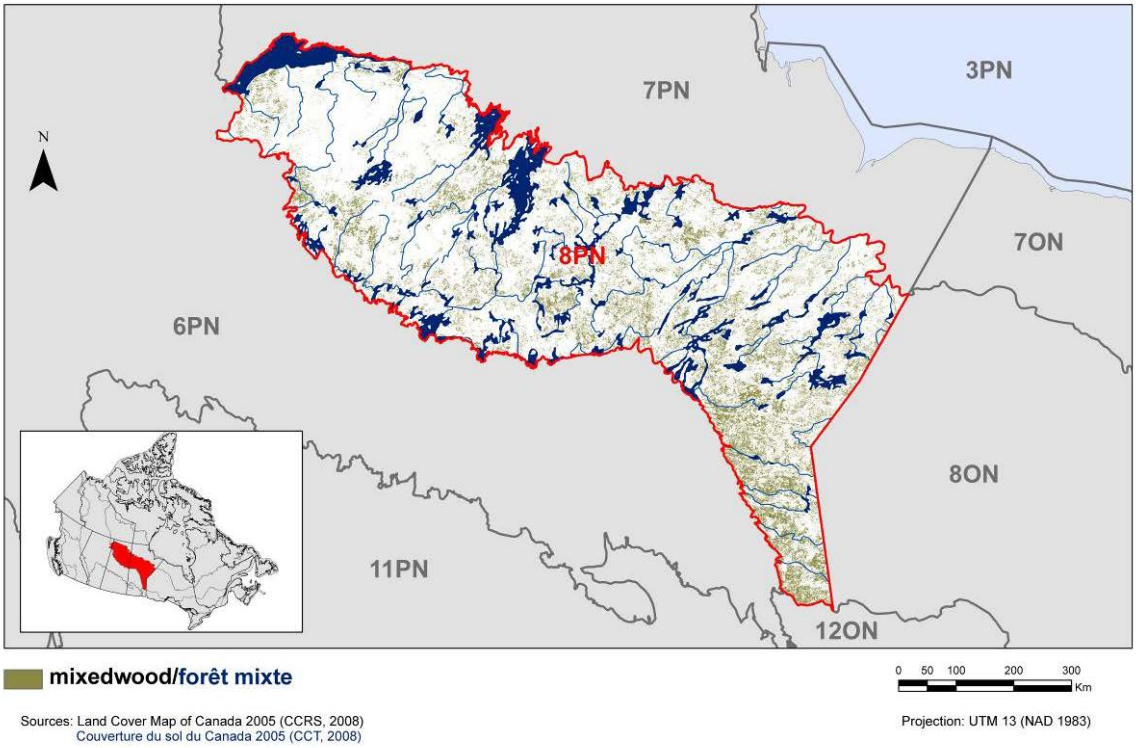


Figure 10. Map of mixed wood forest in BCR 8 PNR.

Thirty priority species have been identified as using mixed wood habitats within the BCR, five of which are listed as species at risk under SARA and one under provincial legislation (Barred Owl in Alberta; Table 7).

There were no medium or higher magnitude threats identified for priority species in mixed wood forests in BCR 8 PNR (Fig. 11), and therefore no conservation objectives or actions were listed. The threat affecting the most priority species in this habitat type is habitat loss and stand modification through forest harvesting (threat sub-category 5.3) and, to some extent, fire suppression (threat sub-category 7.1), though the magnitude overall remains low due to the low significance of this effect on the priority species.

Table 7. Priority species that use mixed wood habitat, regional habitat sub-class, important habitat features, population objectives and reason for priority status.

Priority Species	Regional Habitat Sub-class	Important Habitat Features	Population Objective	Reason for Priority Status[1]					
				At Risk	CC	S	GS	NAWMP	Ex
American Three-toed Woodpecker	Old-growth	Snags	Assess/Maintain				Y		
Barred Owl	Mature to old	Nest sites and high prey abundance	Assess/Maintain	Y			Y		
Bay-breasted Warbler	Young to old-growth conifer dominated	Spruce budworm specialist	Assess/Maintain				Y		
Black-and-white Warbler	Young to old deciduous-dominated		Assess/Maintain			Y			
Brown Creeper	Conifer-dominated	Snags	Assess/Maintain				Y		
Bufflehead	All types near water	Secondary cavities; abandoned nests of other species	Assess/Maintain		Y			Y	
Canada Warbler	Deciduous-dominated	Dense understory, poorly drained, slope	Recovery Objective[2]	Y					
Cape May Warbler	Conifer-dominated	Tall spruce for perches; mossy understory; spruce budworm specialist	Assess/Maintain			Y	Y		
Chestnut-sided Warbler	Young/second-growth deciduous-dominated	Dense shrub	Increase 50%			Y			
Common Goldeneye	All types near water	Snags; cavities	Assess/Maintain		Y			Y	
Common Nighthawk	Regenerating	Open ground	Recovery Objective[2]	Y			Y		

[1] Reasons for inclusion in the priority species list are as follows. At Risk: the species is assessed by COSEWIC, listed on SARA, or listed provincially (AB, SK, MB) as either Endangered, Threatened or Special Concern; CC: the species meets conservation concern criteria for its bird group; S: the species meets stewardship criteria (landbirds only); GS: the species has a provincial General Status rank of At Risk, May Be At Risk or Sensitive; NAWMP: the species has NAWMP priority of Moderate-High, High or Highest in the BCR (waterfowl only); Ex: the species was included based on expert opinion.

[2] The species is listed under SARA, but its recovery documents have not yet been finalized.

Table 7 continued

Priority Species	Regional Habitat Sub-class	Important Habitat Features	Population Objective	Reason for Priority Status[1]					
				At Risk	CC	S	GS	NAWMP	Ex
Common Yellowthroat	Regenerating to young, deciduous-dominated	Thicket/dense understory; proximity to water	Increase 50%				Y		
Connecticut Warbler	Young to old-growth deciduous-dominated		Increase 50%		Y				
Eastern Whip-poor-will	Early- to mid-successional	Open understory; clearings	Recovery Objective[2]	Y					
Evening Grosbeak	Mature to old-growth conifer-dominated		Assess/Maintain			Y			
Great Gray Owl	Conifer-dominated		Assess/Maintain				Y		
Least Flycatcher	Young to old deciduous-dominated		Assess/Maintain				Y		
Lesser Yellowlegs	All types near water	Wetlands	Increase 100%		Y				
Mourning Warbler	Young deciduous-dominated		Assess/Maintain			Y			
Nashville Warbler	Young to mature deciduous-dominated	Shrubby understory	Assess/Maintain			Y			
Northern Flicker	All types; open; riparian	Snags	Increase 50%			Y			
Olive-sided Flycatcher	Coniferous-dominated	Tall trees or snags; openings (bogs, harvest, fire, water)	Recovery Objective[2]	Y					
Ovenbird	Young to mature deciduous-dominated		Assess/Maintain			Y			
Pileated Woodpecker	Old to old-growth; young with large residual trees	Snags	Assess/Maintain				Y		
Purple Finch	Mature to very old conifer-dominated		Increase 50%		Y				
Ruffed Grouse	Old to old-growth deciduous-dominated	Drumming log; small clearings	Assess/Maintain			Y			
Rusty Blackbird	Conifer-dominated	Near water	Assess/Maintain	Y			Y		
White-winged Crossbill	Mature to old-growth conifer-dominated	Seed crops	Assess/Maintain				Y		
Yellow-bellied Flycatcher	Young to old-growth conifer dominated; bog, fen		Assess/Maintain			Y			
Yellow-bellied Sapsucker	Old to old-growth deciduous-dominated		Increase 50%			Y			

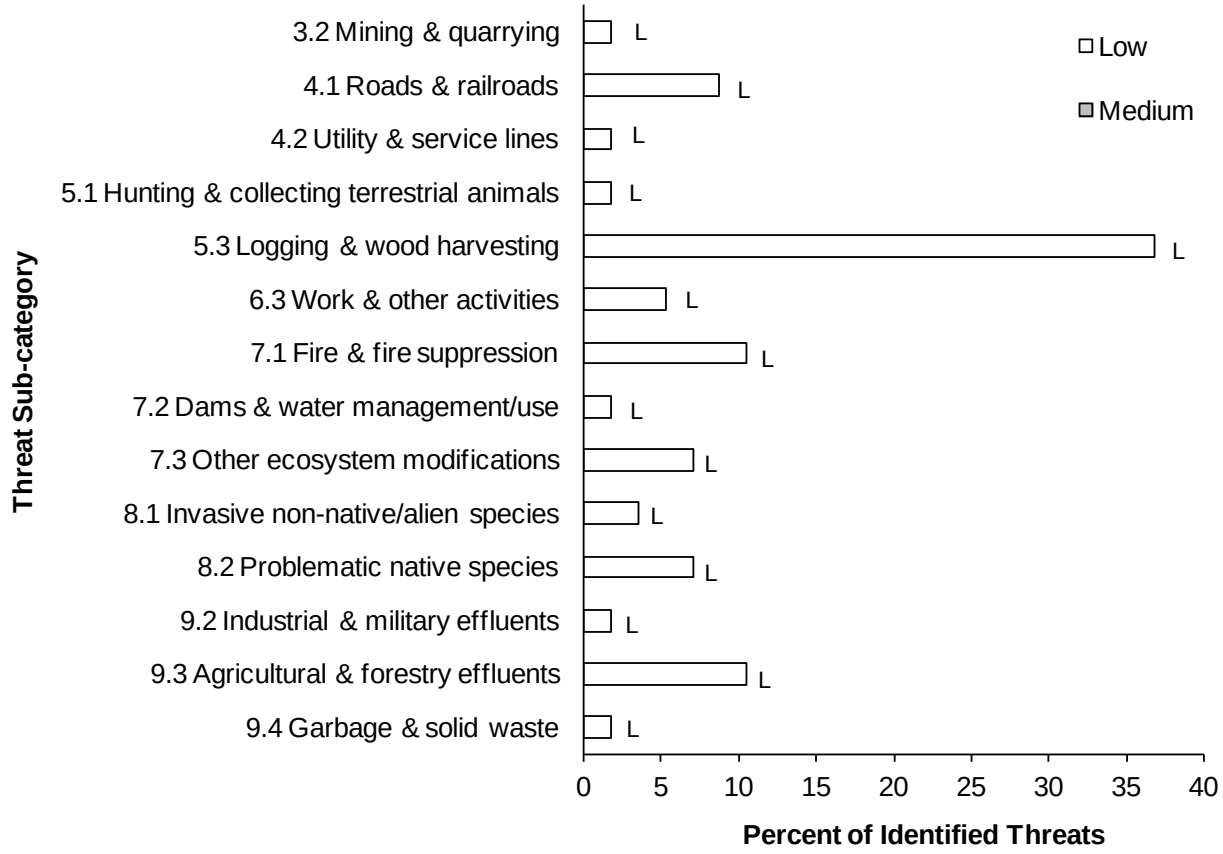


Figure 11. Percent of identified threats to priority species in mixed wood habitat in each threat sub-category for BCR 8 PNR.

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 6.3 Work & other activities, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L) and Medium (M) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked M for one species and L for another; the shading illustrates the proportion of L and M rankings in the sub-category). The overall magnitude of the sub-threat in mixed wood habitat is shown at the end of each bar (also presented in Table 4, Relative magnitude of identified threats to priority species within BCR 8 PNR by threat category and broad habitat class).
Note: Threats of all magnitudes are included, although low-ranked threats affecting only a single species were not assigned conservation objectives or recommended actions.

Shrub/Early Successional

Ruffed Grouse Photo: © Rock Arsenault

The shrub and early successional habitat class covers areas where vegetation is shrubby due to its early successional stage, such as patches of forest where disturbance has removed the tree cover, or where they naturally occur in association with water (e.g., shrubby bogs/fens, thicket swamps, riparian edges). Shrub and early successional habitat is relatively widespread in BCR 8 PNR, occurring wherever wildfire, timber harvest (more common in the southern portion of the sub-region), or other disturbances have created openings in forest cover. In most cases, this habitat type is lost as succession progresses and young forests develop (Fig. 12).

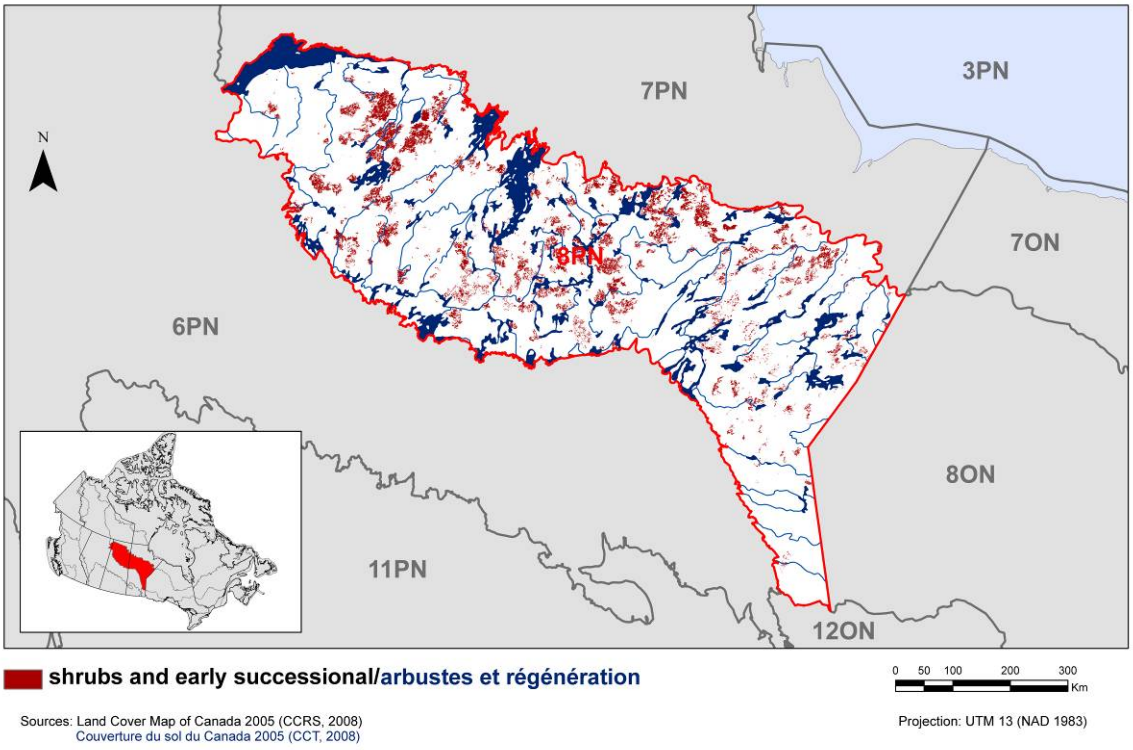


Figure 12. Map of shrub and early successional habitat in BCR 8 PNR.

Twenty-three priority species in BCR 8 PNR are associated with this habitat class, including the SARA-listed Olive-sided Flycatcher and Rusty Blackbird (Table 8).

There were no medium or higher magnitude threats identified for priority species in shrub and early successional habitats in BCR 8 PNR (Fig. 13), and therefore no conservation objectives or actions were listed. The low-level threats in this habitat are primarily related to habitat loss and degradation due to logging and wood harvesting (threat sub-category 5.3) and fire suppression (sub-category 7.1), and the lethal and sub-lethal toxic effects of industrial contaminants such as selenium, mercury and other heavy metals (sub-category 9.2).

Table 8. Priority species that use shrub/early successional habitat, regional habitat sub-class, important habitat features, population objectives and reason for priority status.

Priority Species	Regional Habitat Sub-class	Important Habitat Features	Population Objective	Reason for Priority Status[1]					
				At Risk	CC	S	GS	NAWMP	Ex
Alder Flycatcher	Thicket; shrubland		Increase 50%			Y			
American Wigeon	Thicket		Increase 50%		Y			Y	
Cape May Warbler	Shrubs	Scattered tall spruce for singing perches; open, mossy understory; spruce budworm specialist	Assess/Maintain			Y	Y		
Chestnut-sided Warbler	Shrubland		Increase 50%			Y			
Common Yellowthroat	Thicket; shrubland	Shrubby fens, thicket swamps	Increase 50%				Y		
Eastern Phoebe	Shrubland	Natural/man-made overhang for nest site	Assess/Maintain				Y		
Evening Grosbeak	Shrubs		Assess/Maintain			Y			
Green-winged Teal	Thicket		Assess/Maintain		Y		Y	Y	
Least Flycatcher	Shrubland		Assess/Maintain				Y		
Lesser Scaup	Thicket		Increase 50%		Y		Y	Y	
Mallard	Thicket		Assess/Maintain		Y			Y	
Mourning Warbler	Shrubland		Assess/Maintain			Y			
Northern Flicker	Thicket; shrubland	Dead/dying trees; snags	Increase 50%			Y			
Northern Hawk Owl	Shrubland	Natural/secondary cavities; snags	Assess/Maintain				Y		
Olive-sided Flycatcher	Shrubland	Tall prominent trees/snags; openings	Recovery Objective[2]	Y					
Ring-necked Duck	Thicket		Asses/maintain		Y			Y	
Ruffed Grouse	Thicket	Drumming log; small clearings	Assess/Maintain			Y			
Rusty Blackbird	Shrubs; shrubland	Near open water	Assess/Maintain	Y			Y		
Solitary Sandpiper	Shrubland	Near open water	Increase 50%		Y				
Surf Scoter	Thicket		Increase 50%		Y			Y	

[1] Reasons for inclusion in the priority species list are as follows. At Risk: the species is assessed by COSEWIC, listed on SARA, or listed provincially (AB, SK, MB) as either Endangered, Threatened or Special Concern; CC: the species meets conservation concern criteria for its bird group; S: the species meets stewardship criteria (landbirds only); GS: the species has a provincial General Status rank of At Risk, May Be At Risk or Sensitive; NAWMP: the species has NAWMP priority of Moderate-High, High or Highest in the BCR (waterfowl only); Ex: the species was included based on expert opinion.

[2] The species is listed under SARA, but its recovery documents have not yet been finalized.

Table 8 continued

Priority Species	Regional Habitat Sub-class	Important Habitat Features	Population Objective	Reason for Priority Status[1]					
				At Risk	CC	S	GS	NAWMP	Ex
White-winged Scoter	Thicket	Islands	Increase 50%		Y		Y	Y	
Wilson's Snipe	Willow/alder shrubland		Increase 100%		Y				
Yellow-bellied Sapsucker	Shrubland		Increase 50%			Y			

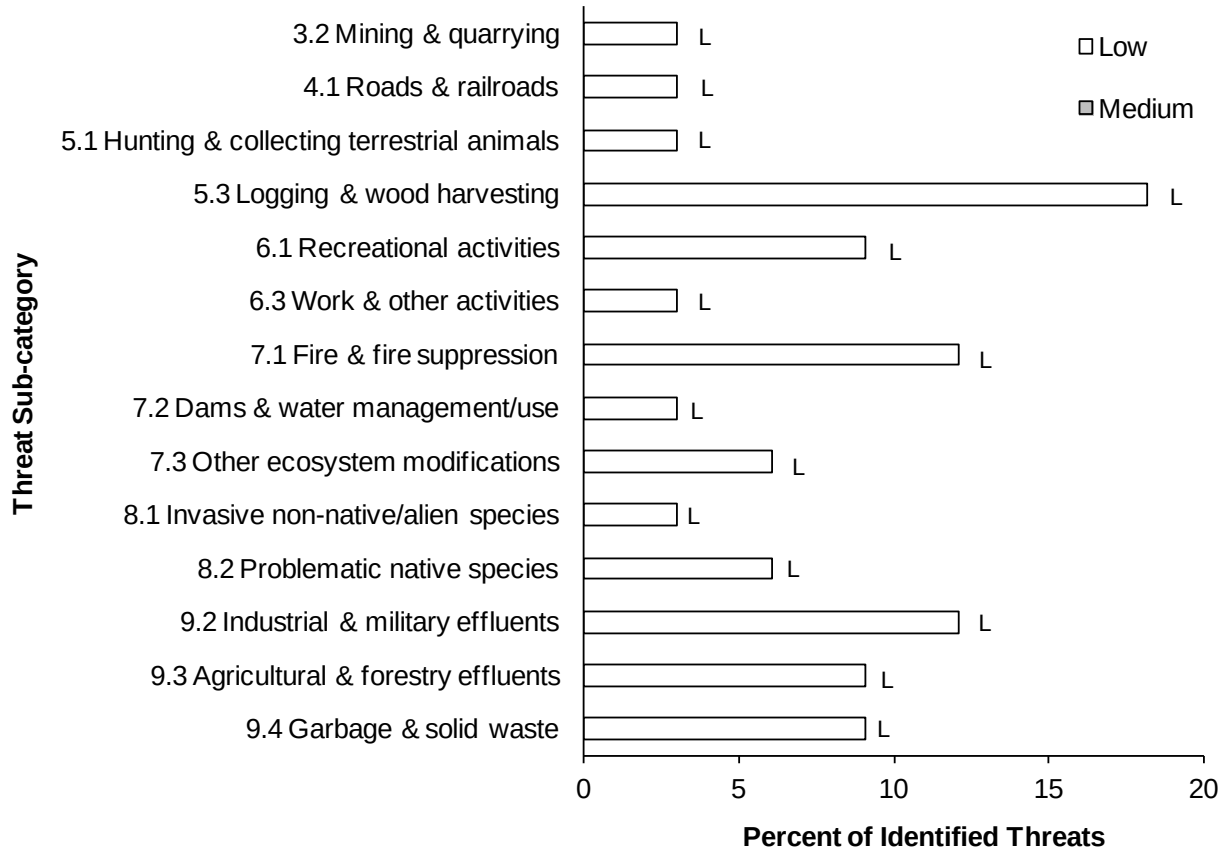


Figure 13. Percent of identified threats to priority species in shrub/early successional habitat in each threat sub-category for BCR 8 PNR.

Each bar represents the percent of the total number of threats identified in each threat sub-category in shrub/early successional habitat (for example, if 100 threats were identified in total for all priority species in shrub/early successional habitat, and 10 of those threats were in the category 6.3 Work & other activities, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L) and Medium (M) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked M for one species and L for another; the shading illustrates the proportion of L and M rankings in the sub-category). The overall magnitude of the sub-threat in shrub/early successional habitat is shown at the end of each bar (also presented in Table 4, Relative magnitude of identified threats to priority species within BCR 8 PNR by threat category and broad habitat class).

Note: Threats of all magnitudes are included, although low-ranked threats affecting only a single species were not assigned conservation objectives or recommended actions.

Herbaceous

Red-necked Phalarope Photo: © Chgans

The herbaceous habitat class includes native grassland, meadowlands and pastureland. In general, herbaceous habitats occur primarily in the northwest portion of the BCR in areas where there are large open meadow lands. Very limited grazing and agriculture occurs along the southern fringes of the BCR in Manitoba where there are pasturelands and grasslands (Fig. 14).

Seventeen priority species use herbaceous habitats in BCR 8 PNR, two of which are listed under SARA as species of Special Concern. Priority species, such as Red-necked Phalaropes, principally use herbaceous habitats associated with water and likely use small patches of herb/forb areas adjacent to wetlands, ponds and lakes (Table 9). There were no medium or higher magnitude threats identified for herbaceous habitat in BCR 8 PNR (Fig. 15), and therefore no conservation objectives or actions were recommended. The low-level threats in this habitat are primarily related to human disturbance of breeding priority bird species by recreational and work activities (sub-categories 6.1 and 6.3), and lethal and sub-lethal effects from heavy metals (sub-category 9.2) and spent lead shot (sub-category 9.4).

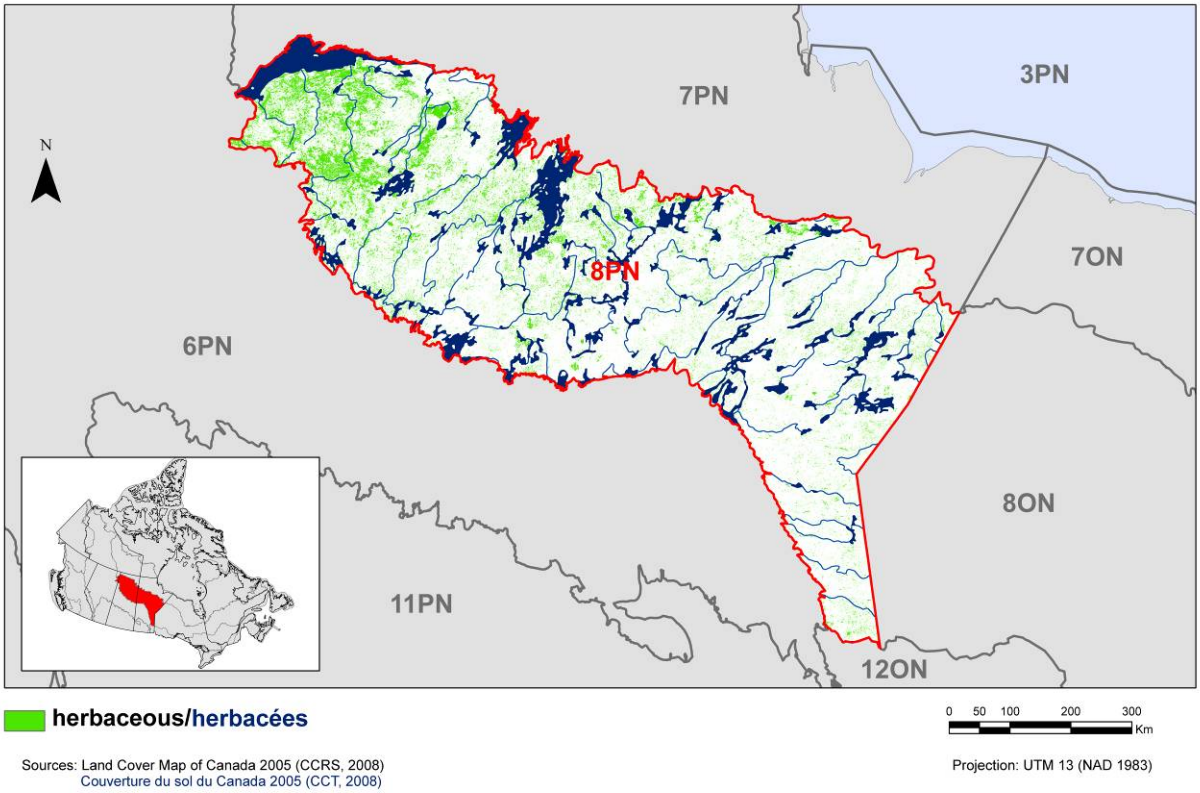


Figure 14. Map of herbaceous habitat in BCR 8 PNR.

Table 9. Priority species that use herbaceous habitat, regional habitat sub-class, important habitat features, population objectives and reason for priority status.

Priority Species	Regional Habitat Sub-class	Important Habitat Features	Population Objective	Reason for Priority Status[1]					
				At Risk	CC	S	GS	NAWMP	Ex
American Bittern	Dense emergent vegetation	Near wetlands; emergent vegetation	Increase 50%		Y		Y		
American Wigeon	Wet meadow	Near wetlands	Increase 50%		Y			Y	
Black Tern	Wet meadow	Near wetlands	Increase 100%		Y				
Green-winged Teal	Wet meadow	Near wetlands	Assess/Maintain		Y		Y	Y	
Killdeer	Short-grass meadows; native grasslands/pasture		Increase 50%		Y				
Lesser Scaup	Wet meadow	Near wetlands	Increase 50%		Y		Y	Y	
Mallard	Wet meadow	Near wetlands	Assess/Maintain		Y			Y	
Red-necked Phalarope	Wet meadow	Near wetlands	Migrant (no population objective)		Y				
Ring-necked Duck	Wet meadow	Near wetlands	Assess/maintain		Y			Y	
Short-billed Dowitcher	Wet meadow	Near wetlands	Increase 100%		Y		Y		
Short-eared Owl			Assess/Maintain	Y			Y		
Sora	Dense emergent vegetation	Near wetlands	Assess/maintain		Y		Y		
Surf Scoter	Wet meadow	Near wetlands	Increase 50%		Y			Y	
Swamp Sparrow	Wet meadow	Near wetlands	Assess/maintain			Y			
Virginia Rail	Dense emergent vegetation	Near wetlands	Assess/maintain		Y				
White-winged Scoter	Wet meadow	Near wetlands	Increase 50%		Y		Y	Y	
Yellow Rail	Dense emergent vegetation	Near wetlands	Assess/maintain	Y	Y		Y		

[1] Reasons for inclusion in the priority species list are as follows. At Risk: the species is assessed by COSEWIC, listed on SARA, or listed provincially (AB, SK, MB) as either Endangered, Threatened or Special Concern; CC: the species meets conservation concern criteria for its bird group; S: the species meets stewardship criteria (landbirds only); GS: the species has a provincial General Status rank of At Risk, May Be At Risk, or Sensitive; NAWMP: the species has NAWMP priority of Moderate-High, High or Highest in the BCR (waterfowl only); Ex: the species was included based on expert opinion.

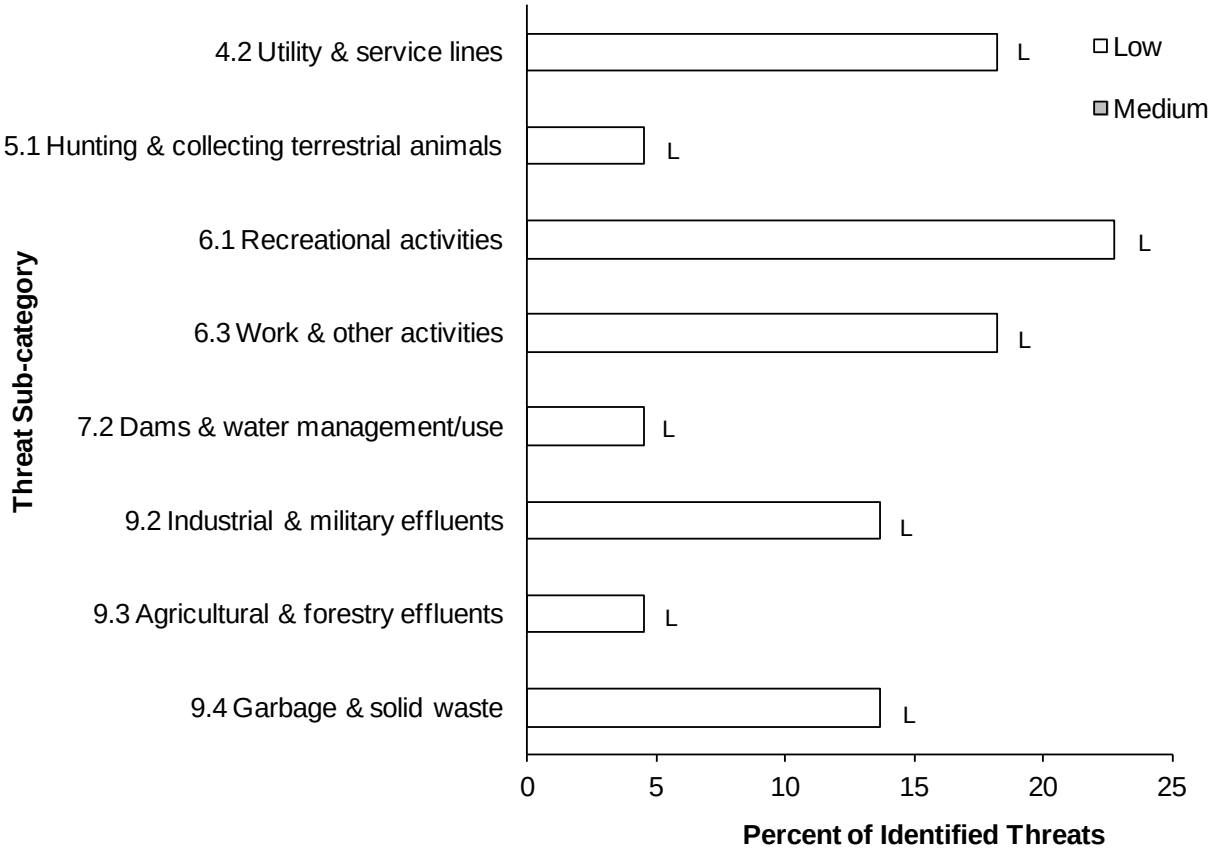


Figure 15. Percent of identified threats to priority species in herbaceous habitat in each threat sub-category for BCR 8 PNR.

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 6.3 Work & other activities, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L) and Medium (M) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked M for one species and L for another; the shading illustrates the proportion of L and M rankings in the sub-category). The overall magnitude of the sub-threat in herbaceous habitat is shown at the end of each bar (also presented in Table 4, Relative magnitude of identified threats to priority species within BCR 8 PNR by threat category and broad habitat class).

Note: Threats of all magnitudes are included, although low-ranked threats affecting only a single species were not assigned conservation objectives or recommended actions.

Cultivated and Managed Areas

The category "Cultivated and Managed Areas" includes crop lands that replace natural vegetation, and urban vegetation such as parks and tree plantations. This habitat occurs primarily at the extreme southern edge of BCR 8 PNR, where very limited agriculture occurs along the southern fringes of the BCR in Manitoba (Fig. 16).

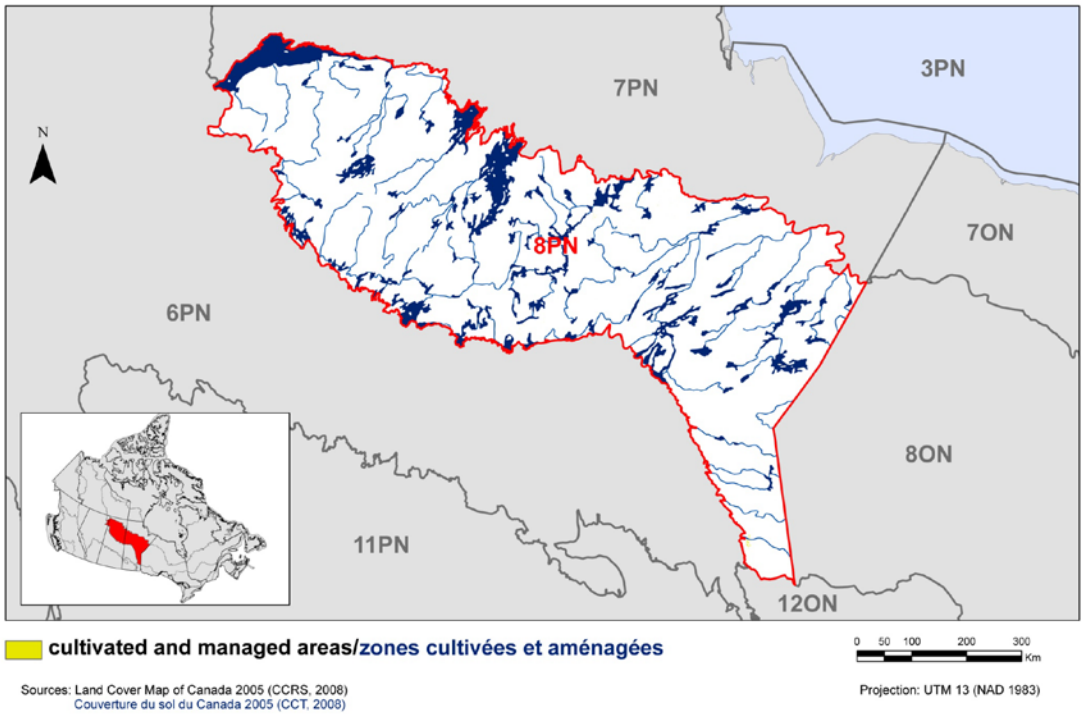


Figure 16. Map of cultivated and managed habitat in BCR 8 PNR.

Eighteen priority species use cultivated and managed habitats in BCR 8 PNR, principally associated with grain crops, though a few with parks and tree plantations (Table 10). Three priority species are listed under Schedule 1 of SARA: Eastern Whip-poor-will, Common Nighthawk and Peregrine Falcon (*anatum/tundrius*), which is also provincially listed in Alberta and Manitoba.

There were no medium or higher magnitude threats identified for cultivated and managed habitat in BCR 8 PNR (Fig. 17), and therefore no conservation objectives or actions were recommended. The low-level threats in this habitat were primarily related to habitat loss from managing water levels (threat sub-category 7.2), mortality from ingestion of spent lead shot or garbage (sub-category 9.4), and human disturbance of breeding priority bird species by recreational and work activities (sub-categories 6.1 and 6.3.

Table 10. Priority species that use cultivated and managed habitat, regional habitat sub-class, important habitat features, population objectives and reason for priority status.

Priority Species	Regional Habitat Sub-class	Important Habitat Features	Population Objective	Reason for Priority Status[1]					
				At Risk	CC	S	GS	NAWMP	Ex
American Bittern	Field of graminoid crops	Moderately tall, dense, vegetation adjacent to wetlands	Increase 50%		Y				
American Wigeon	Field of graminoids or non-graminoid crops		Increase 50%		Y			Y	
California Gull	Field of graminoids or non-graminoid crops		Assess/Maintain		Y				
Common Nighthawk	Field of graminoids or non-graminoid crops		Recovery Objective[2]	Y				Y	
Eastern Whip-poor-will	Field of needle-leaved tree crop	Open conifer plantations	Recovery Objective[2]	Y					
Evening Grosbeak	Vegetated urban area/parks	Urban/suburban areas; feeding stations	Assess/Maintain			Y			
Herring Gull	Wet meadow	Ploughed fields	Increase 50%		Y				
Killdeer	Vegetated urban area/parks	Lawns; golf courses; athletic fields; airports; road shoulders	Increase 50%		Y				
Lesser Scaup	Field of graminoids or non-graminoid crops	Near water	Increase 50%		Y			Y	
Mallard	Field of graminoid crops	Near water	Assess/Maintain		Y			Y	
Northern Flicker	Vegetated urban area/parks		Increase 50%			Y			
Peregrine Falcon (*anatum/tundrius*)	Vegetated urban area/parks		Recovery Objective[2]	Y					
Purple Finch	Field of needle-leaved tree crop	Orchards and ornamental plantations	Increase 50%		Y				

[1] Reasons for inclusion in the priority species list are as follows. At Risk: the species is assessed by COSEWIC, listed on SARA, or listed provincially (AB, SK, MB) as either Endangered, Threatened or Special Concern; CC: the species meets conservation concern criteria for its bird group; S: the species meets stewardship criteria (landbirds only); GS: the species has a provincial General Status rank of At Risk, May Be At Risk or Sensitive; NAWMP: the species has NAWMP priority of Moderate-High, High or Highest in the BCR (waterfowl only); Ex: the species was included based on expert opinion.

[2] The species is listed under SARA, but its recovery documents have not yet been finalized.

Table 10 continued

Priority Species	Regional Habitat Sub-class	Important Habitat Features	Population Objective	Reason for Priority Status[1]					
				At Risk	CC	S	GS	NAWMP	Ex
Red-necked Phalarope	Cultivated aquatic or regularly flooded area	Near water	Migrant (no population objective)		Y				
Ring-necked Duck		Near water	Assess/Maintain						
Sedge Wren	Large sized field of graminoid crops	Near water	Assess/Maintain						Y
Short-eared Owl	Field of graminoids or non-graminoid crops		Assess/Maintain	Y			Y		
Sora	Dense emergent vegetation	Near water	Assess/Maintain		Y				

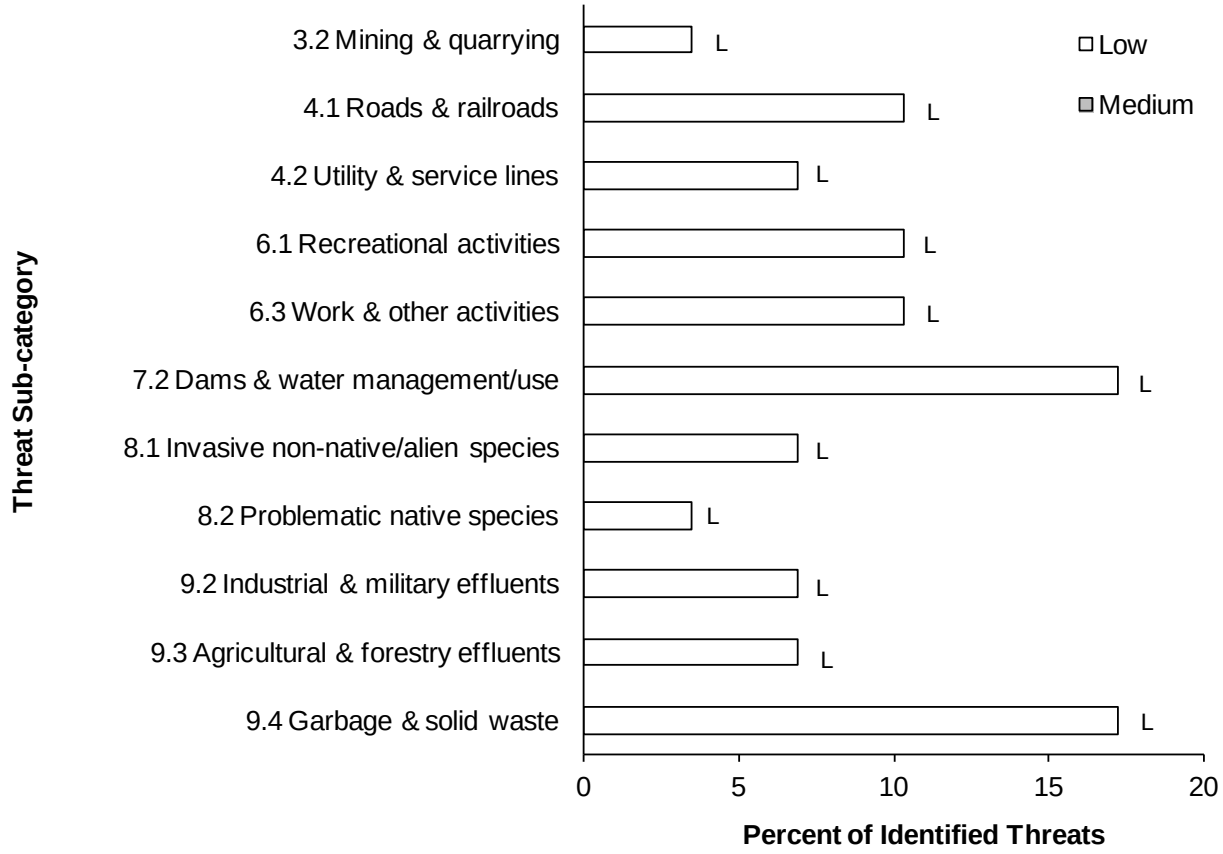


Figure 17. Percent of identified threats to priority species in cultivated and managed habitat in each threat sub-category for BCR 8 PNR.

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 6.3 Work & other activities, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L) and Medium (M) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked M for one species and L for another; the shading illustrates the proportion of L and M rankings in the sub-category). The overall magnitude of the sub-threat in herbaceous habitat is shown at the end of each bar (also presented in Table 4, Relative magnitude of identified threats to priority species within BCR 8 PNR by threat category and broad habitat class).

Note: Threats of all magnitudes are included, although low-ranked threats affecting only a single species were not assigned conservation objectives or recommended actions.

Urban

Urban habitat (and artificial surfaces) comprises a very small proportion of this sparsely inhabited BCR, and include buildings, parking lots, garbage dumps and other human-made structures (Fig. 18).

Many of the management issues in these areas involve preventing the use of these atypical habitats in order to protect the birds (Chimney Swifts in chimneys, gulls at garbage dumps, etc.).

Eight priority species are associated with these habitat types in BCR 8 PNR (Table 11), three of which are listed federally and/or provincially (Chimney Swift, Common Nighthawk and Peregrine Falcon [*anatum/tundrius*]), and one has been assessed by COSEWIC as Threatened (Barn Swallow).

There were no medium or higher magnitude threats identified for urban habitats in BCR 8 PNR (Fig. 19), and therefore no conservation objectives or actions were recommended. Many of the low-level threats associated with urban habitats involve human activities that can lead to disturbance of nests (threat sub-categories 6.1, 6.3 and 7.2). Mortality from ingestion of garbage is also an issue of concern for the gull species in this habitat (sub-category 9.4).

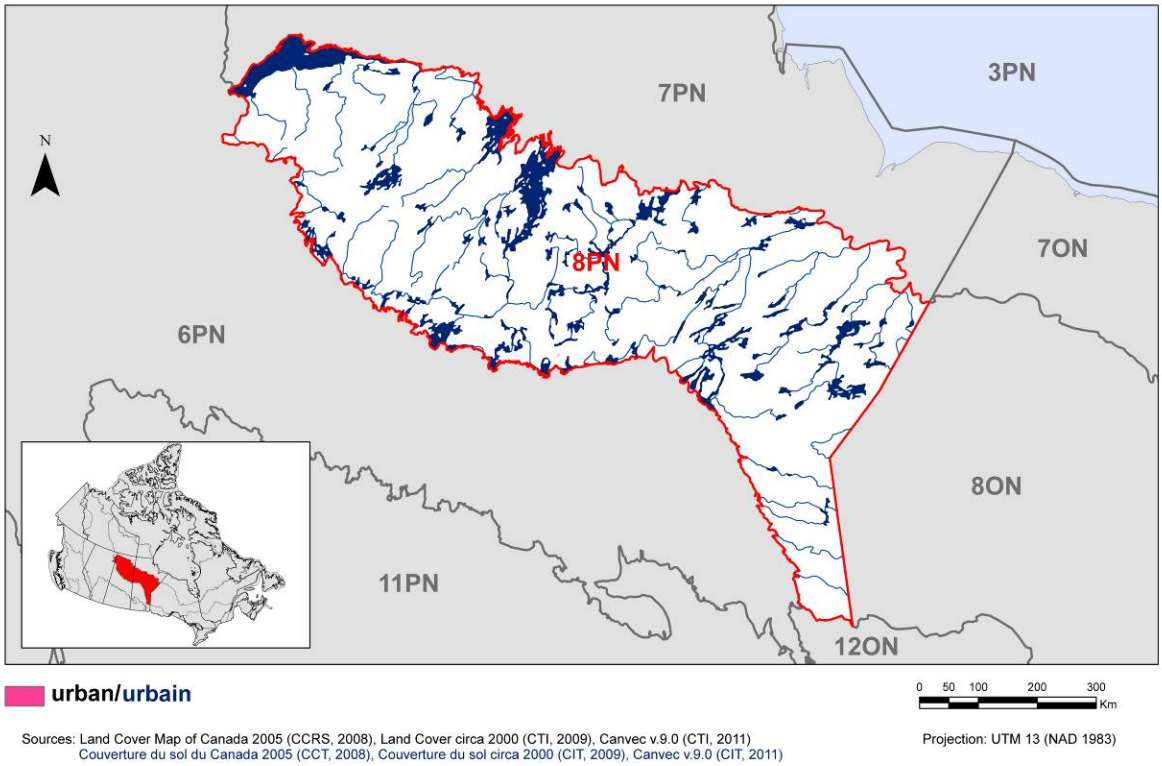


Figure 18. Map of urban habitat in BCR 8 PNR.

Table 11. Priority species that use urban habitat, regional habitat sub-class, important habitat features, population objectives and reason for priority status.

Priority Species	Regional Habitat Sub-class	Important Habitat Features	Population Objective	Reason for Priority Status[1]					
				At Risk	CC	S	GS	NAWMP	Ex
Barn Swallow	Structures with overhangs	Protected overhangs or open buildings	Increase 50%	Y					
California Gull	Dumps; urban areas; schoolyards; feed lots	Islands	Assess/Maintain		Y				
Chimney Swift	Human-made structures	Chimneys/cavities for nest sites and communal roosts	Recovery Objective[2]	Y			Y		
Common Nighthawk	Gravel roofs; airports; mines	Open ground	Recovery Objective[2]	Y			Y		
Eastern Phoebe	Bridges, culverts, outbuildings	Natural/human-made overhang for nest site	Assess/Maintain				Y		
Herring Gull	Dumps; picnic areas; fish-processing plants; parking lots; fields; airport runways; roof tops	Islands	Increase 50%		Y				
Killdeer	Construction sites; roads/driveways/parking lots; rooftops		Increase 50%		Y				
Peregrine Falcon (*anatum/tundrius*)	Quarries and buildings	Cliffs/ledges or structures for nesting	Assess/ Maintain	Y			Y		

[1] Reasons for inclusion in the priority species list are as follows. At Risk: the species is assessed by COSEWIC, listed on SARA, or listed provincially (AB, SK, MB) as either Endangered, Threatened or Special Concern; CC: the species meets conservation concern criteria for its bird group; S: the species meets stewardship criteria (landbirds only); GS: the species has a provincial General Status rank of At Risk, May Be At Risk, or Sensitive; NAWMP: the species has NAWMP priority of Moderate-High, High or Highest in the BCR (waterfowl only); Ex: the species was included based on expert opinion.

[2] The species is listed under SARA, but its recovery documents have not yet been finalized.

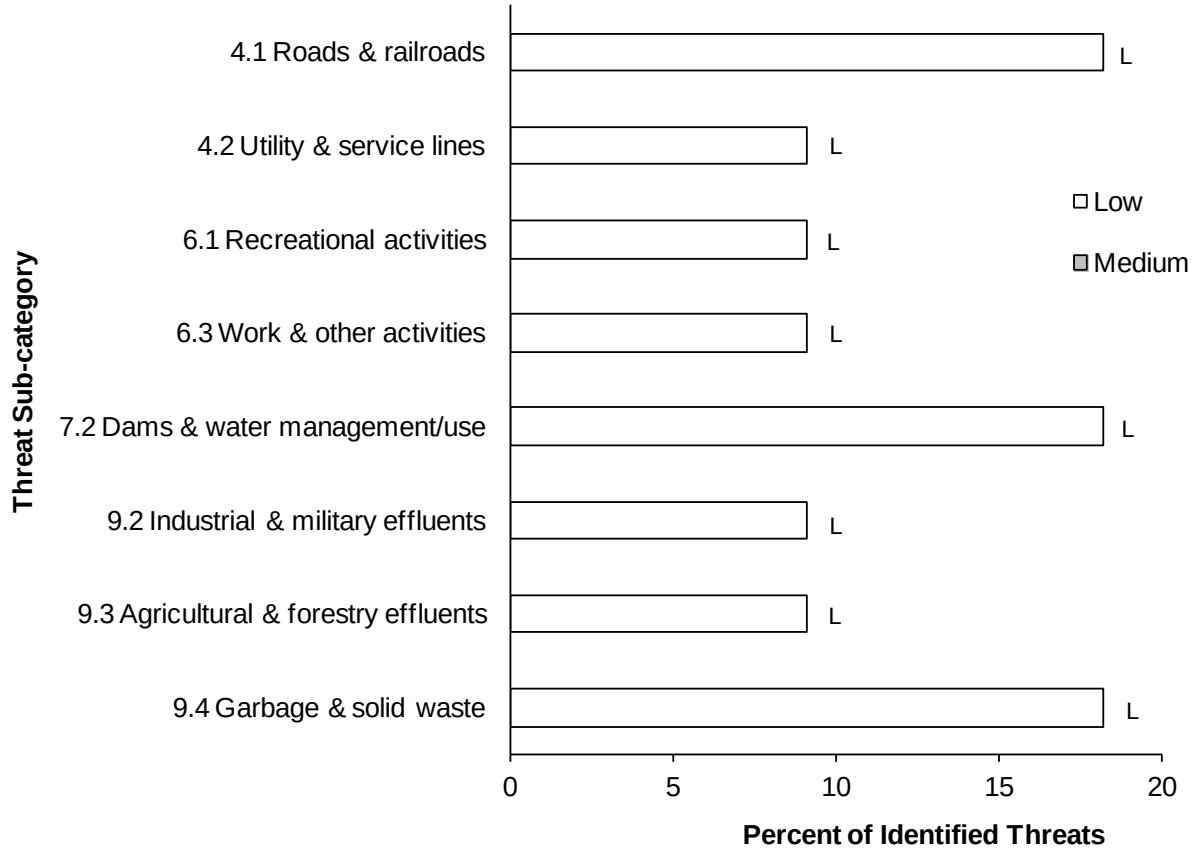


Figure 19. Percent of identified threats to priority species in urban habitat in each threat sub-category for BCR 8 PNR.

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 6.3 Work & other activities, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L) and Medium (M) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked M for one species and L for another; the shading illustrates the proportion of L and M rankings in the sub-category). The overall magnitude of the sub-threat in urban habitat is shown at the end of each bar (also presented in Table 4, Relative magnitude of identified threats to priority species within BCR 8 PNR by threat category and broad habitat class).

Note: Threats of all magnitudes are included, although low-ranked threats affecting only a single species were not assigned conservation objectives or recommended actions.

Wetland

Wetlands represent a large proportion of BCR 8 PNR, and largely consist of peatlands, bogs, fens and shallow open ponds (Fig. 20). Not surprisingly, there are more priority species utilizing wetland habitat than any other habitat type in the sub-region, with 41 species from all 4 bird groups (Table 12).

There are also several priority species at risk that use wetlands in BCR 8 PNR. Six species have been listed federally or provincially, and two have been assessed as at risk by COSEWIC.

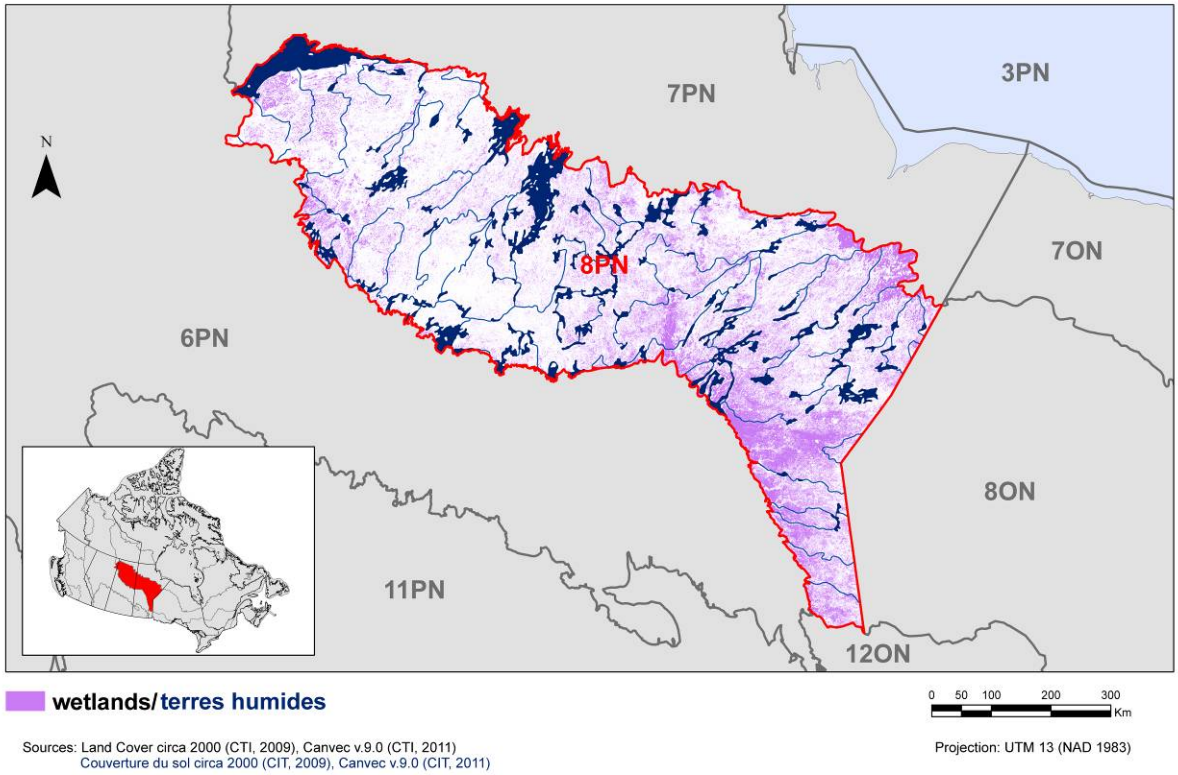


Figure 20. Map of wetland habitats in BCR 8 PNR.

Species using wetland habitats face a wide variety of threats, one of the most important of which is climate change (see Section 3: Widespread Issues). Changes in precipitation and increased temperatures are expected to lower water levels and small or shallow wetlands (which are some of the most productive) may be lost completely. Biological, chemical and thermal characteristics of wetlands are also expected to change (e.g., become ice-free earlier, warmer, and eutrophic due to increases in primary productivity). Bogs and fens occurring more regularly in northern and remote regions of the BCR face less direct human impact, although some disturbance through mining practices is occurring.

Unlike the prairie and boreal transition regions of PNR, wetlands in the Boreal Softwood Shield have not been heavily impacted by human activities such as agriculture and urban development. Among the low-magnitude threats to wetland ecosystems within BCR 8 PNR are hydrologic regime shifts due to forest harvesting activities (threat sub-category 5.3; Fig. 21) and water drawdowns (sub-category 7.2). Disturbance from noise and activity associated with human recreation and work (sub-categories 6.1 and 6.3) affects the nesting success of several priority species. Although hunting is a significant source of mortality for some waterfowl species (sub-category 5.1), the level of harvest is managed to be sustainable. Additional threats include pollution from industrial effluents (sub-category 9.2), but these occur on a localized scale and pose a low threat across the entire BCR. There were no medium or higher magnitude threats identified for wetland habitats in BCR 8 PNR (Fig. 21), and therefore no conservation objectives or actions were recommended.

Table 12. Priority species that use wetland habitat, regional habitat sub-class, important habitat features, population objectives and reason for priority status.

Priority Species	Regional Habitat Sub-class	Important Habitat Features	Population Objective	Reason for Priority Status[1]					
				At Risk	CC	S	GS	NAWMP	Ex
Alder Flycatcher	Thicket swamp	Dense, wet shrub	Increase 50%			Y			
American Bittern	Shallow Water; marsh	Emergent vegetation	Increase 50%		Y		Y		
American White Pelican	Shallow Water	Islands for nesting; semi-colonial	Assess/Maintain		Y		Y		
American Wigeon	Shallow Water; marsh		Increase 50%		Y			Y	
Barn Swallow	Open areas for feeding		Increase 50%	Y					
Bay-breasted Warbler	Treed bog/fen, conifer swamp	Spruce budworm specialist	Assess/Maintain				Y		
Black Tern	Shallow Water; marsh	Floating or emergent vegetation	Increase 100%		Y				
Black-and-white Warbler	Deciduous/mixed forest swamp		Assess/Maintain			Y			
Bonaparte's Gull	Marsh; bog; fen	Islands	Assess/Maintain		Y				
Bufflehead	Shallow water		Assess/Maintain		Y			Y	
California Gull	Bog	Islands	Assess/Maintain		Y				
Caspian Tern	Shallow Water	Islands	Assess/Maintain				Y	Y	
Common Goldeneye	Shallow Water		Assess/Maintain		Y				
Common Nighthawk	Bog	Open ground	Recovery Objective[2]	Y			Y		
Common Tern	Marsh	Islands	Assess/Maintain		Y				
Connecticut Warbler	Treed bog		Increase 50%		Y				
Green-winged Teal	Marsh	Open water	Assess/Maintain		Y		Y	Y	
Horned Grebe (western population)	Shallow Water	Open water	Increase 100%	Y	Y		Y		
Killdeer	Sandy or open shorelines		Increase 50%		Y				

[1] Reasons for inclusion in the priority species list are as follows. At Risk: the species is assessed by COSEWIC, listed on SARA, or listed provincially (AB, SK, MB) as either Endangered, Threatened or Special Concern; CC: the species meets conservation concern criteria for its bird group; S: the species meets stewardship criteria (landbirds only); GS: the species has a provincial General Status rank of At Risk, May Be At Risk, or Sensitive; NAWMP: the species has NAWMP priority of Moderate-High, High or Highest in the BCR (waterfowl only); Ex: the species was included based on expert opinion.

[2] The species is listed under SARA, but its recovery documents have not yet been finalized.

Table 12 continued

Priority Species	Regional Habitat Sub-class	Important Habitat Features	Population Objective	Reason for Priority Status[1]					
				At Risk	CC	S	GS	NAWMP	Ex
Lesser Scaup	Shallow water; marsh	Open water	Increase 50%		Y		Y	Y	
Lesser Yellowlegs	Marsh		Increase 100%		Y				
Mallard	Swamp; marsh	Open water	Assess/Maintain		Y			Y	
Nashville Warbler	Treed bog, fen, conifer swamp	Shrub	Assess/Maintain			Y			
Northern Hawk Owl	Bog	Natural/secondary cavities; snags	Assess/Maintain				Y		
Olive-sided Flycatcher	Treed bog, fen, conifer swamp	Tall trees or snags; openings (bogs, harvest, fire, water)	Recovery Objective[2]	Y					
Peregrine Falcon (*anatum/tundrius*)	All types	Cliffs/ledges or structures for nesting	Assess/Maintain	Y			Y		
Pied-billed Grebe	Marsh	Open water	Assess/Maintain				Y		
Red-necked Phalarope	Shallow Water		Migrant (No pop objective)		Y				
Ring-necked Duck	Swamp; shallow water; marsh		Assess/Maintain		Y			Y	
Rusty Blackbird	Treed bog, fen, conifer swamp	Open water	Assess/Maintain	Y			Y		
Sedge Wren	Marsh; shrubby fen, bog		Assess/Maintain					Y	
Short-billed Dowitcher	Marsh; fen; bog		Increase 100%		Y		Y		
Short-eared Owl	Marsh; bog	Open areas; prey availability	Assess/Maintain	Y			Y		
Solitary Sandpiper	Bog	Near open water	Increase 50%		Y				
Sora	Marsh	Dense emergent vegetation	Assess/Maintain		Y		Y		
Swamp Sparrow	Marsh; fen; bog	Emergent vegetation	Assess/Maintain			Y			
Virginia Rail	Shallow Water; marsh	Dense emergent vegetation	Assess/Maintain		Y				
White-winged Crossbill	Treed bog, fen, conifer swamp	Coniferous seed crops	Assess/Maintain				Y		
Wilson's Snipe	Marsh		Increase 100%		Y				
Yellow Rail	Shallow Water; marsh; bog	Dense emergent vegetation	Assess/Maintain	Y	Y		Y		
Yellow-bellied Flycatcher	Treed bog/fen, conifer swamp		Assess/Maintain			Y			

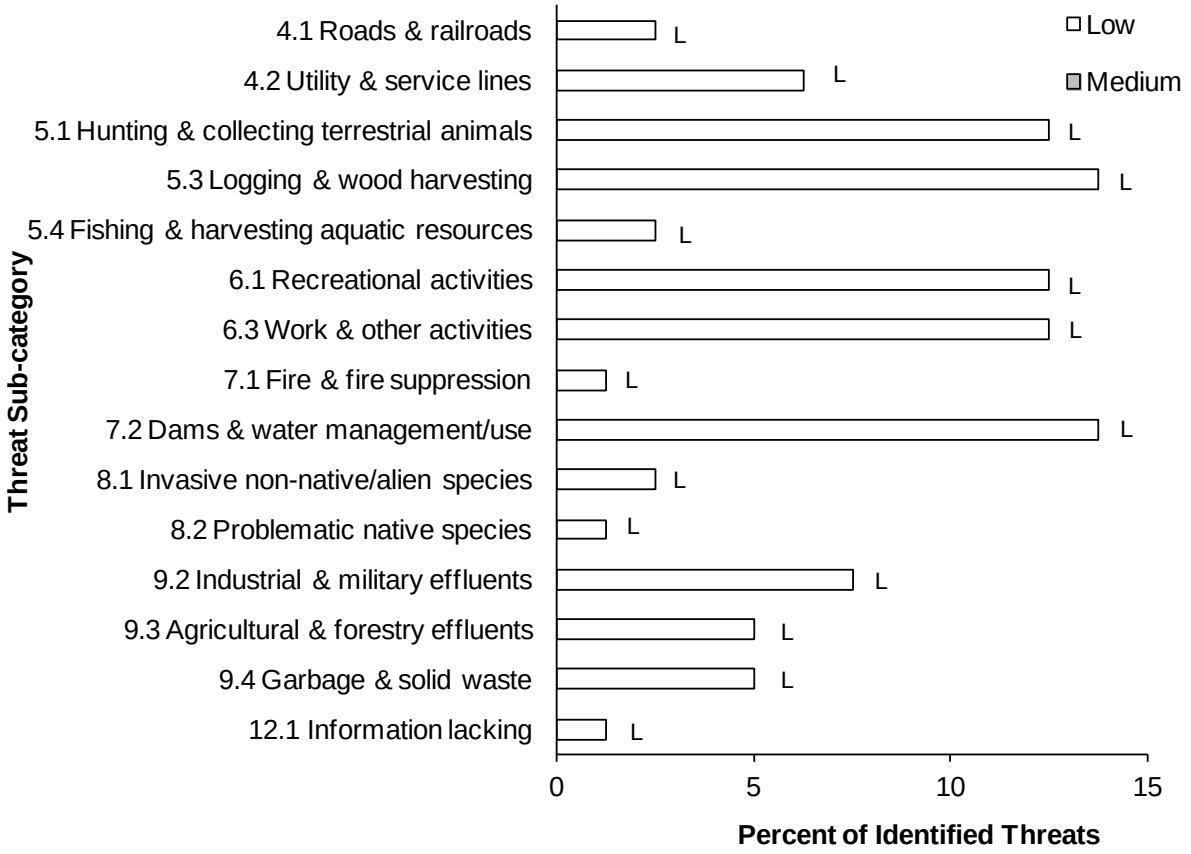


Figure 21. Percent of identified threats to priority species in wetland habitat in each threat sub-category for BCR 8 PNR.

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 6.3 Work & other activities, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L) and Medium (M) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked M for one species and L for another; the shading illustrates the proportion of L and M rankings in the sub-category). The overall magnitude of the sub-threat in wetland habitat is shown at the end of each bar (also presented in Table 4, Relative magnitude of identified threats to priority species within BCR 8 PNR by threat category and broad habitat class).

Note: Threats of all magnitudes are included, although low-ranked threats affecting only a single species were not assigned conservation objectives or recommended actions.

Waterbodies

The waterbodies habitat class includes standing and flowing water such as reservoirs, lakes, ponds and river systems, which cover a large portion of BCR 8 PNR (Fig. 22). Twenty-five species are listed as priority species, and most rely on waterbodies for food sources and nesting habitat (Table 13). The Chimney Swift has been listed as Threatened under SARA, and the Horned Grebe (western population) has been assessed by COSEWIC as Special Concern.

White-winged Scoter Photo: © Len Blumin

Priority species in these habitats face a number of threats including climate change (see Section 3: Widespread Issues below), which is expected to alter precipitation patterns, causing earlier and more intense spring floods while reducing summer and fall flows (Harding 2009).

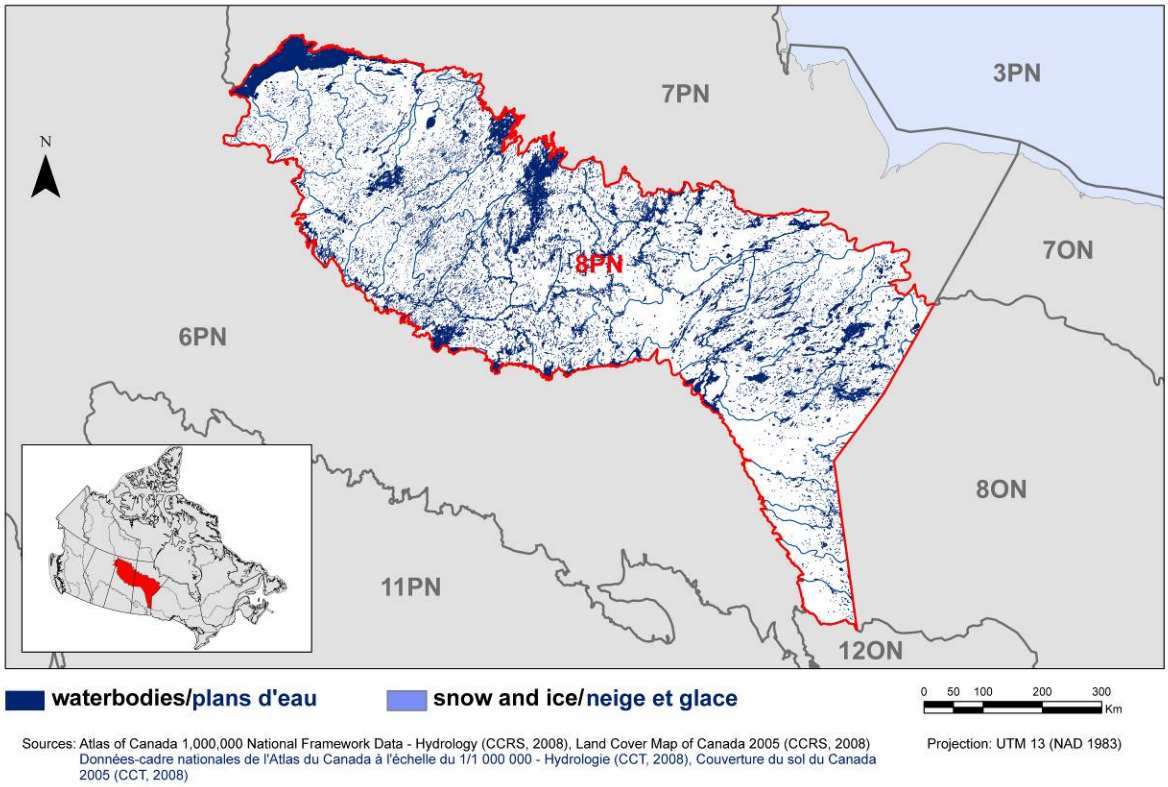


Figure 22. Map of waterbodies habitat in BCR 8 PNR. There are no significant areas of permanent snow and ice cover.

Although hunting (threat sub-category 5.1) is a major source of mortality for many species of waterfowl, it is not likely a limiting factor due to the ongoing close monitoring and regulation of the sport harvest. Disturbance from noise and activity associated with human recreation and work (sub-categories 6.1 and 6.3) affects the nesting success of several priority species. Changes to water levels and hydrologic patterns due to water management (e.g., dams, flood control measures, human water use; threat sub-category 7.2) pose a low threat to priority species in this habitat by altering the quality and availability of foraging and nesting habitat. There are currently limited numbers of hydroelectric reservoirs and dams, but this may increase with greater demand for cleaner energy sources. There were no medium or higher magnitude threats identified for waterbodies in BCR 8 PNR (Fig. 23), and therefore no conservation objectives or actions were recommended.

Table 13. Priority species that use waterbodies, regional habitat sub-class, important habitat features, population objectives and reason for priority status.

Priority Species	Regional Habitat Sub-class	Important Habitat Features	Population Objective	Reason for Priority Status[1]					
				At Risk	CC	S	GS	NAWMP	Ex
American White Pelican	Perennial river/large lake	Islands	Assess/Maintain		Y		Y		
American Wigeon	Pond/small lake		Increase 50%		Y			Y	
Black Tern	Perennial pond/small lake	Floating or emergent vegetation	Increase 100%		Y				
Bonaparte's Gull	Not enough information to define class	Islands	Assess/Maintain		Y				
Bufflehead	Perennial pond/small lake	Abandoned NOFL cavities	Assess/Maintain		Y			Y	
California Gull	Perennial river/large lake	Islands	Assess/Maintain		Y				
Caspian Tern	Perennial large lake	Islands	Assess/Maintain				Y		Y
Chimney Swift	Perennial pond/small lake	Chimneys/cavities for nest sites and communal roosts	Recovery Objective[2]	Y			Y		
Common Goldeneye	Perennial river/pond/lake	Snags/cavities	Assess/Maintain		Y			Y	
Common Loon	Perennial large lake		Assess/Maintain		Y				
Common Tern	Perennial pond/small lake	Islands	Assess/Maintain		Y				
Green-winged Teal	Non-perennial pond/small lake		Assess/Maintain		Y		Y	Y	
Herring Gull	Perennial large lake	Islands	Increase 50%		Y				
Horned Grebe (western population)	Perennial pond/small lake; artificial waterbody		Increase 100%	Y	Y		Y		
Lesser Scaup	Perennial large lake; Non-perennial pond/small lake	Emergent vegetation	Increase 50%		Y		Y	Y	
Mallard	Non-perennial pond/small lake	Emergent vegetation	Assess/Maintain		Y			Y	

[1] Reasons for inclusion in the priority species list are as follows. At Risk: the species is assessed by COSEWIC, listed on SARA, or listed provincially (AB, SK, MB) as either Endangered, Threatened or Special Concern; CC: the species meets conservation concern criteria for its bird group; S: the species meets stewardship criteria (landbirds only); GS: the species has a provincial General Status rank of At Risk, May Be At Risk, or Sensitive; NAWMP: the species has NAWMP priority of Moderate-High, High or Highest in the BCR (waterfowl only); Ex: the species was included based on expert opinion.

[2] The species is listed under SARA, but its recovery documents have not yet been finalized.

Table 13 continued

Priority Species	Regional Habitat Sub-class	Important Habitat Features	Population Objective	Reason for Priority Status[1]					
				At Risk	CC	S	GS	NAWMP	Ex
Pied-billed Grebe	Perennial pond/small lake; Non-perennial pond/small lake	Emergent vegetation	Assess/Maintain				Y		
Red-necked Phalarope	Perennial pond/lake; artificial waterbody		Migrant (No pop. objective)		Y				
Ring-necked Duck	Perennial pond/small lake	Emergent vegetation	Assess/Maintain		Y			Y	
Solitary Sandpiper	Perennial pond/small lake	Shallow water near conifer	Increase 50%		Y				
Sora	Non-perennial pond/small lake	Emergent vegetation	Assess/Maintain		Y		Y		
Surf Scoter	Perennial large lake		Increase 50%		Y			Y	
Virginia Rail	Non-perennial pond/small lake	Emergent vegetation	Assess/Maintain		Y				
White-winged Scoter	Perennial large lake	Islands	Increase 50%		Y		Y	Y	
Wilson's Snipe	Perennial pond/small lake		Increase 100%		Y				

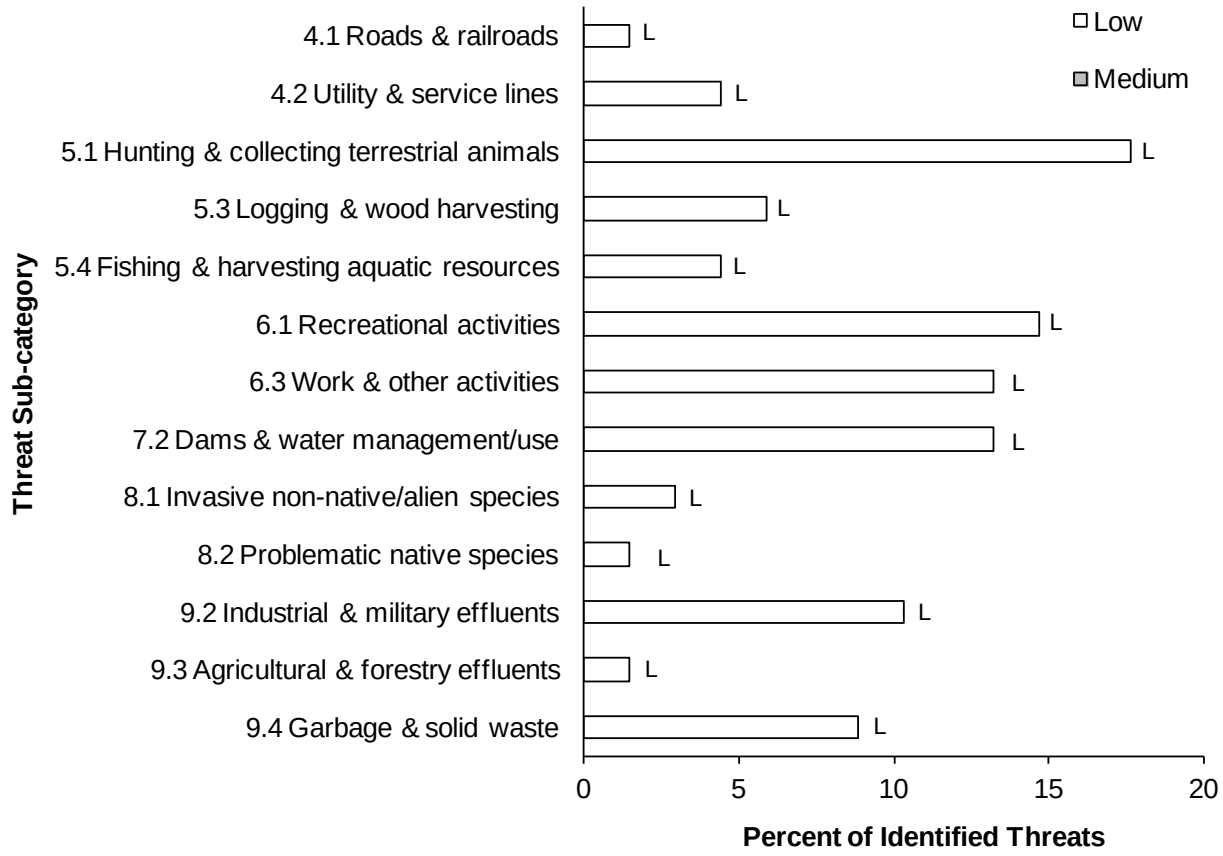
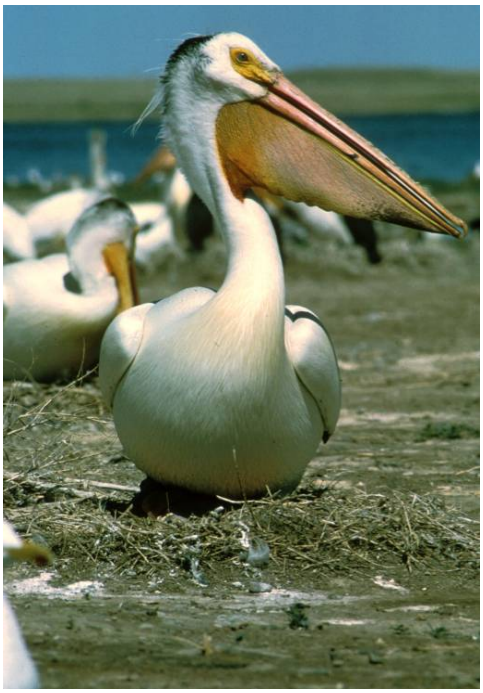


Figure 23. Percent of identified threats to priority species in waterbodies habitat in each threat sub-category for BCR 8 PNR.

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 6.3 Work & other activities, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L) and Medium (M) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked M for one species and L for another; the shading illustrates the proportion of L and M rankings in the sub-category). The overall magnitude of the sub-threat in waterbodies habitat is shown at the end of each bar (also presented in Table 4, Relative magnitude of identified threats to priority species within BCR 8 PNR by threat category and broad habitat class).

Note: Threats of all magnitudes are included, although low-ranked threats affecting only a single species were not assigned conservation objectives or recommended actions.

Bare Areas



American White Pelican Photo: © U.S. Fish and Wildlife Service

Bare areas, devoid of vegetation, are habitats scattered across BCR 8 PNR in the form of upland sand dunes or coarse soils and rock adjacent to waterbodies. A large majority of bare area habitats in BCR 8 PNR consist of rocky outcrops and sand/gravel substrates that are often associated with the many lake and river systems that spread across the BCR (Fig. 24). Three of the nine species that use bare areas are listed as species at risk by SARA: Peregrine Falcon, Common Nighthawk and Eastern Whip-poor-will (Table 14).

The priority species associated with bare areas use this habitat primarily for nesting and accessing food sources within nearby aquatic ecosystems. Several of these species may be vulnerable to population decline. Threats to these species are complex and are likely due to changes in abundance of food sources impacted by pollution, invasive species, direct mortality and a host of other issues.

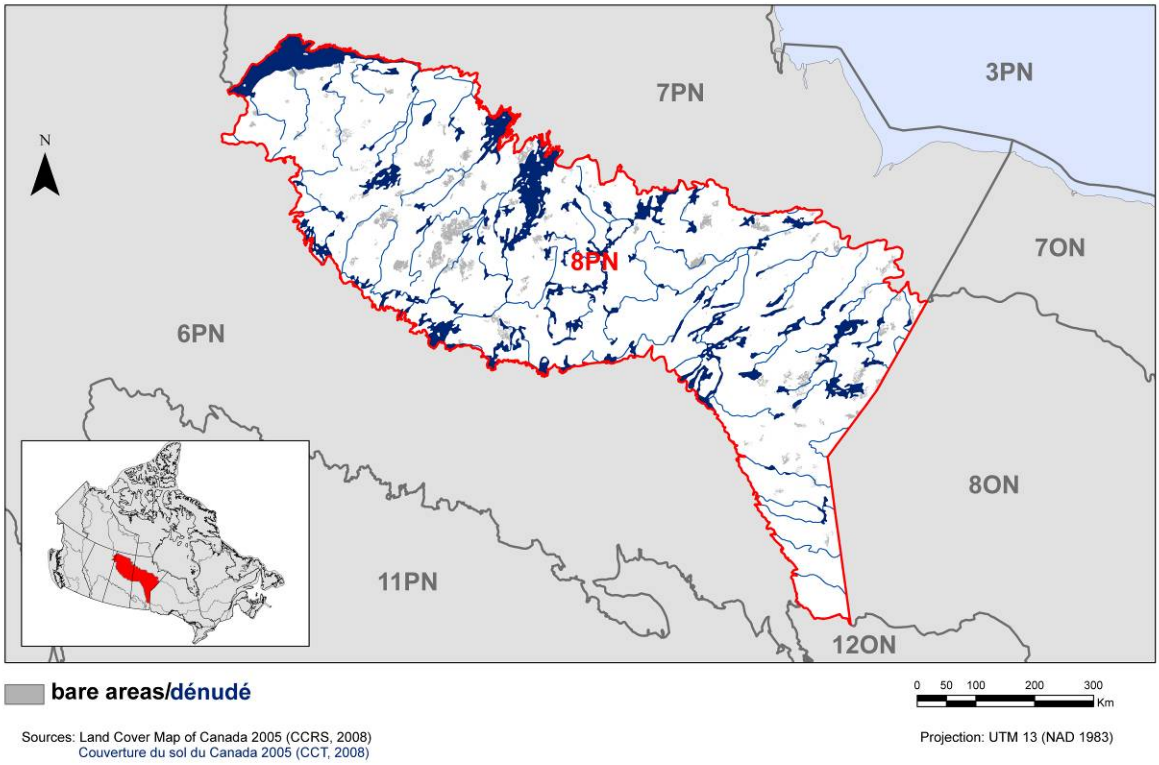


Figure 24. Map of bare area habitats in BCR 8 PNR.

There were no medium or higher magnitude threats identified for bare areas in BCR 8 PNR (Fig. 25), and therefore no conservation objectives or actions were recommended. Threats of low magnitude that occurred in bare areas include disturbance from noise and activity associated with human recreation and work (sub-categories 6.1 and 6.3), and negative effects on productivity associated with water drawdowns (sub-category 7.2).

Table 14. Priority species that use bare area habitats, regional habitat sub-class, important habitat features, population objectives and reason for priority status.

Priority Species	Regional Habitat Sub-class	Important Habitat Features	Population Objective	Reason for Priority Status[1]					
				At Risk	CC	S	GS	NAWMP	Ex
American White Pelican	Soil/sand/rock	Islands	Assess/Maintain		Y		Y		
Caspian Tern	Rock/sand	Islands	Assess/Maintain				Y		Y
Common Nighthawk	Rock; sand; burned over and logged areas	Open ground	Recovery Objective[2]	Y			Y		
Common Tern	Sand/gravel/shell cobble	Islands	Assess/Maintain		Y				
Eastern Phoebe	Rock	Natural/human-made overhang for nest site	Assess/Maintain				Y		
Eastern Whip-poor-will	Barrens with scattered trees	Open understory	Recovery Objective[2]	Y					
Herring Gull	Rock/sand	Islands	Increase 50%		Y				
Killdeer	Mud/gravel/sand		Increase 50%		Y				
Peregrine Falcon (*anatum/tundrius*)	All types	Cliffs/ledges or structures for nesting	Assess/Maintain	Y			Y		

[1] Reasons for inclusion in the priority species list are as follows. At Risk: the species is assessed by COSEWIC, listed on SARA, or listed provincially (AB, SK, MB) as either Endangered, Threatened or Special Concern; CC: the species meets conservation concern criteria for its bird group; S: the species meets stewardship criteria (landbirds only); GS: the species has a provincial General Status rank of At Risk, May Be At Risk, or Sensitive; NAWMP: the species has NAWMP priority of Moderate-High, High or Highest in the BCR (waterfowl only); Ex: the species was included based on expert opinion.

[2] The species is listed under SARA, but its recovery documents have not yet been finalized.

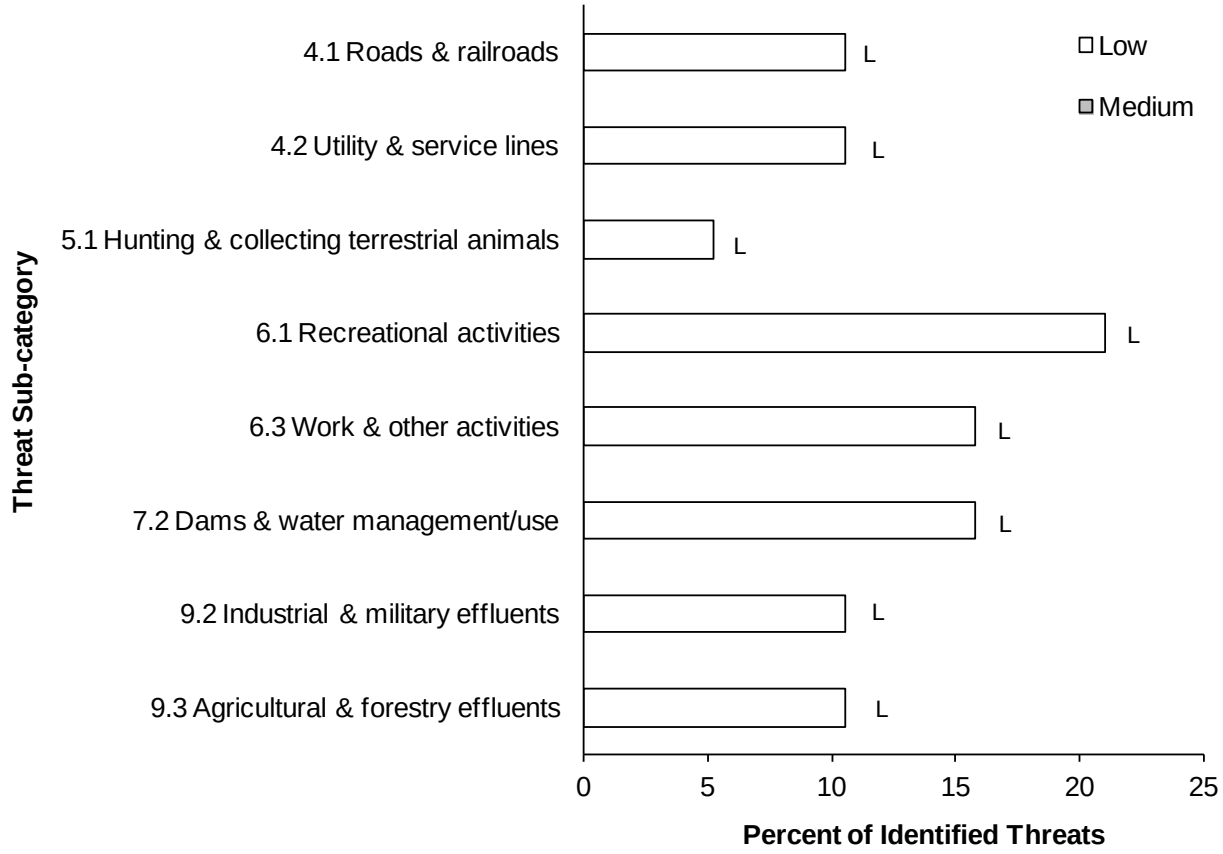


Figure 25. Percent of identified threats to priority species in bare area habitats in each threat sub-category for BCR 8 PNR.

Each bar represents the percent of the total number of threats identified in each threat sub-category in bare area habitats (for example, if 100 threats were identified in total for all priority species in bare area habitats, and 10 of those threats were in the category 6.3 Work & other activities, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L) and Medium (M) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked M for one species and L for another; the shading illustrates the proportion of L and M rankings in the sub-category). The overall magnitude of the sub-threat in bare area habitats is shown at the end of each bar (also presented in Table 4, Relative magnitude of identified threats to priority species within BCR 8 PNR by threat category and broad habitat class).

Note: Threats of all magnitudes are included, although low-ranked threats affecting only a single species were not assigned conservation objectives or recommended actions.

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, etc.)
- Predation by domestic cats
- Pollution/pesticides/oil spills
- Climate change
- Roads

Because the widespread issues do not fit into the standard presentation format used in the BCR strategies, they are presented separately here. The mortality estimates included here are largely based on draft reports that were available within Environment Canada when this strategy was produced; the numbers may change as the final scientific papers are peer-reviewed and published. Human-related avian mortality across all sectors was standardized and compared in Calvert et al. 2013.

Collisions

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.

Communication Towers

There are currently almost 8000 communication towers in Canada >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 (Table 15; Longcore et al. 2012).

Neotropical migrants in the families *Parulidae* (wood-warblers) and *Vireonida*e (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 communication towers may negatively affect the population trends of some birds.

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 15 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, which provide 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.

Due to the low population density and associated infrastructure of buildings, communication towers, power lines and roads, the overall threat magnitude from collisions will be low within BCR 8 PNR. However, with increasing development in this area consideration should be given to reducing avian mortality by using beneficial management practices and designs that minimize collisions. See Table 15 for conservation objectives and actions related to avian mortality due to collisions.

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 impacts 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 DDT.

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 impacts 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 the 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 15 for conservation objectives and actions related to pesticides.

Toxic Chemicals and Heavy Metals

Toxic organic chemicals and heavy metals released into the environment can also negatively impact 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 prey that has been exposed to these substances. See Table 15 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 impact 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). See Table 15 for conservation objectives and actions.

Table 15. Conservation objectives and actions associated with bird mortality from collisions, cats and contaminants.

Threats Addressed	Threat 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 beneficial management practices 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	Brown Creeper, Evening Grosbeak, Purple Finch, Connecticut Warbler, Yellow-bellied Sapsucker
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 beneficial management practices 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	Brown Creeper, Evening Grosbeak, Purple Finch, Connecticut Warbler, Yellow-bellied Sapsucker
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	2.1 Site/area management	Killdeer, Caspian Tern, Yellow Rail, Connecticut Warbler, Sora

Table 15 continued

Threats Addressed	Threat Category	Objective	Objective Category	Recommended actions	Action Category	Example Priority Species Affected
				areas. Avoid siting lines over or near wetlands.		
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 attract 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	Common Nighthawk, Chimney Swift, Canada Warbler, White-winged Crossbill, Eastern Whip-poor-will
Environmental Contaminants						
Mortality, sub-lethal effects, reductions in prey populations and habitat alteration caused by exposure to/use of pesticides.	9.3 Agricultural and forestry effluents	Reduce mortality and sub-lethal effects of pesticides on birds Reduce the effects of pesticides on	2.1 Reduce mortality and/or sub-lethal effects from pesticide use. 5.1 Maintain natural food	Substantially reduce the use of pesticides/rodenticides/herbicides in Canada. Where elimination is not possible, they should be used as part of an integrated pest management system. Improve regulation of pesticides/rodenticides/herbicides in Canada to reduce bird mortality.	5.2 Policies and regulations 5.3 Private sector standards and codes	**Direct or indirect poisoning by pesticides:** Killdeer, Common Yellowthroat, Lesser Yellowlegs, Cape May Warbler, Peregrine Falcon (*anatum/tundrius*)

Table 15 continued

Threats Addressed	Threat Category	Objective	Objective Category	Recommended actions	Action Category	Example Priority Species Affected
		prey species	webs and prey sources.			**Reductions in prey due to pesticide use:** Horned Grebe (western population), Black-and-white Warbler, Chestnut-sided Warbler
Mortality from heavy metals and other contaminants.	9.2 Industrial and 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:** Mallard, Surf Scoters, Bufflehead, Common Loon, Olive-sided Flycatcher **PCBs:** Mallard, Common Tern, Caspian Tern **Other contaminants:** Peregrine Falcon (*anatum/tundrius*)
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	Alder Flycatcher

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 (Manville 2005; Faaborg et al. 2010). See Tables 16 and 17 for a summary of impacts of climate change and conservation objectives.

In a recent study (Stralberg et al. 2013), shifts in the distribution and abundance of 102 boreal bird species were modelled and mapped under climate change scenarios for three 30-year windows between the years 2011 and 2100. Detailed biogeoclimatic niche models for each species were built using the best-available interpolated climate data and bird data from structured surveys in >125 000 locations across boreal North America. Predicted shifts in the climatic conditions that currently characterize species' niches resulted in declines in abundance by 2100 for 36 species while increases were expected for 66 species. The largest decreases were projected for American Tree Sparrow, White-crowned Sparrow and Common Redpoll. Large increases in abundance were expected for Red-winged Blackbird, Black-capped Chickadee and Townsend's Warbler. Predicted shifts in density for 40 species were provided in individual maps. Refugia were identified as areas within a species' range that had a higher than average density within both the current and a future time period. On average, only 36% of species' ranges remained in refugia by 2100 according to the model. Multi-species refugia were largely restricted to western Alaska, the northern Rocky Mountains and northeastern Labrador. Such refugia will be particularly important to the persistence of many species if, as expected, vegetation changes cannot keep pace with climate change. These refugia could be evaluated as potential conservation targets.

Within BCR 8 as a whole, Stralberg et al. (2013) estimated that the suitable climatic envelope will shift for many species through 2100. Species such as Olive-sided Flycatcher, Rusty Blackbird, Alder Flycatcher, Yellow-bellied Flycatcher and White-winged Crossbill are predicted to consistently decline through time. Other species, such as Bay-breasted Warbler and Cape May Warbler, are predicted to increase in the near future and then quickly decrease as their suitable climatic envelope continues to shift northward through BCR 8. Both these responses represent vulnerability to climate change, albeit delayed for the latter suite of species.

There are also species, such as Black-and-white Warbler, Chestnut-sided Warbler, Common Yellowthroat, Eastern Phoebe and Purple Finch, whose populations are predicted to be enhanced by changing climatic conditions, and we will likely see increasing population sizes in BCR 8 (but decreases elsewhere in the range). Some populations increase, but the increase

slows through time (Canada Warbler, Mourning Warbler) or actually declines in time periods approaching 2100 (Connecticut Warbler, Nashville Warbler), again reflecting shifting climate.

These predictions of population change are based on a shifting climatic envelope rather than estimates of actual population sizes. The species listed as examples here had the highest certainty in modelling results (Stralberg et al., in revision). Shifts may be slowed by lags in vegetation response to change climate.

Wetland habitats may be particularly at risk, as climate change modelling predicts that wetlands in BCR 8 PNR will be subject to considerable drying. The smallest lakes and wetlands can be the most productive for breeding waterfowl such as scoters (*Melanita spp*.) and Lesser Scaup. Drever et al. 2012 demonstrate evidence that these species are already affected by climate change and project continued decline through 2080. Conversely, increases in Mallards are forecast over the same time period.

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 impacts of climate change wherever possible (Faaborg et al. 2010).

Table 16. 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; rather, they provide examples of species for which 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, Rusty Blackbird, Lesser Scaup
Extended breeding season	Lesser Scaup
Habitat loss as a result of ecosystem changes (e.g., advances in treeline)	Yellow Rail
Increase in severe weather events	Common Tern, Caspian Tern
Introduction of new predators and competitors	Common Tern, Caspian Tern
Thawing of permafrost and increased evaporation will result in vegetation shifts and loss of wetlands in arctic habitat	Ring-necked Duck, Rusty Blackbird, Yellow Rail

Table 17. Proposed conservation objectives and actions to address climate change.

Threats Addressed	Threat sub-Category	Objective	Objective Category	Recommended Actions	Action Category	Example of Priority Species Affected
Climate change impacts 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	American Wigeon Mallard Lesser Scaup Surf Scoter Alder Flycatcher Bay-breasted Warbler Brown Creeper Cape May Warbler Evening Grosbeak Olive-sided Flycatcher Ovenbird Rusty Blackbird White-winged Crossbill Yellow-bellied Flycatcher
		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	

Table 17 continued

Threats Addressed	Threat sub-Category	Objective	Objective Category	Recommended Actions	Action Category	Example of Priority Species Affected
Population-level effects of climate change are unknown	12.1 Information lacking	Improve understanding of climate change on birds and their habitats	7.5 Improve understanding of potential effects of climate change	Evaluate which species are most vulnerable to 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.	8.1 Research 8.2 Monitoring	American Wigeon Mallard Lesser Scaup Surf Scoter Alder Flycatcher Bay-breasted Warbler Black-and-white Warbler Brown Creeper Canada Warbler Cape May Warbler Chestnut-sided Warbler Common Yellowthroat Connecticut Warbler Eastern Phoebe Evening Grosbeak Nashville Warbler Olive-sided Flycatcher Ovenbird Purple Finch Rusty Blackbird White-winged Crossbill Yellow-bellied Flycatcher

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 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 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.

Although we present population objectives for most species in BCR 8 PNR, many species are not adequately monitored due to the incomplete coverage of existing monitoring programs in northern boreal regions and the absence of new bird, group, or species-specific monitoring programs that effectively monitor all priority species. In Table 18 (below), we address the absence of suitable monitoring initiatives for all bird groups. Furthermore, 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 4 main bird 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

- periodically review the information needs and expenditures for duck banding programs to ensure they correspond with management needs;
- realign resources for eider and scoter monitoring to a more efficient suite of surveys.

As of 2012, most regions farther south are using new or increased BBS coverage to help fill monitoring gaps and bird atlas programs are also collecting some population status data. Clearly the lack of roads, and distance from communities where volunteers could be sourced precludes using the BBS to increase survey coverage for landbirds in the BCR. For part of BCR 8 PNR, the Manitoba bird atlas (with fieldwork continuing to at least 2013) should provide excellent information. However, most current bird monitoring occurring in BCR 8 PNR is localized around a few communities. Colonial waterbirds on some larger lakes have been monitored periodically (Hanneman and Heckbert 2001, Wilson 2013), though the spatial coverage of such surveys is often limited in scope. National or international survey efforts such as the United States Fish and Wildlife Service (USFWS) Spring Waterfowl Survey transects are fairly well represented in BCR 8 PNR, with only a small portion of the BCR not covered by transects (Fig. 26).

eBird Canada (eBird.ca) relies on volunteers to submit their observations and data has been used to model occupancy changes within the two territories in BCR 3 (Environment Canada's Northwest Territories/Nunavut Bird Checklist Survey is now integrated with eBird). However, calculating BCR 8-specific occupancy trends is not possible without a considerably larger survey effort than currently exists (Fig. 26). eBird checklist submissions to date have been clustered in the southeast corner of the BCR and in central Manitoba where road networks provide access for volunteers. Large portions of the BCR are not accessible and have not had eBird checklists submitted (Fig. 26).

The key priorities for monitoring can be summarized (in ascending levels of investment) as (Table 18):

- Basic occurrence data on species at risk in the BCR would be highly useful for environmental assessments to enable any necessary pre- and post-construction monitoring.
- Status and trend monitoring for all priority species would allow a much more relevant assessment of population objectives and future management recommendations. Within the priority of status and trend monitoring is the supporting need of determining methods and designs that work for remote landscapes and the species requiring monitoring. For instance, it is not clear what protocols could be used to monitor some boreal-breeding shorebirds such as Solitary Sandpiper.

Careful consideration in designing a broad program should be given to understanding what sampling in the BCR would tell managers; areas that are not subject to development pressure or were not recently burned/naturally disturbed could provide trends indicative of changes due to climate and/or migration/wintering ground issues that would be most useful for conservation when contrasted with sampling in other BCRs.

Determining the population statuses and trends of species at risk would be very difficult for many species given their typically low densities and discontinuous distributions (compared to more common species listed on the current priority list).

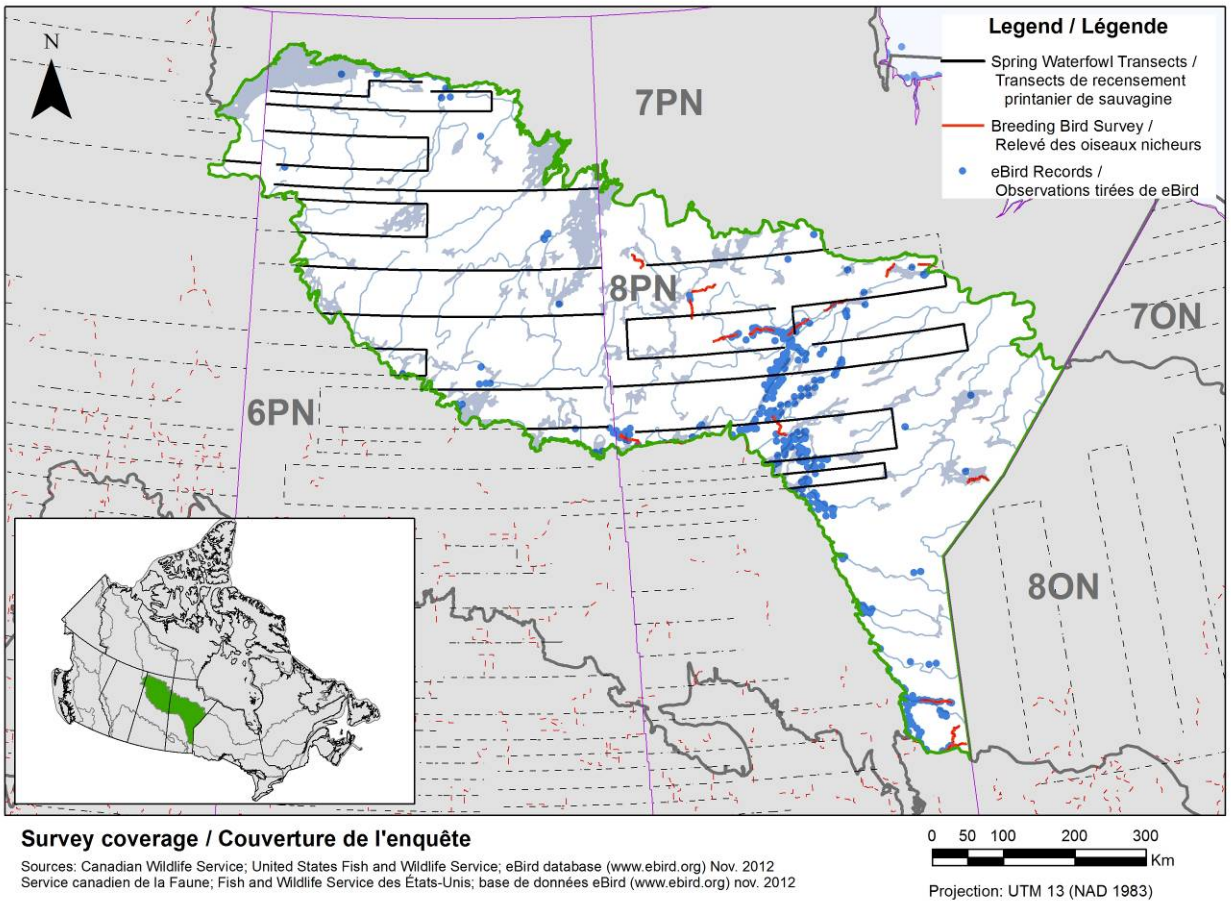


Figure 26. Bird monitoring coverage in BCR 8 PNR.
Black lines represent aerial transects flown annually to count waterfowl (solid in the BCR, dashed outside), red lines represent BBS routes and blue dots represent locations of e-bird checklist submissions. Not shown are colonial waterbird surveys that have been periodically undertaken on larger waterbodies within the BCR.

Table 18. Monitoring recommendations to develop landbird, shorebird, waterbird and waterfowl programs that adequately survey all species within BCR 8 PNR.

Actions	Justification	Refs
All bird groups		
General Action: develop large-scale, long-term coordinated monitoring programs that assess population status, identify causal factors, set population targets, evaluate conservation actions (management approaches), and document recovery at the regional and continental scale.	Monitoring programs are needed to assess population status and trend, identify causal factors in population change, set population targets, and evaluate the success of conservation actions. Current monitoring programs for all bird groups (landbirds, shorebirds, waterbirds, waterfowl) do not meet these objectives.	
Landbirds		
General Action: Increase monitoring effort for landbirds, specifically species with poor trend data (Mo2-low precision of BBS trends–SE of 20 year trend >0.02 or trends based on Christmas Bird Count (CBC) trend graphs); species with inadequate northern coverage (Mo3-> one third of range in boreal and arctic regions north of BBS coverage area); and species that are inadequately monitored by BBS.	Many landbird species groups and species are not adequately monitored using existing landbird monitoring programs. This is a key data gap. New landbird monitoring programs should target the following: 1) species with poor trend data (PIF Mo2); 2) species with inadequate northern coverage (PIF Mo3); 3) species that are not adequately monitored or not monitored using existing monitoring programs (e.g., irruptive species, nomadic species, woodpeckers, grouse, diurnal raptors); and 4) species at risk (federal, provincial/territorial).	Burton et al. 2008
General Action: Develop and implement a boreal landbird monitoring strategy within PNR with the goal of monitoring the health of native landbird populations (distribution; abundance; population trends) and understanding the effects of human activities on birds (habitat relationships; trends in habitat). Monitoring could focus on species with >50% of their breeding range within the boreal forest.	New monitoring plans should be in clear concordance with the results of the Avian Monitoring Review (assess the current and potential contribution of existing monitoring programs). Existing monitoring programs include: BBS, CBC, Forest Bird Monitoring Program (FBMP), Marsh Monitoring Program (MMP), Canadian Migration Monitoring Network (CMMN), Hawk Migration Association of North America, National Nocturnal Owl Survey Programs, Project FeederWatch.	Norton and Machtans 2007
Specific Action: Increase the number of BBS routes and route participation throughout BCR 6 (note-limited by the presence of roads).	Education and awareness programs may be needed in remote areas to encourage volunteers to take on the long-term commitment of conducting BBS routes. See recommendations in Bart et al. (2004) for sample sizes of BBS routes within BC and AB to achieve the monitoring goal for most of the 300 species that can be monitored with BBS. Note that additional landbird surveys will be required to address the habitat and location bias associated with BBS routes in BCR 6 (see below).	Burton et al. 2008

Table 18 continued

Actions	Justification	Refs
Specific Action: For BBS data and all other landbird monitoring data: 1) estimate and correct for potential bias (region-wide and roadside population trends; changes in observer detection rates; analytic methods), and 2) meet precision targets for 80% of landbirds currently sampled by these surveys.	Reliable estimates of trends in population size are critical to effective management of landbirds. Use a standard measure to determine whether landbird populations are adequately monitored: 80% power to detect a 50% decline occurring within 20 years, using a 2-tailed test and a significance level of 0.10, and incorporating effects of potential bias; also requires 2/3 coverage of the target region by the monitoring program. Note: currently only 42% of species considered suitable for monitoring with BBS and similar programs are adequately monitored using these standards--the proposed target would adequately monitor 80% of all species.	Burton et al. 2008, Bart et al. 2004
Specific Action: Design and implement a boreal landbird monitoring program to address gaps in BBS program (coverage, route location bias, habitat bias, specific species and species groups).	Key requirements include: determine target species, develop program objectives, develop detailed design elements (study design, sampling design, sampling protocols) and implementation strategies, and determine partnerships. New monitoring programs and the expansion of existing monitoring programs will monitor species groups and species that cannot be adequately surveyed using the BBS. BBS is a road-based survey that captures avian species that vocalize during June. The BBS may not provide adequate coverage for species associated with contiguous or poorly represented habitats or species with large portions of their breeding range outside areas with road access. The BBS does not provide good coverage for many species and species groups including: irruptive species (e.g., Snowy Owl), nomadic species (e.g., Bohemian Waxwing), woodpeckers (e.g., Black-backed Woodpecker), grouse (e.g., Spruce Grouse), diurnal raptors (e.g., Northern Goshawk), nocturnal raptors (e.g., Eastern Screech Owl) and wetland-associated landbirds. New programs must have well-developed objectives and sampling plans (e.g., random or stratified random sampling to enable extrapolation to larger regions). Target species could include species with >50% of their range within the boreal forest or species with >33% for their range within northern boreal regions.	Burton et al. 2008, Norton and Machtans 2007
Specific Action: Design supplementary monitoring programs to target species at risk and rare species.	Species with narrow geographic distributions and high habitat specificity (rare species) may require additional monitoring effort in order to assess distribution, abundance, status, and population trends.	Hannon et al. 2004
Specific Action: Improve quality of data for northern species that can be most easily monitored on temperate wintering grounds by conducting additional winter surveys (e.g., CBC).	Research is needed on analytical methods and precision estimation. Analysis and reporting should be conducted annually. More than 1/3 of the ranges of 167 landbird species are within the northern boreal regions. These species cannot be monitored solely with temperate breeding season surveys but may be monitored with temperate wintering ground surveys.	Norton and Machtans 2007

Table 18 continued

Actions	Justification	Refs
Specific Action: Continue to expand and improve migration monitoring for raptors by supporting RPI (Raptor Population Index) (http://rpi-project.org/).	RPI is a continent-wide long-term monitoring program of diurnal raptor migration. Research is needed on analytical methods and precision estimation. Analysis and reporting should be conducted annually.	Norton and Machtans 2007
Specific Action: Continue to expand and improve migration monitoring for neotropical migrants that are inaccessible for monitoring both in the breeding and wintering seasons. Expand the number of boreal species monitored and the number of stations in Canada's western boreal forest (NWT, AB, SK).	Research is needed on design, analytical methods, precision estimation, and ability to inform trend estimation. Analysis and reporting should be conducted annually. More than 1/3 of the ranges of 167 landbird species are within the northern boreal regions. These species cannot be monitored solely with temperate breeding season surveys. Currently The Canadian Migration Monitoring Network (CMMN) monitors 150 species of landbirds (80 of which breed in Canada's boreal and other northern forests and are not well monitored by established surveys) at 20 stations across Canada. Species include: Swainson's Thrush, Alder and Yellow-bellied Flycatchers, Blackpoll, Cape May, Connecticut, Wilson's, and Tennessee Warblers.	Norton and Machtans 2007, Crewe et al. 2008
Specific Action: Continue to expand and promote the National Nocturnal Owl Survey Program.	This is a Canadian volunteer-based nocturnal roadside survey for breeding owls. Research is needed on analytical methods and precision estimation. Analysis and reporting should be conducted annually. Education and awareness programs may be needed in remote areas to encourage volunteers to take on the long-term commitment of conducting nocturnal owl surveys.	
Waterbirds		
General Action: Increase monitoring effort for waterbirds, specifically species with poor trend data (e.g., PT score=3); species with inadequate northern coverage (> one third of range in boreal and arctic regions north of BBS coverage area); and species that are inadequately monitored by BBS.	All species of colonial and non-colonial waterbirds have poor trend data in boreal BCRs due to the absence of a national waterbird monitoring program in Canada. This is a key data gap. Large-scale population monitoring is needed to document the severity and geographic extent of population declines.	
General Action: Develop and implement a boreal waterbird monitoring strategy within BCR 8 PNR with the goal of: monitoring the status trends of native waterbird populations (distribution; abundance; population trends); understanding the effects of human activities on birds (habitat relationships; trends in habitat); and understanding regional population dynamics in relation to habitat (upland, water, wetland).	New monitoring plans should be in clear concordance with the results of the Avian Monitoring Review (assess the current and potential contribution of existing monitoring programs). Existing monitoring programs include: BBS, CBC, FBMP, MMP, CMMN, Hawk Migration Association of North America, National Nocturnal Owl Survey Programs, Project FeederWatch. Note that currently a regional or national waterbird monitoring program does not exist.	
Specific Action: Design and implement	Key requirements include: determine target species,	

Table 18 continued

Actions	Justification	Refs
a boreal waterbird monitoring program.	develop program objectives, develop detailed design elements (sampling design and sampling protocols) and implementation strategies, and determine partnerships. New monitoring programs and the expansion of existing monitoring programs will need to be designed to monitor both colonial and non-colonial waterbird species.	
Specific Action: Develop a sampling design framework for both colonial species (e.g., Eared Grebe, American White Pelican, Forster's Tern) and non-colonial species (e.g., Whooping Crane, Least Bittern, Yellow Rail, Common Loon, Pied-billed Grebe).	The sampling design for waterbirds should address the following criteria: 1) probability sampling (i.e., random) to provide a rigorous basis for inference; 2) hierarchical structure to permit nesting of sub-regions within larger geographic areas; 3) spatial balance to improve precision of estimates and to ensure the sample is spatially well-distributed; 4) spatial clustering of sample locations to reduce costs; 5) adaptable; 6) survey-wide consistency. The sampling unit should be the entire wetland (small, discrete wetlands ≤3 ha) or portions of wetlands (large, extensive wetlands >3 ha). Consult species-specific monitoring plans where appropriate.	Johnson et al. 2009, Morris 2006
Specific Action: Develop a specific sampling protocol for monitoring breeding colonial waterbirds in the boreal.	The sampling protocol for colonial waterbirds should consider: specific objectives (distribution or presence, density, population trend); diverse life history strategies of colonial waterbirds; breeding asynchrony in both single and multi-species colonies; number of surveys; timing of surveys; type of census procedure (direct ground, boat/ground visual, air); count bias associated with each census procedure; bias associated with spatial variability, temporal variability, and detection probability.	Steinkamp et al. 2003, Conway 2008
Specific Action: Develop a specific sampling protocol for monitoring breeding non-colonial waterbirds in the boreal.	The sampling protocol for non-colonial waterbirds (includes secretive marshbirds) should consider: specific objectives (distribution or presence, density, population trend); diverse life history strategies of non-colonial waterbirds; secretive behaviour of many species; breeding asynchrony among species; number of surveys; timing of surveys; type of census procedure (ground; passive, call-playback, combination of passive and call-playback); call-playback procedure (species included, order of species calls); count bias associated with each census procedure; bias associated with spatial variability, temporal variability, and detection probability.	Conway and Gibbs 2005 Nadeau et al. 2008
Specific Action: For all waterbird monitoring data: 1) estimate and correct for potential bias (spatial variability; temporal variability; detection probability), and 2) meet precision targets for 80% of waterbirds sampled by surveys.	Reliable estimates of trends in population size are critical to effective management of waterbirds. Use a standard measure to determine whether waterbird populations are adequately monitored. See standards outlined for landbirds: 80% power to detect a 50% decline occurring within 20 years, using a 2-tailed test and a significance level of 0.10, and incorporating effects of potential bias; also requires 2/3 coverage of the target region by the monitoring program.	Bart et al. 2004

Table 18 continued

Actions	Justification	Refs
Shorebirds		
General Action: Increase monitoring effort for shorebirds, specifically species with poor trend data (e.g., PT score=3); species with inadequate northern coverage (> one third of range in boreal and arctic regions north of BBS coverage area); and species that are inadequately monitored by BBS.	All species of shorebird species have poor trend data in boreal BCRs due to the absence of a boreal shorebird monitoring program in Canada. This is a key data gap. Large-scale population monitoring throughout the boreal is needed to document the severity and geographic extent of population declines.	Skagen et al. 2003
General Action: Develop and implement a boreal shorebird monitoring strategy within PNR with the goal of: monitoring the health of native shorebird populations (distribution; abundance; population trends); understanding the effects of human activities on birds (habitat relationships; trends in habitat); and understanding regional population dynamics in relation to habitat (upland, water, wetland).	New monitoring plans should be in clear concordance with the results of the Avian Monitoring Review (assess the current and potential contribution of existing monitoring programs). Existing monitoring programs include: BBS, CBC, MMP, CMMN, Hawk Migration Association of North America, National Nocturnal Owl Survey Programs, Project FeederWatch.	Skagen et al. 2003
General Action: Boreal shorebird monitoring should meet the general program goals of PRISM (Program for Regional and International Shorebird Monitoring).	The goals of PRISM are to: 1) estimate the size of breeding populations; 2) describe the distribution, abundance and habitat relationships; 3) monitor trends in population size; 4) monitor numbers at stopover locations; and 5) assist local managers in meeting conservation goals. PRISM uses a 3-part approach to estimate trends: a) breeding surveys in the arctic, boreal, and temperate regions; b) migration surveys; and c) wintering surveys.	Skagen et al. 2003
Specific Action: Design and implement a boreal shorebird monitoring program.	Key requirements include: determine target species, develop program objectives, develop detailed design elements (sampling design and sampling protocols) and implementation strategies, and determine partnerships. New monitoring programs and the expansion/modification of existing monitoring programs will need to be designed to monitor the 19 species of shorebirds that breed extensively in the boreal. For specific details see Section 6, Recommendations in Sinclair et al. (2004).	Sinclair et al. 2004
Specific Action: Coordinate with existing monitoring programs (landbird, waterfowl) in order to maximize impact of effort and funds for shorebird surveys in the boreal region.	The BBS (landbird survey during breeding season) could be used to effectively monitor Killdeer, Marbled Godwit, Wilson's Snipe, Wilson's Phalarope, Spotted Sandpiper, Lesser Yellowlegs, Solitary Sandpiper, and Upland Sandpiper primarily in southern portions of BCR 6 (with existing road networks) with the following recommendations: increased coverage (assess current and potential coverage for each species), increased consistency of coverage, training of observers, recruitment of observers, paid observers, conducting off-road/near-road	Sinclair et al. 2004, Elliott et al. 2010

Table 18 continued

Actions	Justification	Refs
	counts, and assessing seasonal changes in detectability. In northern portions of BCR 8 PNR, additional off-road surveys could be used to monitor these species.	
Specific Action: Develop protocols (aerial and/or ground surveys) to monitor migrating shorebirds at boreal stopover sites.	For some shorebird species, counts at boreal stopover sites provide the best opportunity for population monitoring (e.g., Surfbird). In BCR 8 PNR, key stopover sites are Quill Lakes, Burke/Porter/Buffer Lakes, Blaine Lakes, Lac Lenore/Basin Lake. Note that there are few significant concentrated sites for migrating shorebirds in the boreal region. Efforts to identify additional boreal region stopover sites throughout BCR 8 PNR should be initiated (stopover sites may be spatially dispersed in the boreal region).	Sinclair et al. 2004
Specific Action: Investigate the need for species-specific shorebird surveys.	Short-billed Dowitcher has a very limited breeding range and may require targeted surveys for population monitoring.	Sinclair et al. 2004
Specific Action: For all shorebird monitoring data: 1) estimate and correct for potential bias (spatial variability; temporal variability; detection probability), and 2) meet precision targets for 80% of shorebirds sampled by surveys.	Reliable estimates of trends in population size are critical to effective management of shorebirds. Use a standard measure to determine whether shorebird populations are adequately monitored. The goal of PRISM is to achieve 80% power to detect a 50% decline occurring within 20 years, using a 2-tailed test with a significance level of 0.15, and acknowledging the effects of potential bias.	Skagen et al. 2003
Waterfowl		
General Action: Increase monitoring effort for waterfowl, specifically species with poor trend data (e.g., PT score=3) or species not monitored by United States Fish and Wildlife Service (USFWS) and Canadian Wildlife Service (CWS).	Aerial breeding waterfowl surveys are conducted across boreal BCRs (USFWS, CWS) annually but only widely-distributed and abundant species are surveyed: American Black Duck, Mallard, Gadwall, American Wigeon, Green-winged Teal, Blue-winged Teal, Northern Shoveler, Northern Pintail, Redhead, Canvasback, Bufflehead, Ring-necked Duck, Canada Geese, Brant, Snow Geese, Ross' Geese, Emperor Geese, White-fronted Geese, and Tundra Swans. Scoters, goldeneyes, and scaup are monitored as groups, not individual species. Mergansers, eiders, Long-tailed Ducks, and Wood Ducks are not monitored. Additional monitoring effort is required to adequately survey diving ducks (e.g., scaup) and cavity-nesting ducks (e.g., mergansers) in the boreal region. Scaup show a dramatic long-term decline (significant over the past 30 years but not the past 5 years). Cavity-nesting ducks may be at risk due to changes in land use patterns and loss of old forest habitat across the boreal region.	CWS Waterfowl Technical Committee 2009, United States Fish and Wildlife Service, 2013

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 conservation recommendations. Research objectives presented here are bigger picture questions, and not necessarily a schedule of studies, that are needed to determine the needs of individual species. Undertaking research will allow us to improve future iterations of BCR strategies and to focus future implementation, and will also enable the development of new tools for conservation.

For BCR 8 PNR we have developed a list of general research and monitoring needs (Table 19). The information in this table addresses key data gaps identified while summarizing data and information for Elements 1–4. Research must focus on two key areas: 1) causes of population declines, and 2) methods/procedures, data products, tools and partnerships to develop habitat-based population objectives within BCR 8 PNR.

Table 19. General research and monitoring needs identified in BCR 8 PNR.

Brief Description	Objective	Actions	Justification	Refs
Developing solutions for scientists, managers, and policy makers to accomplish avian conservation goals.	To develop an approach that combines research results, management activities, and monitoring into an operational framework for advancing avian conservation science and management.	Continue to support NABCI North American Bird Conservation Initiative and the four guiding principles: 1) integration of management needs across species; 2) standardized ecological framework for planning, implementation, and evaluation; 3) use the best available scientific information; 4) use an adaptive approach to bird conservation.	NABCI offers a vehicle for scientific organizations to direct activities, in collaboration with management organizations, toward meeting avian conservation goals.	Ruth et al. 2003
Identifying priority research areas that work towards integrated solutions for scientists, managers, and policy makers.	To organize research and monitoring efforts in the context of five priority areas: 1) avian life history – increase basic ecological knowledge for many species; 2) habitat and environment – understand role of habitat quantity, quality, and distribution of bird populations; 3) integration of information – develop and use models like habitat, population, habitat-population dynamics, and land use to support bird conservation; 4) bird conservation planning – support development and implementation of BCR strategies; 5) communication – maximize the value of data, models, and other	Support basic research into avian life history and bird-habitat relationships at appropriate spatial scales (e.g., regional or sub-regional). Support collaborative partnerships to develop and use models that support bird conservation. Support implementation of Canadian BCR strategies.	These five priority areas represent the general needs of scientists, managers, and policy makers for meeting avian conservation objectives. Recommendations are based on outcomes from the U. S. Geological Survey (USGS) workshop "Science for Avian Conservation: Understanding, Modelling, and Applying Ecological Relationships," held in 2000.	Ruth et al. 2003

Table 19 continued

Brief Description	Objective	Actions	Justification	Refs
	information by using effective communication.			
Identifying a framework for the interface between research and management.	To develop a framework for communicating scientific information to decision-makers and incorporating this information into natural resource policy.	Support the use of ARM (Adaptive Resource Management) by scientists, managers, and policy makers. ARM is resource management under uncertainty, with a focus on the reduction of uncertainty (management strategies are adjusted based on increases in knowledge).	ARM is used to facilitate the development, testing, and use of predictive models; guide management actions; and improve scientific knowledge about various systems. ARM links data and decisions by integrating monitoring, assessment, and decision-making into a coherent framework.	Ruth et al. 2003, Holling 1978, Walters 1986, Williams 2003**Error! Bookmark not defined.**
Key research, monitoring, and science needs should focus on: A) assessing causes of population declines, and B) establishing methods/ procedures, data products, tools, and partnerships to achieve population objectives within BCRs.	To conduct research and monitoring that examines causes of population declines within BCRs focussing on: 1) habitat-related factors, 2) disturbance factors (land uses, cumulative effects), and 3) non-habitat factors.	General Action: To establish cause and effect in bird population declines, research and monitoring projects require: knowledge of natural history; effective monitoring at useful spatial scales; and approaches that can directly link cause and effect relationships to population response.	Research projects should be: long-term studies (>2 yrs); large-scale (e.g., landscape, regional); and replicated (e.g., spatially and temporally).	Donovan et al. 2002
		General Action: Link data from breeding and wintering areas including specific migratory routes.	Linking breeding, wintering, and migratory data would allow an assessment of habitat conditions across the annual cycle of a species and may identify the location of bottlenecks. Conservation actions need to be directed to the correct location if identifying and addressing population declines are the ultimate goals. This is a key research gap.	Donovan et al. 2002
		General Action: Identify primary drivers of population decline (e.g., habitat related or non-habitat related) and identify key questions.	One of the key steps in assessing drivers of population decline is to determine the role of habitat versus non-habitat related drivers. The best habitat management policies will not accomplish population objectives if climate change, pollution, or disease is the primary driver of declines. Declines of aerial insectivores offer a good example of this issue. First steps should	Donovan et al. 2002

Table 19 continued

Brief Description	Objective	Actions	Justification	Refs
			involve testing multiple broad hypotheses (e.g., habitat loss and nest site loss, decline of insects, and direct mortality possibly using existing data sources and meta-analysis techniques) to narrow the research focus and direct research resources appropriately. This is a key research gap.	
		General Action: Identify habitat-related drivers of population decline for each priority species.	Collecting and summarizing data and developing bird-habitat relationships using qualitative and quantitative habitat models (e.g., describe the relationship between habitat variables and bird occurrence or abundance) are key requirements.	
		Specific Action: Identify high-quality habitats that promote high reproduction and survival for each priority species.	Critical or essential habitats are those habitats that support the survival or recovery of a species during breeding, wintering, and for migration. Habitat quality should be linked or indexed to demographic measures like reproductive success, productivity, juvenile and adult survival.	
		General Action: Identify the impacts of disturbance- specifically land use practices (agriculture, ranching, forestry, conventional and non-conventional oil and gas development, mining) and cumulative effects on boreal birds.	Requires specific data, data products, and specialized tools. Requires collaboration among various scientists – wildlife biologists, climatologists, geologists, land use planners. Also requires collaborative partnerships between scientists, managers, and industry.	
		Specific Action: Promote using a hierarchical approach to modelling suitable or essential habitat availability or population density.	A hierarchical approach involves using the best available data sources. At the lowest level in the hierarchy is WHRS models (Wildlife Habitat Rating Standard); the next level is HSI models (Habitat Suitability Index); the next level is empirical or data-driven habitat models; the final level is an integrated habitat-population model. Models at each level require external, independent evaluation using field-based validation or verification methods.	

Table 19 continued

Brief Description	Objective	Actions	Justification	Refs
		General Action: Identify non-habitat related drivers of population declines.	Examine the effects of abiotic factors – climate change, pollutants, acid rain, or disease on bird population declines. This is a key research gap. These issues have received little attention in the past and may become more severe in the future.	
Key research and science needs should focus on: A) assessing causes of population declines, and B) establishing methods/procedures, data products, tools, and partnerships to achieve population objectives within BCRs.	To design, facilitate, collaborate, and conduct projects that establish methods/procedures to achieve population objectives within BCRs.	General Action: Develop the specific data products and tools necessary to develop habitat-based conservation objectives.	Ideally population objectives for priority species should reflect the population levels necessary to maintain long-term species persistence and evolutionary potential. Habitat objectives should reflect the amount of habitat necessary to support population levels of priority species outlined in the population objectives.	
	To develop habitat objectives that reflect the amount of habitat necessary to support proposed population levels (stated population objectives) of priority species.	Continue to investigate methods to account for detectability in surveys of diverse assemblages of birds over extensive areas.	Although many procedures exist to account for detectability there is disagreement over the utility of the multiple approaches developed to overcome imperfect detectability.	Johnson 2008, Thompson and La Sorte 2008
		Develop a common habitat and landcover mapping system to produce maps and geospatial products.	A common habitat and landcover mapping system would allow all partners, stakeholders, agencies (federal, provincial) working on data products for all bird groups to develop and apply products (e.g., bird-habitat models) to one consistent habitat layer.	
		Develop guidelines for the development of consistent habitat mapping across all landscapes using a variety of modelling methods: WHRS models (Wildlife Habitat Rating Standard); HSI models (Habitat Suitability Index); empirical or data-driven habitat models developed using common mapping system attributes (e.g., forest resource inventory data, Land Cover Classification of Canada).	A set of guidelines for large-scale landscape conservation planning should include the development of multiple methods for producing consistent, standardized, and comprehensive habitat mapping. A hierarchy of modelling methods are needed due to differences in data availability, capacity, expertise, and resources in different management units within a BCR. A model could be Landscape Conservation Cooperative (LCC) Planning in the United States.	
		Develop methods to assess historical	What is historical estimated habitat supply? What	

Table 19 continued

Brief Description	Objective	Actions	Justification	Refs
		habitat condition.	is estimated population size for each priority bird species under historical condition? Since qualitative and quantitative population objectives for priority species within each bird group are based on returning to 1970s levels, it is necessary to recreate the historical habitat condition during this time period. This may require the use of historical natural disturbance records (e.g., fire, insect, flood, wind, disease) or Statistics Canada land cover/agriculture census records.	
		Develop various land and resource management scenarios to determine whether changes in land and resource activities can return the landscape to historical condition (or approximate historical condition) and therefore historical population objectives.	If NABCI population objectives are based on 1970s levels, it is imperative to determine under what conditions the current landscape could support 1970s bird population objectives. This requires the development and comparison of multiple resource management scenarios: avian conservation scenario, forest harvest reduction scenario, agriculture reduction and rehabilitation scenario, conventional and non-conventional oil and gas development reduction and rehabilitation scenario.	
		Investigate methods and tools (e.g., landscape accounting tools, landscape models) needed to conduct scenario analyses.	Scenario analyses examine how various resource activities (e.g., forestry, oil and gas exploration and development, mining, agriculture, ranching, transportation, human activity) influence the amount of each habitat type or the size or configuration of habitat patches within a landscape. These can be used to track habitat amount (either spatially or aspatially) over simulated time. There are various landscape accounting tools available to accomplish this task: ALCES (A Landscape Cumulative Effects Simulator), SELES (Spatially Explicit Landscape Effects Simulator), LSL (Landscape Scripting Language), LANDIS.	

Threats Outside Canada

Many bird species found in Canada spend a large portion of their life cycle outside the country (Fig. 27). 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 67 priority species in BCR 8 PNR, 54 (80%) are migratory and spend part of their annual cycle, up to half the year or more, outside Canada.

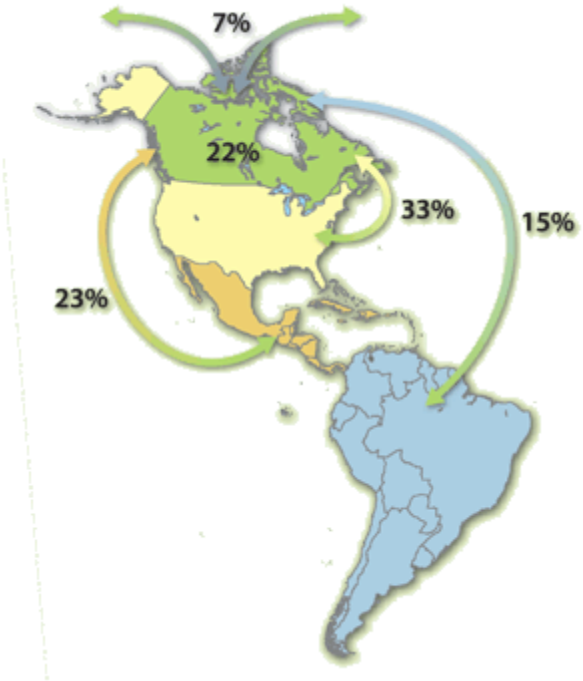


Figure 27. Percent of Canadian breeding birds that migrate to regions outside Canada for part of their life cycle (North American Bird Conservation Initiative 2012).

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, Central and South America. While many of the threats identified in the United States likely affect species throughout their range, unique issues outside 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 Canada.

Regardless, some information is available to inform conservation work outside Canada (Fig. 28). Priority birds from BCR 8 PNR face the loss or degradation of key migration, and wintering habitats. The primary sources of habitat loss and degradation are conversion of grasslands and wetlands to agriculture (threat sub-category 2.1), residential development (threat sub-category 1.1) and logging activities in the wintering habitat (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. One such example is the Yellow Rail, which has a very limited wintering range in the southeast United States, and degradation of coastal marshes along the Gulf of Mexico poses a serious threat to this species.

In addition to habitat loss, priority birds from BCR 8 PNR are affected by increased mortality from human sources during migration and over-wintering. Collisions with human-made structures such as buildings and towers are a significant threat during migration (threat sub-categories 1.1 and 1.2), especially for landbirds. Also, there are significant lethal and sub-lethal impacts to priority species from exposure to industrial contaminants such as oil pollution and heavy metals (threat sub-category 9.2), as well as agricultural pesticides (threat sub-category 9.3). Other large sources of mortality for priority species outside Canada are related to hunting (threat sub-category 5.1), namely legal and illegal hunting, and accidental mortality.

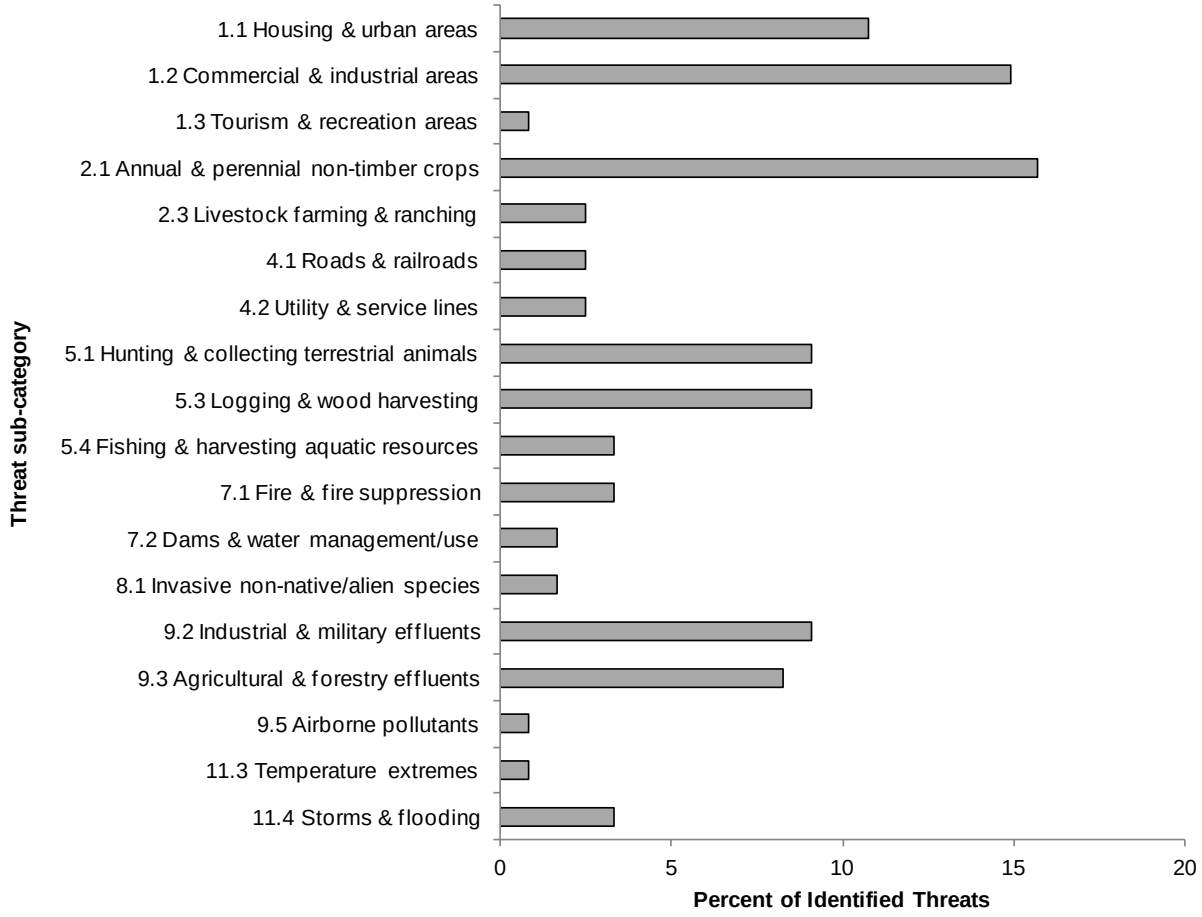


Figure 28. Percent of identified threats to priority species (by threat sub-category) in BCR 8 PNR when they are outside Canada.

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

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, non-governmental organizations 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 in BCR 8 PNR

Table A1. Complete list of species in BCR 8 PNR, when they are in the BCR (breeding, migrant, winter) and their priority status.

Scientific Name	Common Name	Bird Group	Breeding	Migrant	Wintering	Priority
Empidonax alnorum	Alder Flycatcher	Landbirds	X			Yes
Corvus brachyrhynchos	American Crow	Landbirds	X			
Spinus tristis	American Goldfinch	Landbirds	X			
Falco sparverius	American Kestrel	Landbirds	X			
Anthus rubescens	American Pipit	Landbirds		X		
Setophaga ruticilla	American Redstart	Landbirds	X			
Turdus migratorius	American Robin	Landbirds	X			
Picoides dorsalis	American Three-toed Woodpecker	Landbirds	X			Yes
Spizella arborea	American Tree Sparrow	Landbirds	X			
Haliaeetus leucocephalus	Bald Eagle	Landbirds	X			
Icterus galbula	Baltimore Oriole	Landbirds	Irregular			
Riparia riparia	Bank Swallow	Landbirds	X			
Hirundo rustica	Barn Swallow	Landbirds	X			
Strix varia	Barred Owl	Landbirds	X			Yes
Setophaga castanea	Bay-breasted Warbler	Landbirds	X			Yes
Megaceryle alcyon	Belted Kingfisher	Landbirds	X			
Mniotilta varia	Black-and-white Warbler	Landbirds	X			Yes
Picoides arcticus	Black-backed Woodpecker	Landbirds	X			Yes
Coccyzus erythropthalmus	Black-billed Cuckoo	Landbirds	X			
Pica hudsonia	Black-billed Magpie	Landbirds	X			
Setophaga fusca	Blackburnian Warbler	Landbirds	X			
Poecile atricapillus	Black-capped Chickadee	Landbirds	X			
Setophaga striata	Blackpoll Warbler	Landbirds	X			
Setophaga virens	Black-throated Green Warbler	Landbirds	X			
Cyanocitta cristata	Blue Jay	Landbirds	X			
Vireo solitarius	Blue-headed Vireo	Landbirds	X			
Bombycilla garrulus	Bohemian Waxwing	Landbirds	X			
Poecile hudsonicus	Boreal Chickadee	Landbirds	X			
Aegolius funereus	Boreal Owl	Landbirds	X			
Euphagus cyanocephalus	Brewer's Blackbird	Landbirds	X			

Table A1 continued

Scientific Name	Common Name	Bird Group	Breeding	Migrant	Wintering	Priority
Buteo platypterus	Broad-winged Hawk	Landbirds	X			
Certhia americana	Brown Creeper	Landbirds	X			Yes
Toxostoma rufum	Brown Thrasher	Landbirds	Irregular			
Molothrus ater	Brown-headed Cowbird	Landbirds	X			
Wilsonia canadensis	Canada Warbler	Landbirds	Irregular			Yes
Setophaga tigrina	Cape May Warbler	Landbirds	X			Yes
Bombycilla cedrorum	Cedar Waxwing	Landbirds	X			
Setophaga pensylvanica	Chestnut-sided Warbler	Landbirds	X			Yes
Chaetura pelagica	Chimney Swift	Landbirds	Irregular			Yes
Spizella passerina	Chipping Sparrow	Landbirds	X			
Spizella pallida	Clay-colored Sparrow	Landbirds	X			
Petrochelidon pyrrhonota	Cliff Swallow	Landbirds	X			
Quiscalus quiscula	Common Grackle	Landbirds	X			
Chordeiles minor	Common Nighthawk	Landbirds	X			Yes
Corvus corax	Common Raven	Landbirds	X			
Acanthis flammea	Common Redpoll	Landbirds			X	
Geothlypis trichas	Common Yellowthroat	Landbirds	X			Yes
Oporornis agilis	Connecticut Warbler	Landbirds	X			Yes
Junco hyemalis	Dark-eyed Junco	Landbirds	X			
Picoides pubescens	Downy Woodpecker	Landbirds	X			
Sialia sialis	Eastern Bluebird	Landbirds	Irregular			
Tyrannus tyrannus	Eastern Kingbird	Landbirds	X			
Sayornis phoebe	Eastern Phoebe	Landbirds	X			Yes
Antrostomus vociferus	Eastern Whip-poor-will	Landbirds	X			Yes
Contopus virens	Eastern Wood-Pewee	Landbirds	X			
Sturnus vulgaris	European Starling	Landbirds	X			
Coccothraustes vespertinus	Evening Grosbeak	Landbirds	X			Yes
Passerella iliaca	Fox Sparrow	Landbirds	X			
Aquila chrysaetos	Golden Eagle	Landbirds	Irregular			
Regulus satrapa	Golden-crowned Kinglet	Landbirds	X			
Dumetella carolinensis	Gray Catbird	Landbirds	X			
Perisoreus canadensis	Gray Jay	Landbirds	X			
Catharus minimus	Gray-cheeked Thrush	Landbirds		X		
Strix nebulosa	Great Gray Owl	Landbirds	X			Yes
Bubo virginianus	Great Horned Owl	Landbirds	X			
Picoides villosus	Hairy Woodpecker	Landbirds	X			

Table A1 continued

Scientific Name	Common Name	Bird Group	Breeding	Migrant	Wintering	Priority
Zonotrichia querula	Harris's Sparrow	Landbirds		X		
Catharus guttatus	Hermit Thrush	Landbirds	X			
Acanthis hornemanni	Hoary Redpoll	Landbirds			X	
Eremophila alpestris	Horned Lark	Landbirds	Irregular			
Passer domesticus	House Sparrow	Landbirds	X			
Troglodytes aedon	House Wren	Landbirds	Irregular			
Calcarius lapponicus	Lapland Longspur	Landbirds		X		
Ammodramus leconteii	Le Conte's Sparrow	Landbirds	X			
Empidonax minimus	Least Flycatcher	Landbirds	X			Yes
Melospiza lincolnii	Lincoln's Sparrow	Landbirds	X			
Asio otus	Long-eared Owl	Landbirds	X			
Setophaga magnolia	Magnolia Warbler	Landbirds	X			
Falco columbarius	Merlin	Landbirds	X			
Zenaida macroura	Mourning Dove	Landbirds	Irregular			
Oporornis philadelphia	Mourning Warbler	Landbirds	X			Yes
Vermivora ruficapilla	Nashville Warbler	Landbirds	X			Yes
Ammodramus nelsoni	Nelson's Sparrow	Landbirds	Irregular			
Colaptes auratus	Northern Flicker	Landbirds	X			Yes
Accipiter gentilis	Northern Goshawk	Landbirds	X			
Circus cyaneus	Northern Harrier	Landbirds	X			
Surnia ulula	Northern Hawk Owl	Landbirds	X			Yes
Parula americana	Northern Parula	Landbirds	Irregular			
Aegolius acadicus	Northern Saw-whet Owl	Landbirds	X			
Lanius excubitor	Northern Shrike	Landbirds	X			
Seiurus noveboracensis	Northern Waterthrush	Landbirds	X			
Contopus cooperi	Olive-sided Flycatcher	Landbirds	X			Yes
Vermivora celata	Orange-crowned Warbler	Landbirds	X			
Pandion haliaetus	Osprey	Landbirds	X			
Seiurus aurocapilla	Ovenbird	Landbirds	X			Yes
Setophaga palmarum	Palm Warbler	Landbirds	X			
Falco peregrinus	Peregrine Falcon (*anatum/tundrius*)	Landbirds	X			Yes
Vireo philadelphicus	Philadelphia Vireo	Landbirds	X			
Dryocopus pileatus	Pileated Woodpecker	Landbirds	X			Yes
Pinicola enucleator	Pine Grosbeak	Landbirds	X			Yes
Spinus pinus	Pine Siskin	Landbirds	X			
Setophaga pinus	Pine Warbler	Landbirds	Irregular			
Carpodacus purpureus	Purple Finch	Landbirds	X			Yes

Table A1 continued

Scientific Name	Common Name	Bird Group	Breeding	Migrant	Wintering	Priority
Progne subis	Purple Martin	Landbirds	X			
Loxia curvirostra	Red Crossbill	Landbirds	X			
Sitta canadensis	Red-breasted Nuthatch	Landbirds	X			
Vireo olivaceus	Red-eyed Vireo	Landbirds	X			
Buteo jamaicensis	Red-tailed Hawk	Landbirds	X			
Agelaius phoeniceus	Red-winged Blackbird	Landbirds	X			
Columba livia	Rock Pigeon	Landbirds	X			
Pheucticus ludovicianus	Rose-breasted Grosbeak	Landbirds	X			
Buteo lagopus	Rough-legged Hawk	Landbirds		X		
Regulus calendula	Ruby-crowned Kinglet	Landbirds	X			
Archilochus colubris	Ruby-throated Hummingbird	Landbirds	X			
Bonasa umbellus	Ruffed Grouse	Landbirds	X			Yes
Euphagus carolinus	Rusty Blackbird	Landbirds	X			Yes
Passerculus sandwichensis	Savannah Sparrow	Landbirds	X			
Piranga olivacea	Scarlet Tanager	Landbirds	X			
Cistothorus platensis	Sedge Wren	Landbirds	X			Yes
Accipiter striatus	Sharp-shinned Hawk	Landbirds	X			
Tympanuchus phasianellus	Sharp-tailed Grouse	Landbirds	X			
Asio flammeus	Short-eared Owl	Landbirds	X			Yes
Calcarius pictus	Smith's Longspur	Landbirds		X		
Plectrophenax nivalis	Snow Bunting	Landbirds			X	
Bubo scandiacus	Snowy Owl	Landbirds			X	
Melospiza melodia	Song Sparrow	Landbirds	X			
Falcipennis canadensis	Spruce Grouse	Landbirds	X			
Buteo swainsoni	Swainson's Hawk	Landbirds		X		
Catharus ustulatus	Swainson's Thrush	Landbirds	X			
Melospiza georgiana	Swamp Sparrow	Landbirds	X			Yes
Vermivora peregrina	Tennessee Warbler	Landbirds	X			
Tachycineta bicolor	Tree Swallow	Landbirds	X			
Cathartes aura	Turkey Vulture	Landbirds	X			
Catharus fuscescens	Veery	Landbirds	X			
Pooecetes gramineus	Vesper Sparrow	Landbirds	X			
Vireo gilvus	Warbling Vireo	Landbirds	X			
Tyrannus verticalis	Western Kingbird	Landbirds	Irregular			
Sturnella neglecta	Western Meadowlark	Landbirds	Irregular			
Piranga ludoviciana	Western Tanager	Landbirds	X			
Sitta carolinensis	White-breasted Nuthatch	Landbirds	X			

Table A1 continued

Scientific Name	Common Name	Bird Group	Breeding	Migrant	Wintering	Priority
Zonotrichia leucophrys	White-crowned Sparrow	Landbirds		X		
Zonotrichia albicollis	White-throated Sparrow	Landbirds	X			
Loxia leucoptera	White-winged Crossbill	Landbirds	X			Yes
Empidonax traillii	Willow Flycatcher	Landbirds	Irregular			
Wilsonia pusilla	Wilson's Warbler	Landbirds	X			
Troglodytes troglodytes	Winter Wren	Landbirds	X			
Hylocichla mustelina	Wood Thrush	Landbirds	Irregular			
Setophaga petechia	Yellow Warbler	Landbirds	X			
Empidonax flaviventris	Yellow-bellied Flycatcher	Landbirds	X			Yes
Sphyrapicus varius	Yellow-bellied Sapsucker	Landbirds	X			Yes
Setophaga coronata	Yellow-rumped Warbler	Landbirds	X			
Vireo flavifrons	Yellow-throated Vireo	Landbirds	Irregular			
Pluvialis dominica	American Golden-Plover	Shorebirds		X		
Tringa melanoleuca	Greater Yellowlegs	Shorebirds	X			
Limosa haemastica	Hudsonian Godwit	Shorebirds		X		
Charadrius vociferus	Killdeer	Shorebirds	X			Yes
Calidris minutilla	Least Sandpiper	Shorebirds	Irregular			
Tringa flavipes	Lesser Yellowlegs	Shorebirds	X			Yes
Phalaropus lobatus	Red-necked Phalarope	Shorebirds		X		Yes
Charadrius semipalmatus	Semipalmated Plover	Shorebirds		X		
Limnodromus griseus	Short-billed Dowitcher	Shorebirds	X			Yes
Tringa solitaria	Solitary Sandpiper	Shorebirds	X			Yes
Actitis macularius	Spotted Sandpiper	Shorebirds	X			
Gallinago delicata	Wilson's Snipe	Shorebirds	X			Yes
Botaurus lentiginosus	American Bittern	Waterbirds	X			Yes
Fulica americana	American Coot	Waterbirds	X			
Pelecanus erythrorhynchos	American White Pelican	Waterbirds	X			Yes
Chlidonias niger	Black Tern	Waterbirds	X			Yes
Nycticorax nycticorax	Black-crowned Night-Heron	Waterbirds	Irregular			
Chroicocephalus philadelphia	Bonaparte's Gull	Waterbirds	X			Yes
Larus californicus	California Gull	Waterbirds	X			Yes

Table A1 continued

Scientific Name	Common Name	Bird Group	Breeding	Migrant	Wintering	Priority
Hydroprogne caspia	Caspian Tern	Waterbirds	X			Yes
Gavia immer	Common Loon	Waterbirds	X			Yes
Sterna hirundo	Common Tern	Waterbirds	X			Yes
Phalacrocorax auritus	Double-crested Cormorant	Waterbirds	X			
Leucophaeus pipixcan	Franklin's Gull	Waterbirds	Irregular			
Ardea herodias	Great Blue Heron	Waterbirds	X			
Larus argentatus	Herring Gull	Waterbirds	X			Yes
Podiceps auritus	Horned Grebe (western population)	Waterbirds	X			Yes
Larus canus	Mew Gull	Waterbirds	X			
Podilymbus podiceps	Pied-billed Grebe	Waterbirds	X			Yes
Podiceps grisegena	Red-necked Grebe	Waterbirds	X			
Larus delawarensis	Ring-billed Gull	Waterbirds	X			
Grus canadensis	Sandhill Crane	Waterbirds	X			
Porzana carolina	Sora	Waterbirds	X			Yes
Rallus limicola	Virginia Rail	Waterbirds	Irregular			Yes
Aechmophorus occidentalis	Western Grebe	Waterbirds	Irregular			
Coturnicops noveboracensis	Yellow Rail	Waterbirds	X			Yes
Anas americana	American Wigeon	Waterfowl	X			Yes
Melanitta nigra	Black Scoter	Waterfowl		X		
Anas discors	Blue-winged Teal	Waterfowl	X			
Bucephala albeola	Bufflehead	Waterfowl	X			Yes
Branta canadensis	Canada Goose	Waterfowl	X			
Aythya valisineria	Canvasback	Waterfowl	Irregular			
Bucephala clangula	Common Goldeneye	Waterfowl	X			Yes
Mergus merganser	Common Merganser	Waterfowl	X			
Anas strepera	Gadwall	Waterfowl	X			
Aythya marila	Greater Scaup	Waterfowl		X		
Anas crecca	Green-winged Teal	Waterfowl	X			Yes
Lophodytes cucullatus	Hooded Merganser	Waterfowl	X			
Aythya affinis	Lesser Scaup	Waterfowl	X			Yes
Chen caerulescens caerulescens	Lesser Snow Goose	Waterfowl		X		
Anas platyrhynchos	Mallard	Waterfowl	X			Yes
Anas acuta	Northern Pintail	Waterfowl	X			
Anas clypeata	Northern Shoveler	Waterfowl	X			
Mergus serrator	Red-breasted Merganser	Waterfowl	X			
Aythya americana	Redhead	Waterfowl	Irregular			

Table A1 continued

Scientific Name	Common Name	Bird Group	Breeding	Migrant	Wintering	Priority
Aythya collaris	Ring-necked Duck	Waterfowl	X			Yes
Chen rossii	Ross's Goose	Waterfowl		X		
Oxyura jamaicensis	Ruddy Duck	Waterfowl	Irregular			
Melanitta perspicillata	Surf Scoter	Waterfowl	X			Yes
Cygnus columbianus	Tundra Swan (Eastern Population)	Waterfowl		X		
Cygnus columbianus	Tundra Swan (Western Population)	Waterfowl		X		
Melanitta fusca	White-winged Scoter	Waterfowl	X			Yes
Aix sponsa	Wood Duck	Waterfowl	Irregular			

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 life cycle)
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 subregion. 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 (Partners in Flight [landbirds], Wings Over Water [waterbirds], Canadian Shorebird Conservation Plan [shorebirds], North American Waterfowl Management Plan [waterfowl]).

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

- population size,
- breeding and non-breeding distribution,
- 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, BCR-specific assessment data were obtained from the Rocky Mountain Bird Observatory (Rocky Mountain Bird Observatory 2005), and priority and stewardship species were identified following Partners in Flight (PIF) guidelines (Panjabi et al. 2005). For waterfowl, waterfowl conservation region (WCR)-specific assessment data were obtained from the NAWMP Implementation Framework (NAWMP Plan Committee 2004); for shorebirds and waterbirds, only national assessment data and information were used (Milko et al. 2003; Donaldson et al. 2000). Within BCR 8 PNR, additional species were added to the priority species list based on two assessments at the regional level: Provincial/Territorial General Status Ranks and expert opinion.

General Status Ranks

General Status (GS) rank is a numerical ranking (0.1, 1–8) assigned for a species that represents its status in a specific province or territory where it occurs. GS ranks are reassessed every five years; GS ranks from 2005 were used to assess additional PNR species, as ranks from 2010 were not yet available. To be included as a priority species (P-PNR), a species' GS rank had to be ≤3 ("At Risk," "May be at Risk" or "Sensitive") in a province or territory that overlaps the species' range within BCR 8 PNR. See www.wildspecies.ca/wildspecies2005/index.cfm?lang=e for more information on GS ranks.

Expert Opinion

Opinions of experts for the four bird groups were sought for each BCR. Some species were added or removed from the priority list based on expert opinion; where this occurred, the reasoning was documented. Species that were removed from the priority species list were retained on the candidate list.

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 (LCCS) developed by the United Nations Food and Agriculture Organization (2000). Some modifications were made to the LCCS scheme to reflect habitat types that are important to birds that are not included in the classification (mostly marine). Species often are assigned to more than one of these coarse classes (Fig. 3). To retain the link to regional spatial data (provincial forest inventories, etc.) or to group species into regionally relevant habitat classes, some plans identify finer-scale 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. These attributes can be important features for priority species and include nesting attributes (e.g., snags, cliffs) and habitat modifiers (e.g., burns, seral stage, riparian vegetation, structural complexity).

For BCR 8 PNR, a maximum of five habitat associations were identified for each priority species based on published literature, gray literature, field guides and expert opinion. Although other habitats may be used by priority species, the five selected represented the most important or most commonly used habitats for each species. However, we did not rank the relative importance of each habitat association for a given species.

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 "assess and maintain," and a monitoring objective is set. Harvested waterfowl and stewardship species that are already at desired population levels are given an objective of "maintain." For any species listed under the 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 available, objectives are set using the same approach as for other species within that bird group. Once recovery objectives are available, they will replace interim objectives.

Quantitative population trends for landbirds were based on BBS data from BCR 8 PNR wherever possible; however, due to poor survey coverage not all species are surveyed adequately. For example, survey data for nocturnal raptors had to be obtained from National Nocturnal Owl Surveys, which only exists for the last decade. Where available, quantitative trends for waterfowl were obtained from the Population Status of Migratory Game Birds in Canada (CWS Waterfowl Technical Committee 2009); if unavailable, we used a qualitative trend from the bird group plan (North American Waterfowl Management Plan 2004). Qualitative trends for shorebirds and waterbirds were obtained at the continental level from bird group plans (Milko et al. 2003; Donaldson et al. 2000).

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 using a standardized classification scheme (Salafsky et al. 2008).
2. Ranking the magnitude of threats for priority species using a standardized protocol (Kennedy et al. 2012).
3. Preparing a set of threat profiles for the BCR subregion, 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 subregion 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.

In BCR 8 PNR, threats for individual species were identified using a variety of sources, including peer-reviewed literature, national and regional conservation plans, and government reports and internal documents. We developed and conducted a systematic review process (Pullin and

Knight 2001; Pullin and Knight 2003; Pullin et al. 2004) to document the hierarchy of evidence (the value of the literature or data used to document the threats with respect to scientific rigour) and the heterogeneity of evidence (variability in the types of studies that document threats). We assessed the quality of information for each threat using the following hierarchy of evidence: Study Type (the type of scientific study), Ecological Scale (the ecological or biological scale to which the information or study applies), and Location (area to which the information or study applies during the season in which the species is present in the BCR). We used this information to determine the weight of evidence associated with each threat.

Element 5: Conservation Objectives

Overall, conservation objectives represent the desired conditions within the subregion 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 subregion (the quantity, quality and configuration of priority habitats)
- non-habitat objectives within the BCR subregion (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 our 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 beneficial management practices, ecosystem plans or multiple recovery documents are available for a subregion. 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.

www.**ec.gc.ca**

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