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Bird Conservation Strategy for Bird Conservation Region 11 in the Prairie and Northern Region: Prairie Potholes

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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

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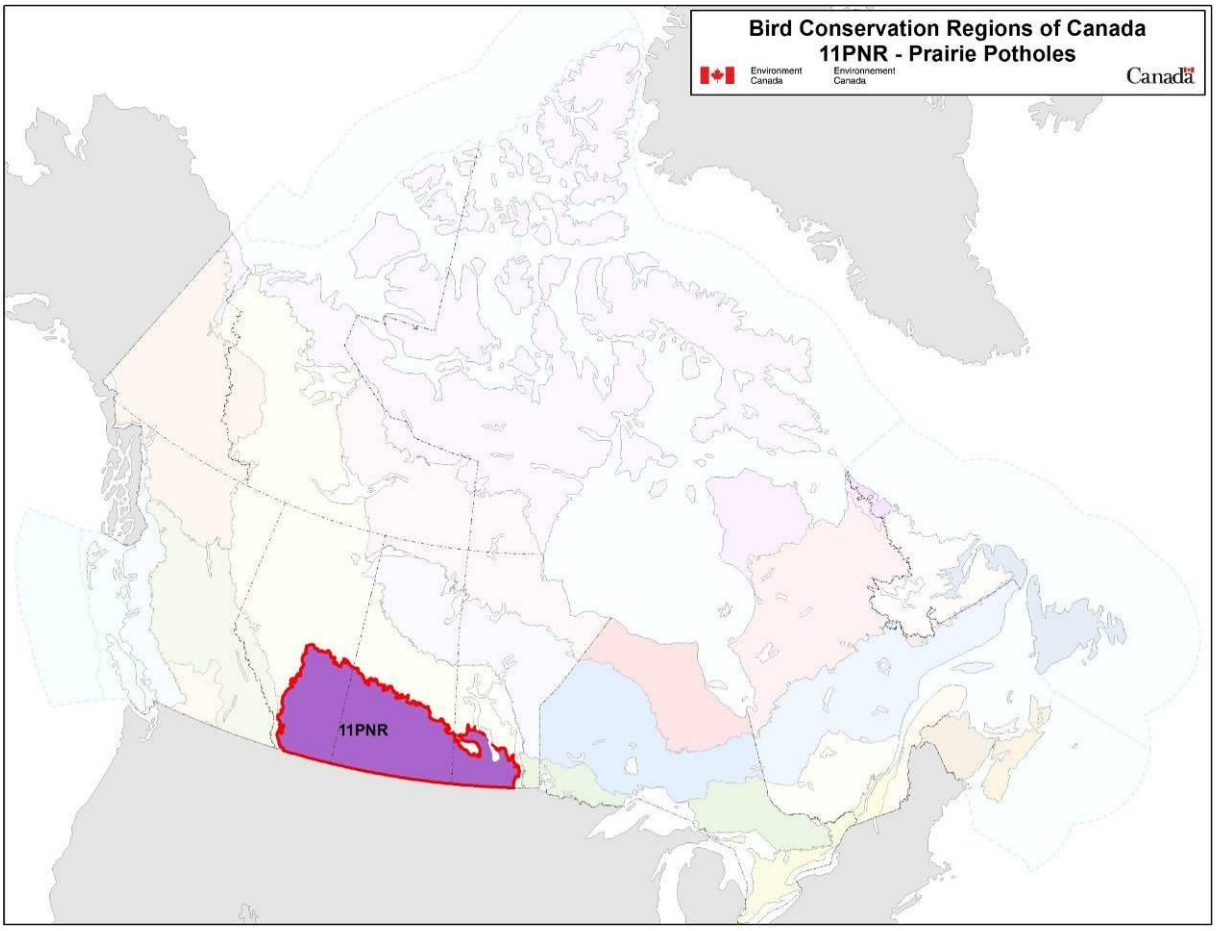
Bird Conservation Strategy for Bird Conservation Region 11 in the Prairie and Northern Region: Prairie Potholes



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Executive Summary

The Prairie Potholes Bird Conservation Region, BCR 11, lies within the Prairie Ecozone at the northern edge of North America's Great Plains. The Canadian portion of this region (467 000 km^2) extends from the foothills of the Rocky Mountains in Alberta to the Red River Valley in Manitoba, and from the Canadian border in the south to the forested habitats of BCR 6 in the north. The climate of BCR 11 PNR is generally dry and grasslands are the dominant type of natural habitat, but a moister climate in the northern and eastern extent of the region supports continuous tree cover. Native grasslands are predominantly mixed-grass prairie, but fescue prairie is also found in the west and north, and tallgrass prairie in parts of Manitoba. The Prairie Potholes Bird Conservation Region (BCR) derives its name from the millions of shallow wetlands scattered across the landscape; depressional wetlands from irregular glacial deposits. These natural habitats support many of the region's birds, but a majority of the landcover has been converted to cropland, rangeland or other agricultural uses; habitats with a reduced value to most birds.

In Canada, BCR 11 is contained within Environment Canada's Prairie and Northern Region (PNR). This conservation strategy for BCR 11 PNR builds on existing bird conservation plans and complements those created for the other BCRs across Canada. These strategies will serve as a framework for implementing bird conservation nationally, and also identify international conservation issues for Canada's priority birds. This strategy is not intended to be highly prescriptive, but rather is intended to guide future implementation efforts undertaken by various partners and stakeholders.

We evaluated 341 bird species that occur in the region, and 118 were determined to qualify as priority species (35%). All bird groups were represented, with 36% of the list consisting of landbirds, 25% waterfowl, 21% shorebirds and 19% waterbirds. Among the priority species were 30 assessed as Special Concern or greater by COSEWIC, 26 listed under the federal *Species at Risk Act*, and 18 listed by provincial species at risk legislation in Alberta, Saskatchewan or Manitoba.

In BCR 11 PNR, the largest number of priority bird species were associated with wetlands (78, or 66%), followed by cultivated and managed areas (72, 61%) and waterbodies (55, 47%). The heavy use of wetlands and waterbodies is to be expected, given that 64% of the priority species list consists of waterfowl, waterbirds and shorebirds. In contrast, the high use of cultivated areas by priority species does not reflect a preference for these habitats *per se*, but instead is a result of the landscape of BCR 11 PNR being dominated by these agricultural lands. Similarly, the small number of priority species using coniferous, deciduous and mixed forest habitats reflects the small extent of these habitat types in the region.

Population objectives were set on the basis of observed trends. In the Canadian prairies, waterfowl are in general well-monitored but other species less so. For 26 species or populations (22%), survey data were incomplete and a population goal of "Maintain and Assess" was assigned. Among those species for which quantitative objectives could be assigned, populations were below objectives in 33 cases (28%) and at or above objectives in 24 cases (20%). An additional 20 priority species (17%) are species at risk, and objectives are set out in recovery plans. Among all priority species in the region, the most severe population declines have been observed for specialists of grasslands and sagebrush including Burrowing Owl, Sprague's Pipit, Chestnut-collared Longspur, McCown's Longspur, Baird's Sparrow and Greater Sage-Grouse.

BCR 11 PNR is an area heavily affected by agriculture. We identified a large number and diversity of anthropogenic threats and other conservation issues facing priority species in the region, but issues related directly or indirectly to agriculture were most numerous. Conversion of native upland habitats (e.g., shortgrass prairie, sagebrush) to agricultural land, draining of wetlands for agricultural production and other forms of habitat loss remain a concern, but recent conservation efforts have helped to reverse the trend of habitat loss in some areas. Populations of many priority waterfowl and waterbirds are now stable or increasing in BCR 11 PNR due to these efforts.

Other important threats to prairie habitats and the priority birds dependent on them include overgrazing, oil and gas development, invasive species, and a wide variety of other issues. Climate change is expected to result in drier, hotter summers and warmer, wetter winters in the region, but the full extent of the effects on birds are difficult to predict.

These varied threats to priority birds require a correspondingly varied response. Proposed conservation objectives and actions include development and implementation of beneficial management practices to reduce the adverse effects of agriculture on birds, habitat protection and restoration, maintenance of natural processes such as fire and hydrologic cycles, awareness and education campaigns to engage industry and the public in conservation, and a variety of other forms of conservation action.

Management of birds in the BCR also requires targeted investment in monitoring to be better able to assess population status and set population objectives. Similarly, targeted research in the following key areas will clarify both the causes underlying population declines and the most appropriate conservation actions to take:

- Determine primary drivers of population decline and habitat requirements, particularly for grassland- and sagebrush-dependent species
- Map land-cover changes to correlate habitat loss with species declines, identify priority areas and set quantitative habitat objectives
- Conduct research to develop sector-specific beneficial management practices with an emphasis on bird and biodiversity conservation
- Continue research to improve our understanding of the effects of climate change on habitat and species in BCR 11 PNR

These conservation objectives, actions and research needs could all contribute to the conservation of the priority birds of BCR 11 PNR. However, implementation of the recommendations within this strategy will require the cooperation of federal and provincial governments, industry and other stakeholders. Fostering this broad collaboration is the most important next step towards conservation of birds in Canada’s Prairie Pothole region.

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

The BCR strategies are not highly prescriptive. In most cases, practitioners will need to consult additional information sources at local scales to provide sufficient detail to implement the recommendations of the strategies. Tools such as beneficial management practices 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 subregional level. Section 2 provides more detail on the threats, objectives and actions for priority species, and 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 of Canada. The approach and methodology are summarized in the appendices, but details are available in a separate document (Kennedy et al. 2012). A national database houses all the underlying information summarized in this strategy and is available from Environment Canada.

[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 11

The Prairie Pothole Region (PPR) is the northernmost portion of North America's Great Plains. The Canadian portion of this region encompasses an area of 467 000 km^2, from the foothills of Alberta's Rocky Mountains in the west to the Red River Valley in Manitoba in the east (Fig. 1). The PPR in Canada is bound by the boreal forest in the north and stretches south to the Canada–U.S. border. The area is also known as the Prairie Ecozone, in the Ecological Framework of Canada.

BCR 11 is generally characterized by a dry climate that supports temperate grasslands; however, moister climates in the northern and eastern portions sustain continuous tree cover. Native grasslands are largely mixed-grass prairie with fescue prairie in the west and north, and tallgrass prairie limited to parts of Manitoba. It is the millions of shallow wetlands, however, that have defined the pothole region. Depressional wetlands stem from irregular glacial deposits and today contribute substantially to the region's biodiversity (Thorpe and Godwin 2010).

The geomorphologic and climatic characteristics that define the PPR's suitability for wildlife have made the region particularly attractive for human settlement. As a result of its fertile soils and moderate climate, the region has experienced extensive cultivation, wetland drainage and other forms of habitat modification since the time of European settlement. These historic landscape-level changes have caused widespread loss and degradation of marshlands and native habitats. In particular, the loss of native grassland is unparalleled in other natural habitats of North America. Despite substantial changes to the landscape, the PPR remains among North America's most important regions for many bird populations. Wetlands of the PPR are renowned for their importance to sustaining populations of waterfowl. Breeding density of dabbling ducks in the PPR may exceed 40 pairs per square kilometre in some areas during years with favourable wetland conditions, and the region comprises the core of the breeding range of most dabbling duck and several diving duck species. The PPR also provides key breeding and staging habitat for over 200 species of waterbirds, shorebirds and landbirds including priority species such as Piping Plover, Sprague's Pipit, Chestnut-collared Longspur, Baird's Sparrow, Yellow Rail, Franklin's Gull, Wilson's Phalarope, Marbled Godwit and American Avocet (North American Bird Conservation Initiative, U.S. Committee, 2010).

Continued wetland degradation and fragmentation of remaining grasslands and other native habitats threaten future suitability of the PPR for all of these birds; however, other contemporary threats also exist. Environmental pollution, predominantly from agricultural and industrial sources, competition and predation from both native and introduced species, energy development and collisions with human-made structures all threaten high proportions of priority species in BCR 11 PNR. A number of protected areas have been established in BCR 11 PNR aimed at conserving threatened species and their habitats (Fig. 2).

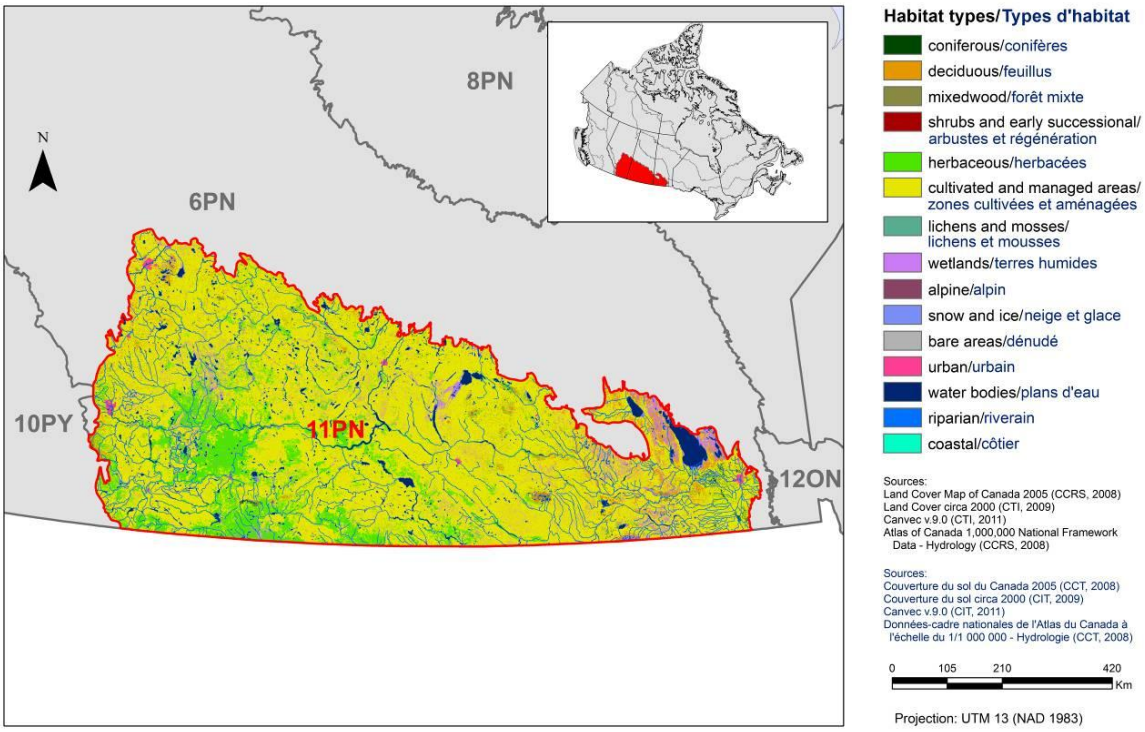

Figure 1. Landcover in BCR 11 Prairie and Northern Region: Prairie Potholes.

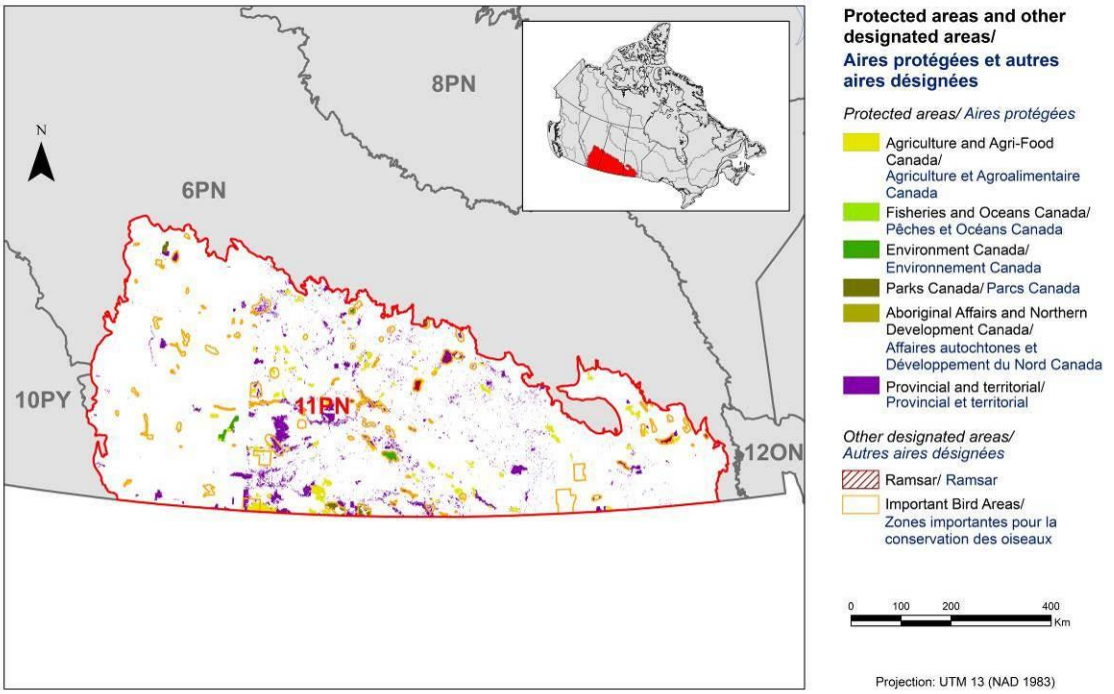

Figure 2. Map of protected and designated areas in BCR 11 Prairie and Northern Region: Prairie Potholes.

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 11 PNR by bird group and by the reason for priority status. We evaluated 341 bird species that occur in the region, and 118 were determined to qualify as priority species (35%; Table 2). All bird groups were represented, with 36% of the list consisting of landbirds, 25% waterfowl, 21% shorebirds and 19% waterbirds. Among the priority species were 28 recognized as Special Concern or greater by COSEWIC, 25 listed under the federal *Species at Risk Act*, and 18 listed by provincial species at risk legislation in Alberta, Saskatchewan or Manitoba (Table 3).

Table 1. Priority species in BCR 11 PNR, population objectives, and the reason for priority status.

Methods used to survey abundance are as follows: 1) Breeding Bird Survey/Grassland Bird Monitoring (based on Partners in Flight (PIF) scores), 2) trend information reported in COSEWIC reports, 3) National Nocturnal Owl Survey, 4) Canadian Shorebird Conservation Plan (CSCP; 2000), 5) CWS/USFWS Breeding Population and Habitat Survey (Smith 1995) as presented in the Prairie Habitat Joint Venture (2008) and NAWMP (2004), 6) Christmas Bird Count (Audubon 2010), 7) species-specific survey, ND = "no data", breeding populations not surveyed by any method. Trend scores are as follows: 1) increasing, 2) stable, 3) unknown or unreliably surveyed, 4) moderate decline, 5) strong decline, E = extirpated or extinct. The population objective was set based on the higher population trend score. Population trends of non-listed migratory shorebirds were not assessed here but information is provided in the BCR 3 strategy, which covers the breeding range for these species.

								Reason for Inclusion					
Species	**Method**	**BCR 11 Trend**	**Conti-nental Trend**	**Population Objective**	**COSEWIC[1]**	**SARA[2]**	**Provincial Listing[3]**	**National / Continental Concern (PIF, CSCP, NAWMP, WOW)[4]**	**Regional Concern**	**Continental Stewardship**	**Regional Steward-ship**	**NAWMP Rank[5] (waterfowl only)**	**Manage-ment Concern**	**Expert Review[6] (Changes)**
Landbirds														
Baird's Sparrow	1	5	5	Increase 100%	SC		MB-END	Yes	Yes		Yes			
Black-billed Cuckoo	1	5	5	Increase 100%					Yes		Yes			
Black-billed Magpie	1	2	2	Maintain current							Yes			
Bobolink	1	2	5	Increase 100%	THR									
Brown Thrasher	1	5	5	Increase 100%					Yes	Yes				
Burrowing Owl	2	5	5	Recovery Objective	END	END	AB-END, SK-END, MB-END		Yes					
Chestnut-collared Longspur	1,2	5	5	Recovery Objective[7]	THR	THR			Yes	Yes	Yes			
Chimney Swift	1,2	3	5	Recovery Objective[7]	THR	THR								
Clay-colored Sparrow	1	4	4	Increase 50%					Yes		Yes			

[1] Assessed by COSEWIC (Committee on the Status of Endangered Wildlife in Canada) as: EXT, Extirpated; END, Endangered; THR, Threatened; SC, Special Concern.
[2] Species listed on Schedule 1 of the *Species at Risk Act* (SARA) as EXT, Extirpated; END, Endangered; THR, Threatened; SC, Special Concern (Species at Risk Public Registry).
[3] Provincial SAR refers to species listed as "Extirpated," "Endangered,' "Threatened" or "Special Concern" by the governments of Alberta and Manitoba, or as "Extirpated", "Endangered", "Threatened" or "Vulnerable" by the government of Saskatchewan.
[4] PIF refers to Partners in Flight (Rich et al. 2004), CSCP refers to Canadian Shorebird Conservation Plan (Donaldson et al. 2000), and WOW refers to Wings Over Water (Milko et al. 2003).
[5] NAWMP: North American Waterfowl Management Plan (North American Waterfowl Management Plan, Plan Committee, 2004).
[6] Expert review indicates that at species was added or removed from the priority list as a result of expert opinion.
[7] The species is listed under SARA, but its recovery documents have not yet been finalized.

Table 1 continued

Species	Method	BCR 11 Trend	Conti-nental Trend	Population Objective	Reason for Inclusion									
					COSEWIC[1]	SARA[2]	Provincial Listing[3]	National / Continental Concern (PIF, CSCP, NAWMP, WOW)[4]	Regional Concern	Continental Stewardship	Regional Steward-ship	NAWMP Rank[5] (waterfowl only)	Manage-ment Concern	Expert Review[6] (Changes)
Common Nighthawk	2	3	4	Recovery Objective[7]	THR	THR								
Common Yellowthroat	1	2	4	Increase 50%										Added
Eastern Screech-Owl	3	3	3	Assess/Maintain										Added
Eastern Whip-poor-will	2	3	4	Recovery Objective[7]	THR	THR								
Ferruginous Hawk	2	1	1	Recovery Objective[7]	THR	THR	AB-END, MB-THR		Yes		Yes			
Golden Eagle	1	3	3	Assess/Maintain					Yes					
Golden-winged Warbler	1,2	3	5	Recovery Objective[7]	THR	THR		Yes						
Grasshopper Sparrow	1	5	5	Increase 100%					Yes	Yes				
Greater Prairie-Chicken	2	E	5	Recovery Objective[7]	EXT	EXT	SK-EXT, MB-EXT	Yes	Yes					
Greater Sage-Grouse (*urophasianus* subspecies)	2	5	5	Recovery Objective	END	END	SK-END	Yes	Yes					
Horned Lark	1	5	5	Increase 100%					Yes		Yes			
Lark Bunting	1	5	5	Increase 100%					Yes	Yes				
Le Conte's Sparrow	1	2	3	Assess/Maintain					Yes					
Least Flycatcher	1	1	4	Increase 50%										Added
Loggerhead Shrike (excubitorides subspecies)	1,2	5	5	Recovery Objective[7]	THR	THR	AB-SC, MB-END		Yes					
Long-eared Owl	3	3	4	Increase 50%										Added
McCown's Longspur	1,2	5	5	Increase 100%[7]	SC	SC		Yes	Yes		Yes			

Table 1 continued

Species	Method	BCR 11 Trend	Conti-nental Trend	Population Objective	Reason for Inclusion									
					COSEWIC[1]	SARA[2]	Provincial Listing[3]	National / Continental Concern (PIF, CSCP, NAWMP, WOW)[4]	Regional Concern	Continental Stewardship	Regional Steward-ship	NAWMP Rank[5] (waterfowl only)	Manage-ment Concern	Expert Review[6] (Changes)
Nelson's Sparrow	1	3	3	Assess/Maintain				Yes	Yes		Yes			
Northern Flicker	1	4	4	Increase 50%					Yes					
Northern Harrier	1	4	4	Increase 50%					Yes		Yes			
Olive-sided Flycatcher	2	3	5	Recovery Objective[7]	THR	THR		Yes						
Peregrine Falcon	2	3	1	Assess/Maintain[7]	SC	SC	AB-THR, MB-END			Yes				
Prairie Falcon	1	3	2	Assess/Maintain			AB-SC		Yes					
Red-headed Woodpecker	1,2	4	5	Recovery Objective[7]	THR	THR		Yes	Yes					
Rusty Blackbird	2,6	3	5	Increase 100%[7]	SC	SC		Yes						
Sage Thrasher	2	3	2	Recovery Objective	END	END				Yes				
Sedge Wren	1	1	2	Maintain current							Yes			
Sharp-tailed Grouse	1	5	3	Increase 100%					Yes	Yes	Yes			
Short-eared Owl	6	5	5	Increase 100%[7]	SC	SC		Yes	Yes					
Sprague's Pipit	2	5	5	Recovery Objective[7]	THR	THR	AB-SC, MB-THR	Yes	Yes		Yes			
Swainson's Hawk	1	2	2	Maintain current				Yes	Yes		Yes			
Western Meadowlark	1	5	5	Increase 100%					Yes					
Willow Flycatcher	1	1	4	Maintain current				Yes						
Shorebirds														
American Avocet	1	2	3	Assess/Maintain										Added
American Golden-Plover	4	NA	4	Migrant (no population objective)				Yes						

Table 1 continued

Species	Method	BCR 11 Trend	Conti-nental Trend	Population Objective	Reason for Inclusion									
					COSEWIC[1]	SARA[2]	Provincial Listing[3]	National / Continental Concern (PIF, CSCP, NAWMP, WOW)[4]	Regional Concern	Continental Stewardship	Regional Steward-ship	NAWMP Rank[5] (waterfowl only)	Manage-ment Concern	Expert Review[6] (Changes)
Black-bellied Plover	4	NA	5	Migrant (no population objective)				Yes						
Buff-breasted Sandpiper	4	NA	4	Migrant (no population objective)	SC			Yes						
Eskimo Curlew	3	E	E	Recovery Not Feasible	END	END	SK-EXT, MB-END	Yes						
Hudsonian Godwit	4	NA	3	Migrant (no population objective)				Yes						
Killdeer	1	4	5	Increase 100%				Yes			Yes			
Long-billed Curlew	3	4	4	Increase 50%	SC	SC	AB-SC, MB-EXT	Yes	Yes					
Long-billed Dowitcher	4	NA	2	Migrant (no population objective)										Added
Marbled Godwit	1	4	4	Increase 50%				Yes	Yes		Yes			
Mountain Plover	3	3	5	Recovery Objective	END	END	AB-END	Yes						
Piping Plover	3	5	5	Recovery Objective	END	END	AB-END, SK-END, MB-END	Yes	Yes		Yes			
Red Knot (*rufa* subspecies)	3	NA	5	Recovery Objective[7]	END	END		Yes						
Red-necked Phalarope	4	NA	4	Migrant (no population objective)				Yes						
Ruddy Turnstone	4	NA	4	Migrant (no population objective)				Yes						
Sanderling	4	NA	5	Migrant (no population objective)				Yes						
Semipalmated Sandpiper	4	NA	5	Migrant (no population				Yes						

Table 1 continued

Species	Method	BCR 11 Trend	Conti-nental Trend	Population Objective	Reason for Inclusion									
					COSEWIC[1]	SARA[2]	Provincial Listing[3]	National / Continental Concern (PIF, CSCP, NAWMP, WOW)[4]	Regional Concern	Continental Stewardship	Regional Steward-ship	NAWMP Rank[5] (waterfowl only)	Manage-ment Concern	Expert Review[6] (Changes)
				objective)										
Short-billed Dowitcher	4	3	5	Migrant (no population objective)				Yes						
Spotted Sandpiper	1	2	4	Increase 50%					Yes		Yes			
Stilt Sandpiper	4	NA	3	Migrant (no population objective)										Added
Upland Sandpiper	1	2	3	Assess/Maintain					Yes		Yes			
Whimbrel	4	NA	5	Migrant (no population objective)				Yes						
Willet	1	4	4	Increase 50%					Yes		Yes			
Wilson's Phalarope	1	2	3	Assess/Maintain				Yes	Yes		Yes			
Wilson's Snipe	1	1	2	Maintain current										Added
Waterbirds														
American Bittern	1	3	4	Increase 50%				Yes						
American White Pelican	1	1	1	Maintain current				Yes						
Black Tern	1	5	3	Increase 100%				Yes						
Black-crowned Night-Heron	1	3	3	Assess/maintain										Added
Bonaparte's Gull	ND	3	3	Assess/Maintain				Yes						
Caspian Tern	1	3	3	Assess/Maintain										Added
Clark's Grebe	ND	3	3	Assess/Maintain										Added
Common Loon	1	3	3	Assess/Maintain				Yes						
Common Tern	1	3	3	Assess/Maintain				Yes						

Table 1 continued

Species	Method	BCR 11 Trend	Conti-nental Trend	Population Objective	Reason for Inclusion									
					COSEWIC[1]	SARA[2]	Provincial Listing[3]	National / Continental Concern (PIF, CSCP, NAWMP, WOW)[4]	Regional Concern	Continental Stewardship	Regional Steward-ship	NAWMP Rank[5] (waterfowl only)	Manage-ment Concern	Expert Review[6] (Changes)
Eared Grebe	1	3	3	Assess/Maintain				Yes						
Forster's Tern	1	3	3	Assess/Maintain				Yes						
Franklin's Gull	1	2	3	Assess/Maintain										Added
Great Blue Heron	1	3	1	Assess/Maintain										Added
Horned Grebe	1	4	4	Increase 50%	SC			Yes						
Least Bittern	2	3	4	Recovery Objective	THR	THR		Yes						
Pied-billed Grebe	1	2	3	Assess/Maintain										Added
Red-necked Grebe	1	3	3	Assess/Maintain										Added
Sora	1	2	2	Maintain current				Yes						
Virginia Rail	1	3	3	Assess/Maintain				Yes						
Western Grebe	ND	3	3	Assess/Maintain			AB-SC	Yes						
Whooping Crane	2	NA	1	Recovery Objective	END	END	AB-END, SK-END, MB-END	Yes						
Yellow Rail	ND	3	3	Assess/Maintain	SC	SC		Yes						
Waterfowl														
American Wigeon	5	5	5	Increase				Yes				Mod High		
Blue-winged Teal	5	2	2	Maintain current				Yes				High		
Bufflehead	5	NA	1	Assess/Maintain								Mod Low		Added
Cackling Goose, Shortgrass Prairie Population	5	NA	5	Migrant (no population objective)								High		
Cackling Goose, Tallgrass Prairie	5	NA	2	Migrant (no population								High		

Table 1 continued

Species	Method	BCR 11 Trend	Conti-nental Trend	Population Objective	Reason for Inclusion									
					COSEWIC[1]	SARA[2]	Provincial Listing[3]	National / Continental Concern (PIF, CSCP, NAWMP, WOW)[4]	Regional Concern	Continental Stewardship	Regional Steward-ship	NAWMP Rank[5] (waterfowl only)	Manage-ment Concern	Expert Review[6] (Changes)
Population				objective)										
Canada Goose, Eastern Prairie Population	5	NA	2	Maintain current								High		
Canada Goose, Hi-Line Population	5	NA	1	Decrease				Above Objective				High	Yes	
Canada Goose, Mississippi Flyway Giants Population	5	NA	1	Decrease				Above Objective				High	Yes	
Canada Goose, Western Prairie and Great Plains Population	5	NA	1	Decrease				Above Objective				High	Yes	
Canvasback	5	2	4	Increase				Yes				High		
Gadwall	5	1	2	Maintain current								High		
Greater White-fronted Goose	5	NA	2	Migrant (no population objective)								High		
Green-winged Teal	5	4	4	Increase								High		
Lesser Scaup	5	5	2	Increase				Yes				Highest		
Lesser Snow Goose, Mid-continent Population	5	NA	1	Decrease				Above Objective				High	Yes	
Lesser Snow Goose, Western Arctic Population	5	NA	1	Decrease				Above Objective				High	Yes	
Lesser Snow Goose, Western Central Flyway Population	5	NA	2	Migrant (no population objective)								High		

Table 1 continued

Species	Method	BCR 11 Trend	Conti-nental Trend	Population Objective	Reason for Inclusion									
					COSEWIC[1]	SARA[2]	Provincial Listing[3]	National / Continental Concern (PIF, CSCP, NAWMP, WOW)[4]	Regional Concern	Continental Stewardship	Regional Steward-ship	NAWMP Rank[5] (waterfowl only)	Manage-ment Concern	Expert Review[6] (Changes)
Lesser Snow Goose, Wrangel Island Population	5	NA	1	Migrant (no population objective)				Yes				Mod High		
Mallard	5	4	4	Increase				Yes				Highest		
Northern Pintail	5	5	5	Increase				Yes				Highest		
Northern Shoveler	5	2	2	Maintain current								High		
Redhead	5	2	2	Maintain current				Yes				High		
Ring-necked Duck	1,5	NA	1	Maintain current								Mod High		
Ross's Goose	5	NA	1	Decrease				Above Objective				High	Yes	
Ruddy Duck	1,5	3	1	Assess/Maintain								High		
Trumpeter Swan, Interior Population	5	NA	1	Maintain current			MB-EXT					High		
Trumpeter Swan, Rocky Mountain Population	5,7	NA	1	Maintain current			AB-THR							
Tundra Swan	5	NA	1	Migrant (no population objective)								High		
White-winged Scoter	5	NA	5	Increase			AB-SC	Yes				Mod Low		

Table 2. Summary of priority species, by bird group, in BCR 11 PNR.

Bird Group	Total Species	Priority Species	Percent Listed as Priority	Percent of Priority List
Landbirds	217	42	19%	36%
Shorebirds	39	25	64%	21%
Waterbirds	36	22	61%	19%
Waterfowl	49	29	59%	25%
All	341	118	35%	100%

Table 3. Number of priority species in BCR 11 PNR by reason for priority status.

Reason for Priority Listing[1]	Landbirds	Shorebirds	Waterbirds	Waterfowl
COSEWIC[2]	20	6	4	0
Federal SARA Listed[3]	18	5	3	0
Provincially Listed[4]	9	4	2	3
NAWMP[5]	-	-	-	26
National/Continental Concern	13	18	15	15
Regional Concern	26	7	0	0
National/Continental Stewardship	7	-	-	-
Regional Stewardship	14	7	-	-

[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] COSEWIC indicates species assessed by the Committee on the Status of Endangered Wildlife in Canada as Extirpated, Endangered, Threatened or Special Concern.
[3] Species listed on Schedule 1 of the *Species at Risk Act* as Extirpated, Endangered, Threatened or Special Concern. Designations current to January 2013.
[4] Provincially Listed indicates species listed under species at risk legislation of Alberta, Saskatchewan or Manitoba as Extirpated, Endangered, Threatened, Vulnerable or Special Concern.
[5] NAWMP indicates species ranked in the North American Waterfowl Management Plan (Plan Committee 2004) as having Highest, High or Moderately High breeding or non-breeding conservation and/or monitoring need in the BCR.

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 2Appendix 2 for details on how species were assigned to standard habitat categories). If many priority species associated with the same habitat face similar conservation issues, then conservation action in that habitat may support populations of several priority species. BCR strategies use a modified version of the standard land cover classes developed by the United Nations (Food and Agriculture Organization 2000) to categorize habitats, and species were often assigned to more than one habitat class.

In BCR 11 PNR, the largest number of priority species were associated with wetlands (78, or 66%; Fig. 3), followed by cultivated and managed areas (72, or 61%) and waterbodies (55 or 47%). The heavy use of wetlands and waterbodies is to be expected, given that 64% of the priority species list consists of waterfowl, waterbirds and shorebirds. In contrast, the high use of cultivated areas by priority species does not reflect a preference for these habitats *per se*, but instead is a result of the landscape of BCR 11 being dominated by these agricultural lands. Similarly, the small number of priority species using coniferous, deciduous and mixed forest habitats reflects the small extent of these habitat types in the region.

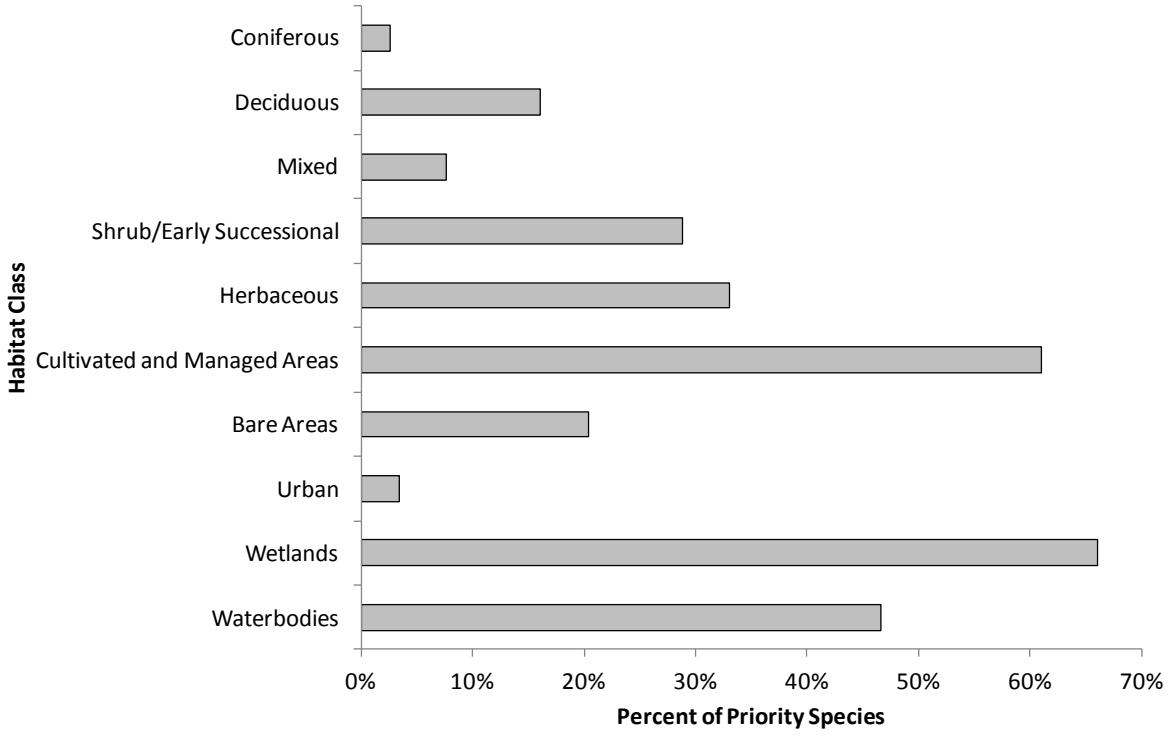

Figure 3. Percent of priority species that are associated with each habitat type in BCR 11 PNR.
The total exceeds 100% because each species may be assigned to more than one habitat.

Element 3: Population Objectives

Population objectives allow us to measure and evaluate conservation success. The objectives in this strategy are assigned to categories and are based on a quantitative or qualitative assessment of species' population trends. If the population trend of a species is unknown, the objective is set as "assess and maintain," and a monitoring objective is given (see Appendix 2). For any species listed under 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 population objectives for priority species in BCR 11 PNR are summarized in Figure 4. Waterfowl of the prairies are surveyed by the large-scale, international "Waterfowl Breeding Population and Habitat Surveys," among other surveys. In comparison with other species in Canada, prairie waterfowl are in general well monitored. However, many other species are poorly surveyed at present. Excluding migrating shorebirds whose population objectives are set in the BCR 3 PNR strategy, an estimated 38% of the non-waterfowl species are not adequately surveyed in a manner that allows us to assess population trends. This is most notable among waterbirds, where only 8 of 22 priority species are adequately monitored at the BCR and continental levels. Many landbirds are surveyed to some extent by the Breeding Bird Survey; we considered results of this survey to be unreliable if a 3%/year change in population size could not be determined over the long term. Among those species and populations that are reliably surveyed (or still show a trend despite low statistical power), 54 of 68 have declined and objectives seek to restore populations to a former abundance. For 19 species at risk, quantitative population goals are available published in recovery plans. Many of these listed species occur in grasslands, mixed-shrub grasslands or sagebrush habitats. Section 2 reviews the threats facing these species, the ongoing conservation efforts to protect populations and the conservation actions that may be needed to reverse the declines.

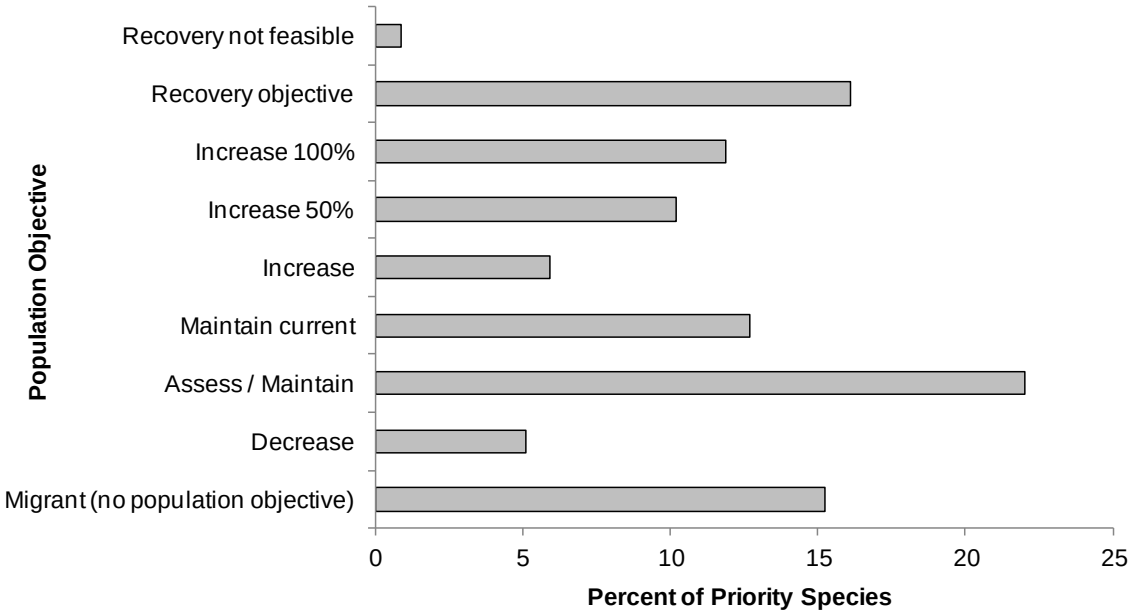

Figure 4. Percent of priority species that are associated with each population objective category in BCR 11 PNR.

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.

BCR 11 PNR is an area heavily dominated by agriculture and, perhaps unsurprisingly, issues related to agriculture such as habitat loss, degradation, disturbance and pollution from agricultural effluents were among the most significant threats to priority birds (Fig. 5, Table 4). Disturbance of habitat or breeding birds, habitat loss from human development and water management also emerged as significant threats. A wide variety of anthropogenic and climate-related impacts affected priority species to varying degrees (Fig. 5). Cumulative effects of these myriad threats may be substantial; a discussion of the population-level impacts and the conservation actions needed to counteract these threats appear in subsequent sections of the strategy. 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.

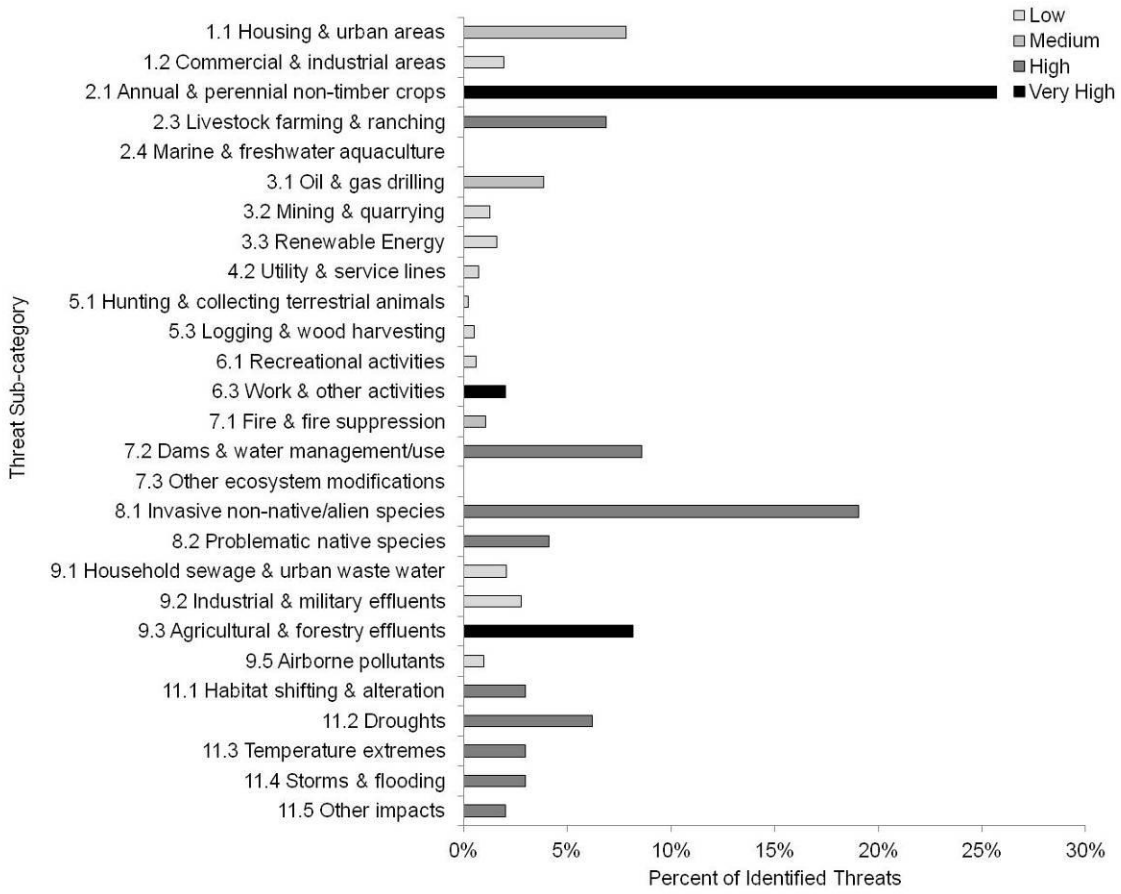

Figure 5. Percent of identified threats to priority species within BCR 11 PNR by threat sub-category. Each bar represents the percent of the total number of threats identified in each threat sub-category in BCR 11 PNR (for example, if 100 threats were identified in total for all priority species in BCR 11 PNR, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). Shading in the bars 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 11 PNR by threat category and broad habitat class.

Overall ranks were generated through a roll-up procedure described in Kennedy et al. (2012). "L" represents Low Magnitude threats; "M" = Medium; "H"= High; "VH" = Very High. Blank cells indicate that no priority species had threats identified in the threat category/habitat combination.

	Habitat Type										
Threat Category	**Coniferous**	**Deciduous**	**Mixed**	**Shrub/Early Successional**	**Herbaceous**	**Cultivated and Managed Areas**	**Bare Areas**	**Urban**	**Wetlands**	**Waterbodies**	**All Habitats**
All threat categories	**H**	**H**	**H**	**VH**	**VH**	**VH**	**H**	**M**	**VH**	**VH**	
1 Residential & commercial development	M		M		M	M	L		M		**M**
2 Agriculture & aquaculture	H	H	H	VH	VH	VH	H		VH	VH	**VH**
3 Energy production & mining	L	M	M	M	M	M	M		M	M	**M**
4 Transportation & service corridors									L		**L**
5 Biological resource use		L		L		L			L		**L**
6 Human intrusions & disturbance	M	H	M	H	H	H	H	M	H	M	**VH**
7 Natural system modifications		H	M	H	H	H	M		H	H	**H**
8 Invasive & other problematic species & genes	L	M	L	M	M	H	H	M	H	H	**H**
9 Pollution	L	H	M	H	H	VH	M	M	H	H	**VH**
11 Climate change & severe weather	H	H	H	H	H	H	H	H	VH	H	**VH**

Element 5: Conservation Objectives

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

In BCR 11 PNR, a majority of threats relate to habitat loss and degradation. Accordingly, the largest proportion of conservation objectives were related to ensuring adequate habitat for priority species (41%; Fig. 6). Direct management of individual species, or direct efforts to reduce mortality or increase productivity, were rare by comparison, accounting for 14% and 9% of recommended actions, respectively (Fig. 6). Because of the potentially far-reaching effects, climate change emerged as a threat of very high magnitude overall (Table 4); conservation objectives directed towards management of the adverse effects of climate change also figure prominently in this strategy.

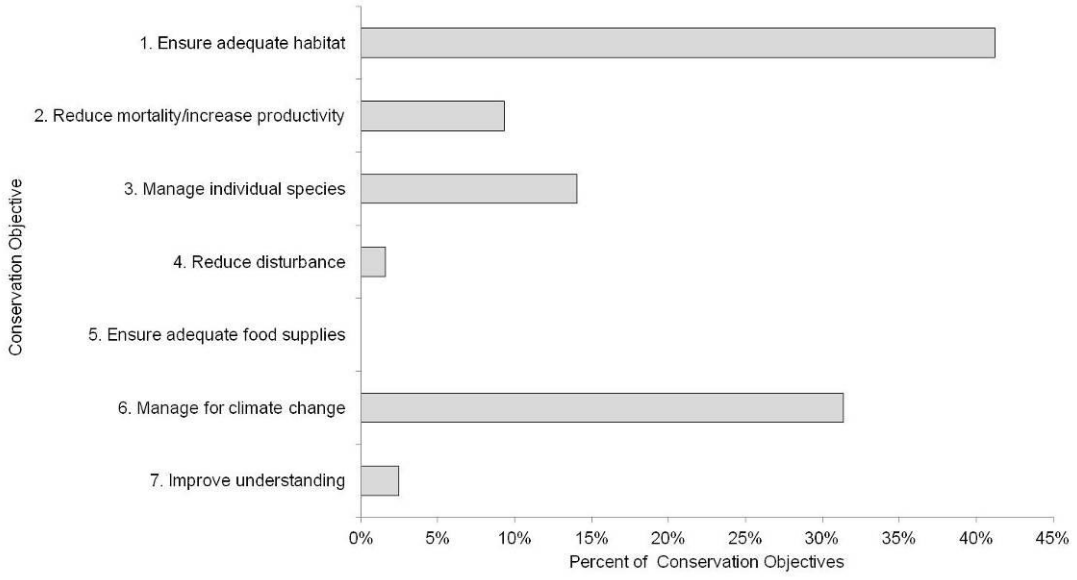

Figure 6. Percent of all conservation objectives assigned to each conservation objective category in BCR 11 PNR.

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.

Conservation in BCR 11 PNR requires the participation of a wide variety of stakeholders. Beneficial management practices, policies and private-sector standards are important tools in the conservation of priority species in the region, as are awareness campaigns and communication with stakeholders and the public (Fig. 7). However, in this heavily human-altered region, protection of remaining natural habitats is also an important conservation need.

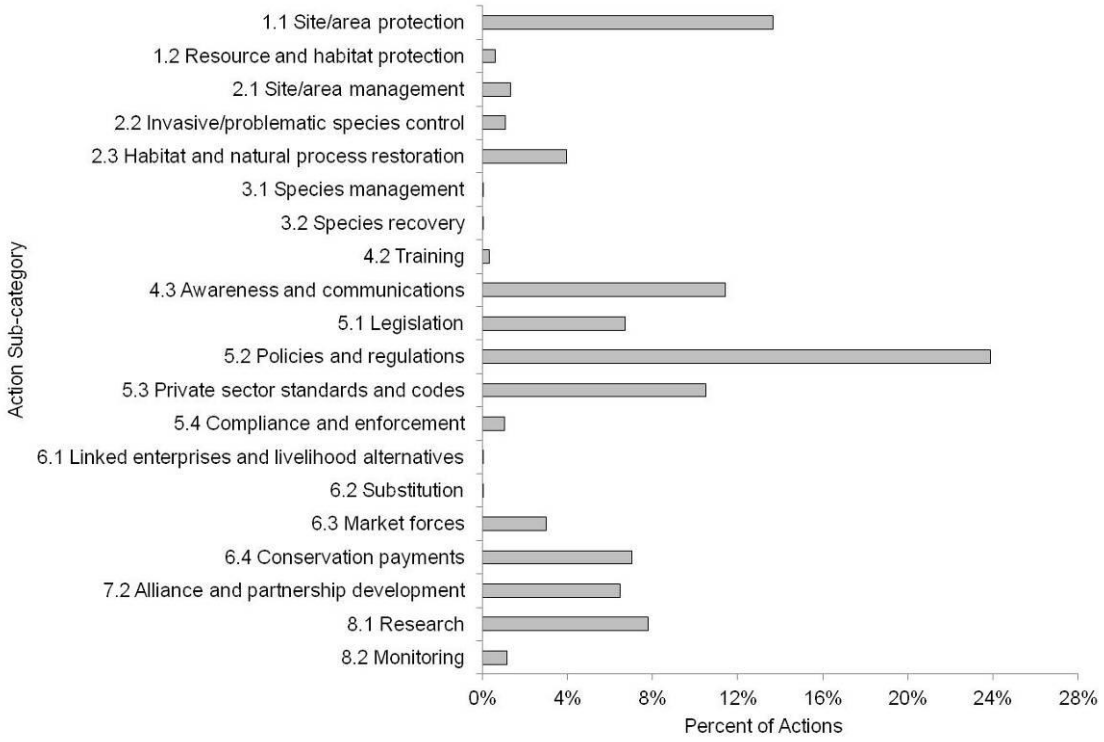

Figure 7. Percent of recommended actions assigned to each sub-category in BCR 11 PNR.
"Research" and "monitoring" refer to specific species where additional information is required. For a discussion of broad-scale research and monitoring requirements, see Research and Population Monitoring Needs.

Section 2: Habitats and Conservation Needs

The following sections provide more detailed information on the habitats used by priority species, the key threats that they face, and objectives and actions needed to counteract these threats. 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.

Cultivated and Managed Areas

Cultivated and managed areas are defined as those that are used for annual/perennial non-timber crops such as wheat, canola, barley and oats as well as habitats that are used for livestock ranching. Combined, about 93% of the total land area in BCR 11 falls under this category, with approximately 54% of that amount as cropland and 46% as pasture habitat (Thorpe and Goodwin 2010; Fig. 8). Although crop lands and managed pastures are both included in the overarching category of cultivated and managed areas, these subcategories are markedly different and provide habitat to different species. Caution is therefore needed when interpreting avian use of this broad habitat class. Only a few species select crop lands in proportion to availability during the breeding season, but they are important stopover habitats for waterfowl and some waterbirds (e.g., Sandhill and Whooping Crane) because of the abundance of fallen commercial grains and peas on cut fields. In contrast, well-managed pastures used for grazing may closely resemble native grasslands and can provide suitable breeding habitat for many grassland birds. The plant communities on pasture are often diverse and composed of native species, although these communities may be susceptible to invasive plant species (e.g., smooth brome), particularly where grazing disturbance is excessive. Many grassland birds evolved with ungulate grazing and are able to capitalize on the vegetative structure resulting from various livestock grazing intensities that would not be present on idle land.

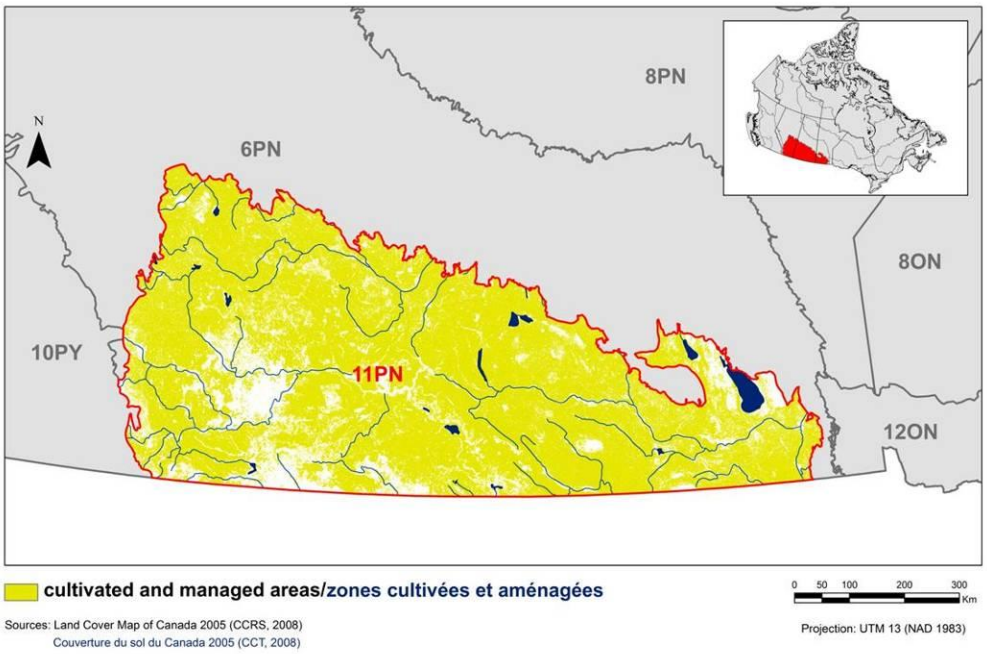

Figure 8. Map of cultivated and managed areas in BCR 11 PNR.

Herbaceous

Historically, herbaceous habitat dominated by graminoids (i.e., grasslands) was the most abundant habitat in BCR 11 PNR. Formerly influenced by drought, grazing and fire, human activities now have the greatest impact on grassland landscapes in this region. This habitat continues to be lost or degraded by cultivation, over-grazing, urban development and invasion of exotic plant species and woody vegetation (Samson and Knopf 1994, Riemer et al. 1997). Canadian prairie grasslands have now been reduced to less than one third of their former extent, including lands that contain native vegetation but are still used for ranching (Canadian Prairie Partners in Flight 2004). Despite this widespread loss, remnant grassland habitat is found throughout the BCR and remains one of the most important native habitat types to avian species in the region.

Herbaceous habitat in BCR 11 PNR (Fig. 9) is composed of three sub-habitat types: short, mixed and tallgrass prairie. Tallgrass prairie is composed of grass species that often grow up to 1.5 metres in height. This sub-habitat is the wettest of the grasslands, receiving annual rainfall of approximately 750 mm. Remaining patches of tallgrass prairie in Canada are found only in the southern portion of Manitoba, where only about 1% of the original coverage remains. Shortgrass prairie is dominated by warm-season grasses that flourish under grazing pressure. This sub-habitat is found in arid areas receiving <250 mm of rainfall annually, particularly in the southwestern portion of BCR 11. Vegetation height in shortgrass prairie is typically below 60 cm. Mixed-grass prairie is the most prominent herbaceous sub-habitat and is found throughout BCR 11. This sub-habitat is characterized by warm-season grasses of the shortgrass prairie to the west, and the cool- and warm-season grasses that grow taller in the east. The

grass species associated with this sub-habitat average about 60 cm in height and thrive under moderate rainfall (400–600 mm per year). Because of this ecotonal mixing, the number of plant species found in the mixed-grass prairie exceeds that found in other prairie types and subsequently provides habitat to a more diverse group of priority species.

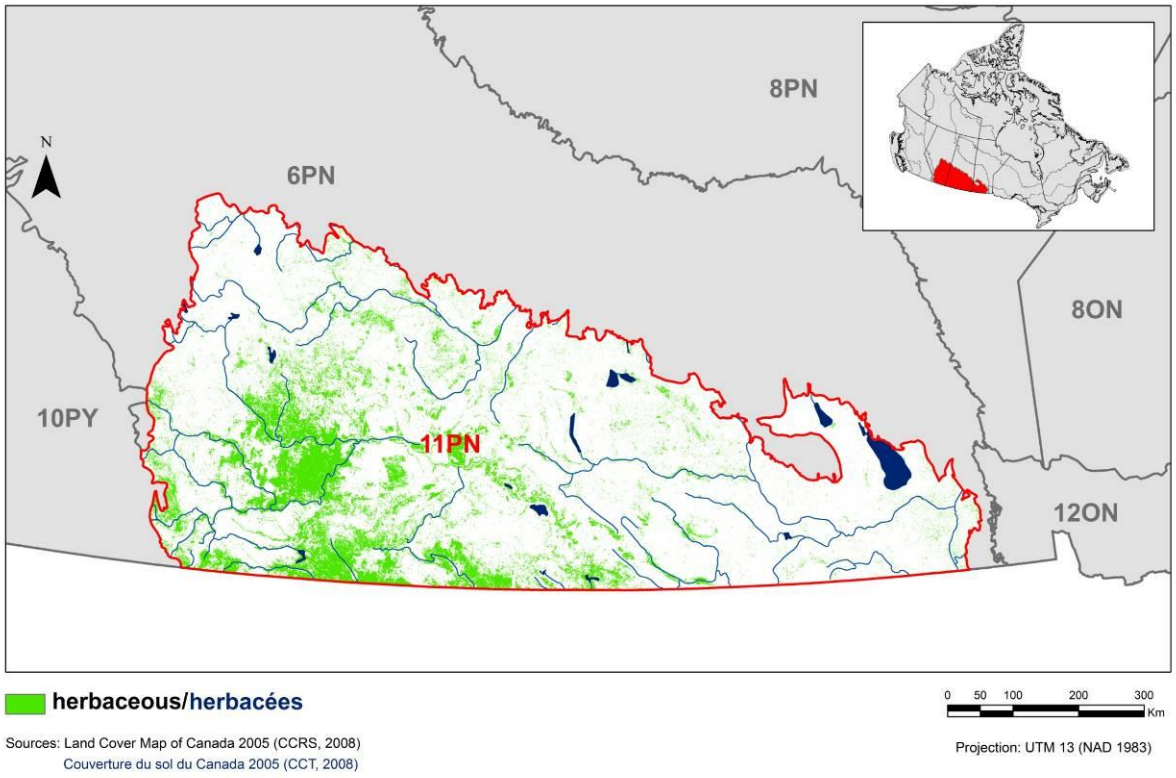

Figure 9. Map of herbaceous habitats in BCR 11 PNR.

Wetlands and Waterbodies

Wetlands and waterbodies (Figs. 10 and 11) constitute the third most common habitat type within the PPR and are a crucial habitat for many priority species (Canadian Prairie Partners in Flight 2004). Wetland habitats include shallow open water (largely unvegetated surfaces <2 m in depth), bogs, swamps, marshes and fens, whereas waterbodies include standing and flowing water such as reservoirs, lakes, human-made ponds, rivers and streams. In many cases, there is no clear distinction between larger wetlands and smaller waterbodies. Both habitat types are an important part of the prairie landscape and improve water quality by filtering and absorbing pollutants. They also recycle nutrients that move through the natural environment and provide habitat for many animal and plant species. A large number of species from all bird groups are dependent on these habitats for nesting and foraging during the breeding season, including wetland-dependent landbirds, shorebirds, waterfowl and waterbirds. These habitats also provide important migratory stopover sites for a number of species in BCR 11, including arctic shorebirds and waterfowl. There has been a drastic reduction in the amount and quality of wetlands and waterbodies as a result of drainage for agricultural activities and urban development, drought, and agricultural runoff.

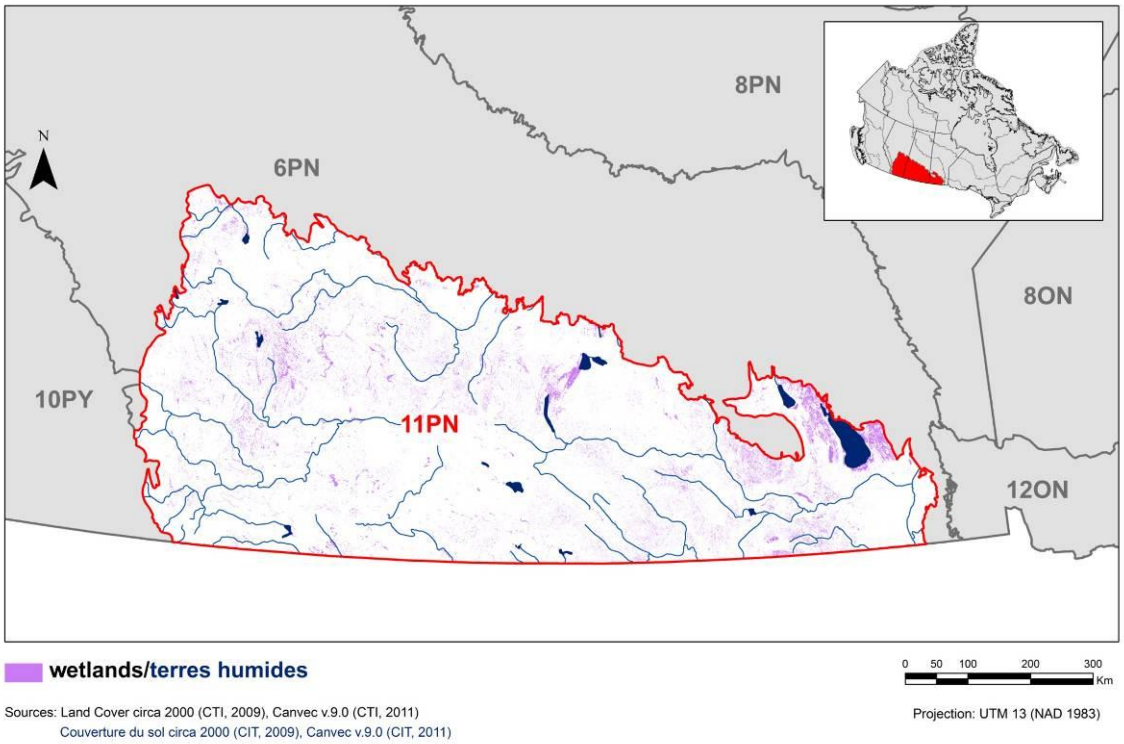

Figure 10. Map of wetland habitats in BCR 11 PNR.

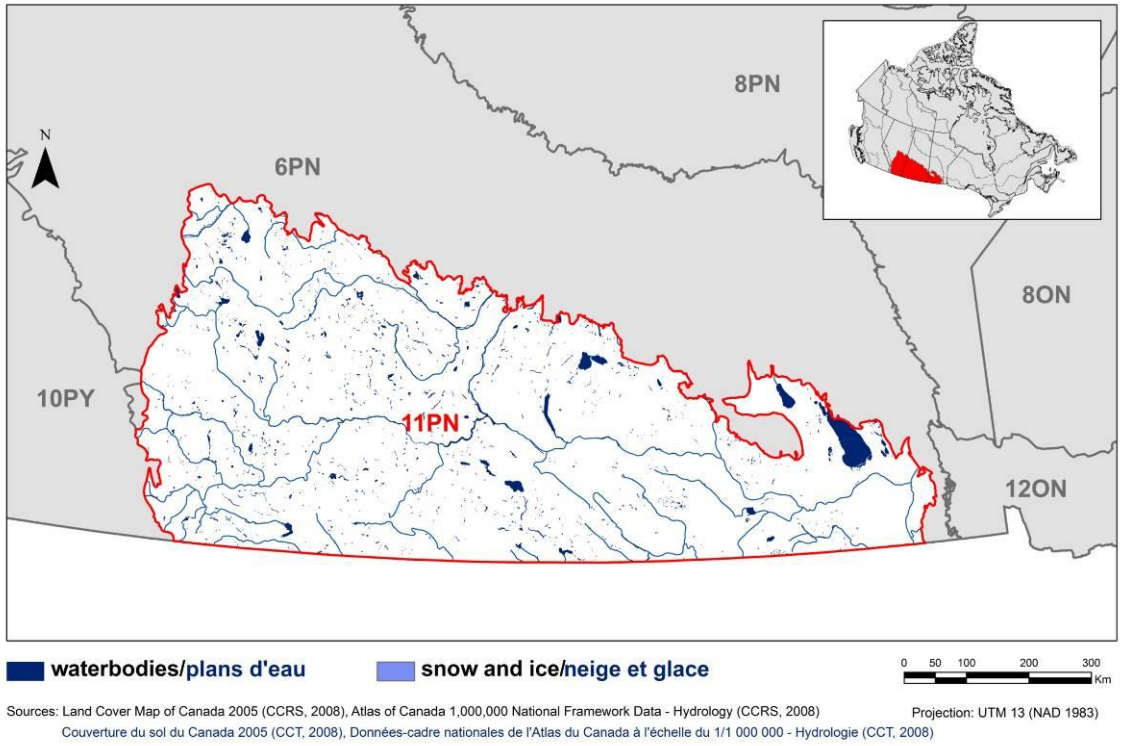

Figure 11. Map of waterbodies in BCR 11 PNR.

Shrub/Early Successional

Although both shrub and early successional vegetation are represented in BCR 11 (Fig. 12), shrubs comprise the largest proportion of this habitat type and are scattered through the region in various landscape configurations. Sagebrush is a unique shrub habitat found in arid southwestern portions of the region. Sagebrush species possess a deep taproot that allow individuals to persist in drought conditions; sagebrush communities provide an essential habitat for some priority species, most notably Greater Sage-Grouse. At a landscape scale, sagebrush habitats are often interspersed with shortgrass prairie and may contain wetlands in low-lying areas. A number of factors threaten sagebrush landscapes, including energy development (oil and gas), overgrazing, introduction of invasive species and the conversion of sagebrush to other plant species that are considered more palatable for cattle grazing.

Many upland habitats in BCR 11 consist of mixed shrub-grasslands where patches of shrub (e.g., wolf-willow (*Eleaegnus commutata*), thorny buffaloberry (*Sheperdia argentea*), Saskatoon (*Amelanchier alnifolia*) and *Salix spp*) are dispersed among larger grassland landscapes. Shrub cover is often highest in coulees and riparian areas where soil moisture is higher. These linear shrub habitats amidst a larger grassland or agricultural landscape are a common feature throughout southern portions of BCR 11 PNR and provide valuable breeding habitat for a number of shrub specialist priority bird species. Along the northern edge of BCR 11 PNR, shrub habitat is often present around wetlands or disturbed areas, and these patches of shrub habitat are also frequently used by several priority birds.

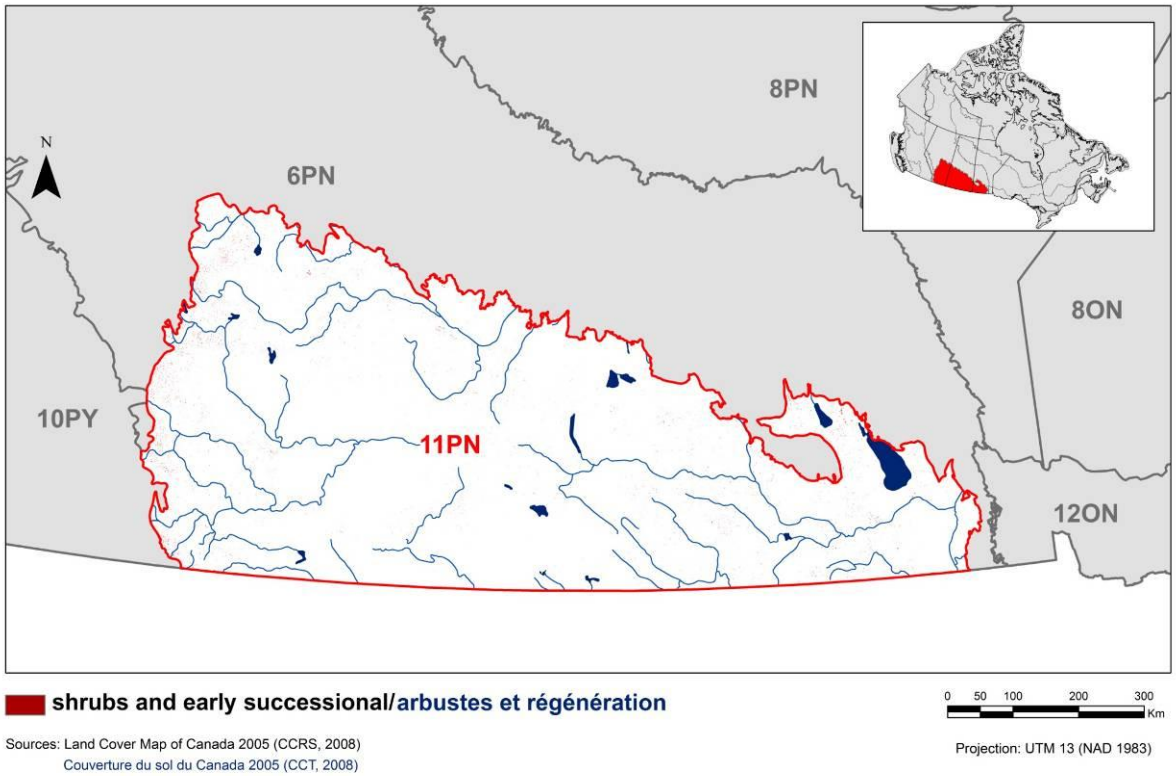

Figure 12. Map of shrub and early successional habitats in BCR 11 PNR.

Deciduous, Coniferous and Mixed Forest

Forested habitats are most prominent in the transition zone between BCR 11 and BCR 6, but occur elsewhere in small areas throughout the region (Figs. 13–15). Deciduous tree species (most commonly Trembling Aspen (*Populus tremuloides*), Balsam Poplar (*P. balsamifera*) and Birch species (*Betula spp.*)) occur throughout the Prairie Ecozone although most extensively in the aspen parkland ecoregion that makes up the northern border of BCR 11 PNR (Canadian Prairie Partners in Flight 2004). Pockets of deciduous habitat are also common along wetlands, rivers and flood plains, and are often adjacent to or interspersed with woody shrubs. Coniferous habitat occurs infrequently in BCR 11 PNR and is typically only found at higher elevations (e.g., pines in Cypress Hills), on north-facing slopes of some river valleys and scattered along riparian valley bottoms. Along the northern edge of the region, jack pine (*Pinus banksiana*) may be prevalent in pockets, while white spruce (*Picea glauca*) is the dominant conifer elsewhere in the region. While stands of pure conifers are rare in BCR 11 PNR, mixed forest (defined as habitat where neither deciduous nor coniferous species comprise >75% of total tree basal area) is more common in northern regions, particularly elevated areas, in association with riparian areas or as young regenerating stands.

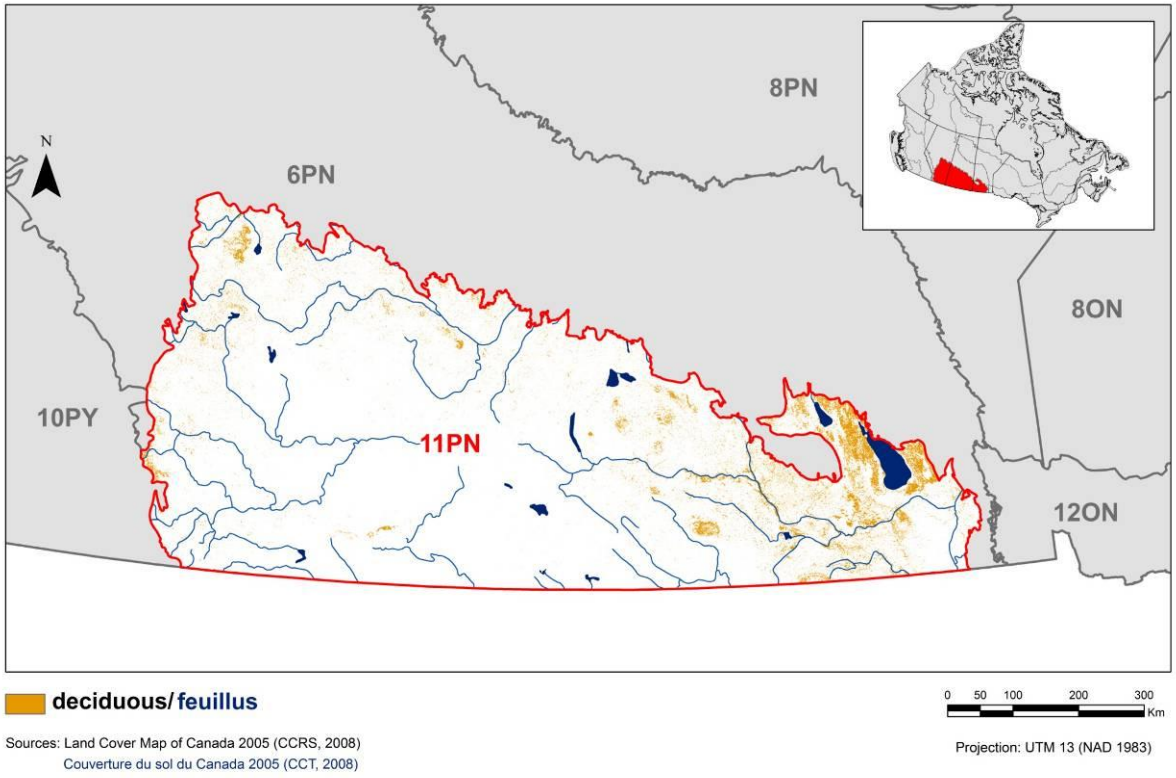

Figure 13. Map of deciduous forest in BCR 11 PNR.

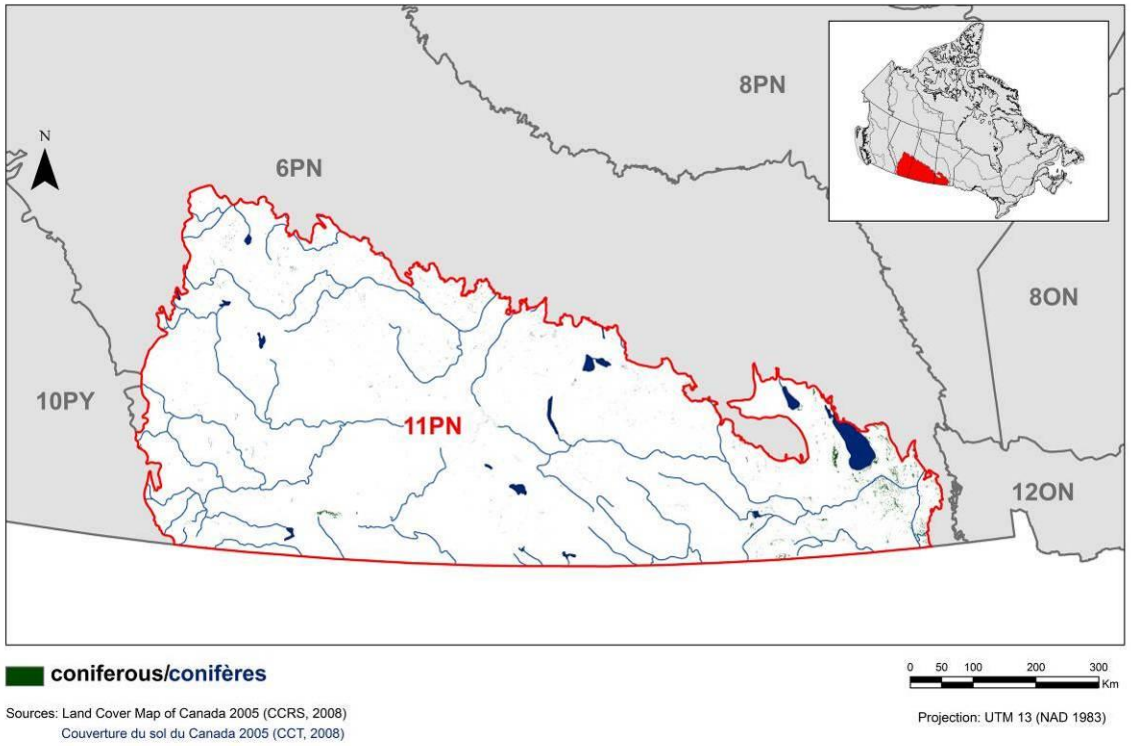

Figure 14. Map of coniferous forest in BCR 11 PNR.

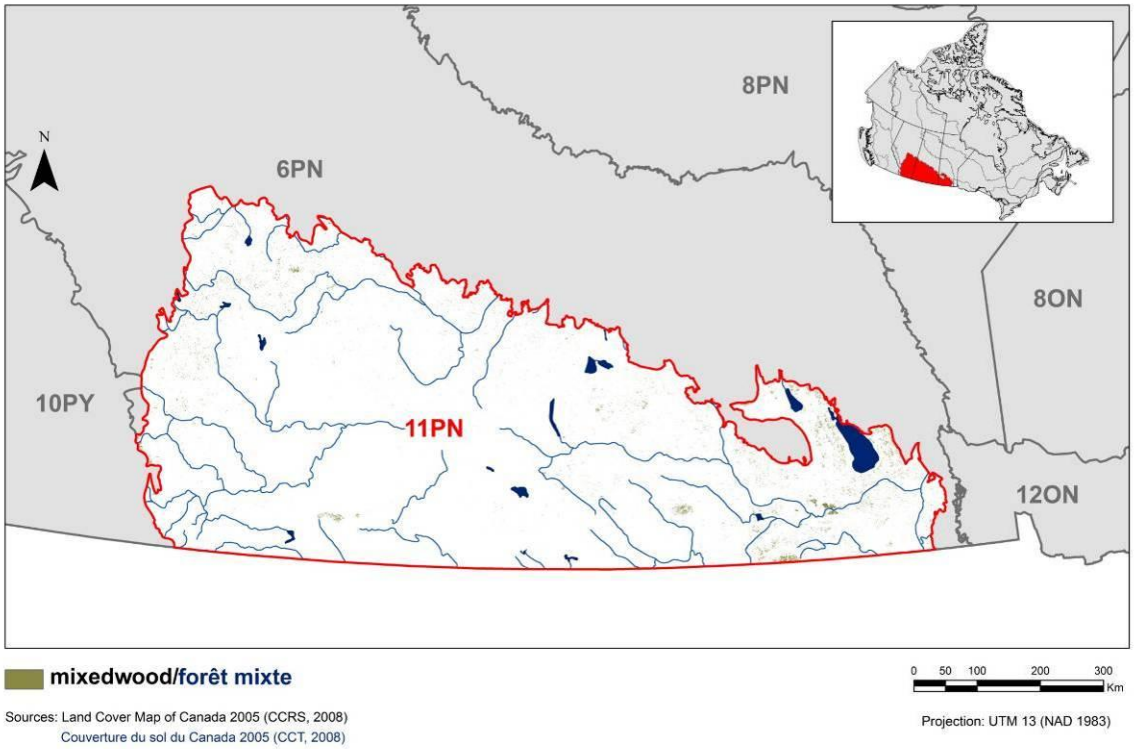

Figure 15. Map of mixed forest in BCR 11 PNR.

Urban

Urban habitat consists of areas where developments such as buildings, roads, parking lots and other impervious surfaces dominate. Although large urban centres are relatively few in BCR 11 PNR, small towns and urban structures (particularly roads) are present throughout the region (Fig. 16). Roads bisect much of BCR 11 at 1 to 2 mile (1.6–3.2 km) intervals, resulting in a highly fragmented landscape with few large contiguous patches of native habitat. A small number of species have adapted to some features of urban habitats (e.g., Peregrine Falcon nesting on tall buildings), but in general urbanization has led to a loss of habitat for most species.

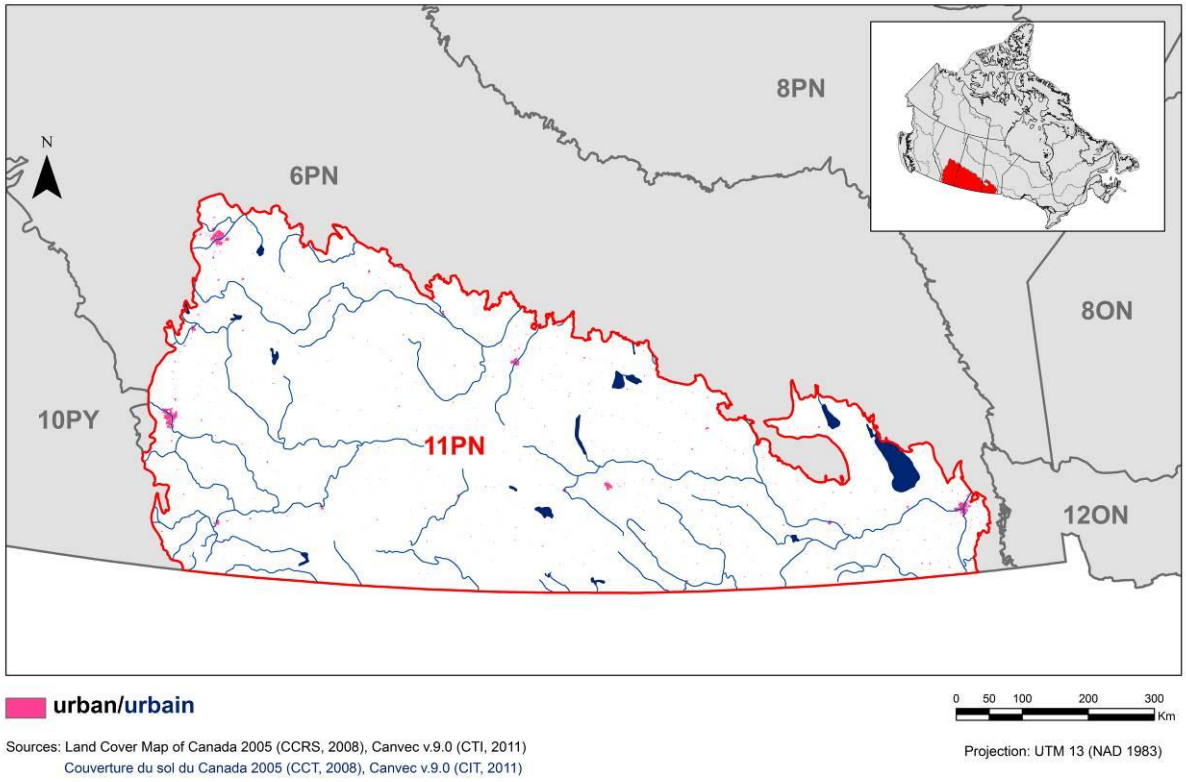

Figure 16. Map of urban areas in BCR 11 PNR.

Bare Areas

Bare areas refer to habitats with less than 4% vegetative cover, such as mud and alkali flats, sand, and bare rock. These habitats are primarily used by three groups of species in BCR 11 PNR: 1) shorebirds (temperate and arctic breeders) that use sand, mud and alkali flats for foraging during the breeding season, or during spring and fall migration for those that breed farther north, 2) colonial waterbirds that nest in large numbers on rocky or sandy islands in large lakes or rivers, and 3) raptors that use rocky outcrops or cliffs for nest sites. Bare areas, primarily mud and alkali flats, are found scattered throughout BCR 11 PNR (Fig. 17), and their coverage is typically higher during dry years when water levels in wetlands and waterbodies are reduced.

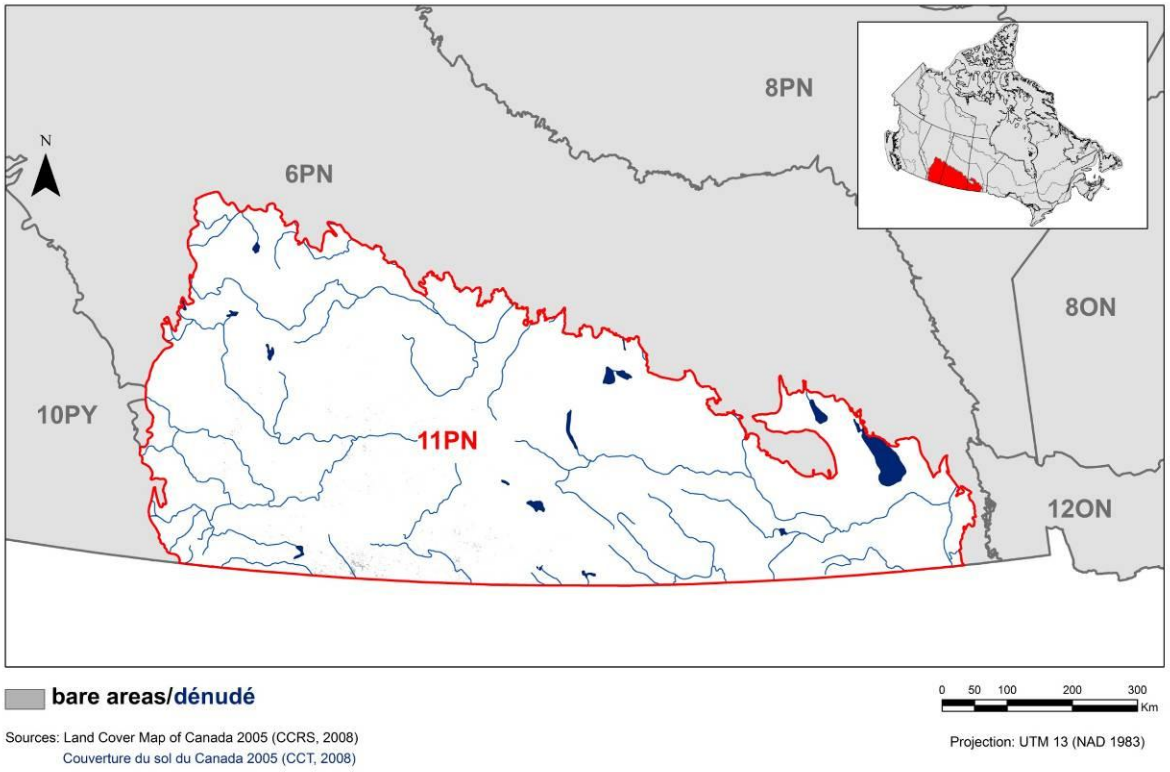

Figure 17. Map of bare areas in BCR 11 PNR.

Habitats Associations of Priority Species in BCR 11

Tables 5 to 8 describe habitat associations of priority species in BCR 11 PNR, based on information obtained from literature searches. It is important to note that habitat selection is complex and occurs at multiple spatial scales. In assigning habitats to species, we include the broad habitat classes above as long as that habitat type represents a main component of preferred landscapes for either nesting or foraging during the breeding season. In this case, it must meet the life requisites of a species (e.g., food, cover, water, and specific requirements for courtship, hibernating, migrating, reproducing or staging). We also include a description of preferred landscapes occupied by the species, for breeding or in some cases during migratory stopovers. We also provide a more specific description of how the species use different habitat configurations in the BCR. This is particularly important in BCR 11 PNR, where habitats are a diverse mosaic and many habitat types co-occur within a small spatial area. In such cases, a species may occasionally use a habitat type that is not preferred (i.e., use is not greater than availability), or that is not beneficial for the species. For example, several species may use croplands for foraging but will only do so if crop fields are nested within a larger grassland landscape.

Table 5. Breeding habitat associations of priority landbird species in BCR 11 PNR.

The landscape habitat description provides a broad picture of the habitat type selected at large scales, while the specific habitat description provides a more detailed reference for how each species selects habitat at different scales. Habitat associations of species are complex and often vary across the species' range. The descriptions here are intended to provide an overview of the primary habitats utilized in BCR 11 PNR based on literature searches, particularly the Birds of North America series and references therein.

Common Name	Broad Habitat Classes	Landscape Habitat Description in BCR 11	Specific Habitat Description in BCR 11
Greater Prairie-Chicken	Herbaceous; Shrubs/Early Successional; Cultivated and Managed Areas	Herbaceous medium to tall grasslands.	Requires extensive tracts of native medium and tall grassland, which may be mixed with sparse medium high shrubs in some parts of the range. Will use cropland for foraging throughout the year but only if embedded in a grassland-dominated landscape (75% grassland, 25% cropland). Vegetative cover on lek sites shorter than nesting habitat (<15 cm).
Sharp-tailed Grouse	Herbaceous; Shrubs/Early Successional; Deciduous; Cultivated and Managed Areas	Grasslands of short to medium height mixed with shrubs and early successional habitat.	Habitats vary throughout the species range but typically include a dense shrub component interspersed with grasses. In BCR 11, these habitats are typically found in upland mixed grassland-shrub communities and shrubby riparian areas. In northern parts of BCR 11, preferred habitats often include deciduous stands mixed with grassland and shrubs. May forage in croplands but requires native habitats nearby. As with other prairie grouse, lek sites tend to be located on areas of low, sparse vegetation.
Greater Sage-Grouse	Shrubs/Early Successional	Sage-brush shrubland.	Dependent on sagebrush dominated landscapes, consisting of shrubs 20–80 cm tall and representing 20–50% cover for nesting. Preferred habitats often contain patches of graminoid meadows and occasional wetlands. Lek sites consist of more sparsely scattered sagebrush (15–25% cover) with interstitial grassland and bare ground. May use crop lands for foraging but only if nested within a sagebrush-dominated landscape.
Northern Harrier	Herbaceous; Wetlands	Upland grasslands, marshy meadows and wetland edge.	Selects open habitats including dry upland grasslands with dense vegetation, wet, marshy meadows and the edges of small to large wetlands with dense vegetation. Foraging habitats may also include croplands and riparian woodland interspersed with grasslands or wetlands.
Swainson's Hawk	Herbaceous; Shrubs/Early Successional; Deciduous; Cultivated and Managed	Open grass or sparse shrubland with occasional trees	Primarily selects open grassland for foraging but also sparse shrublands, parkland and cultivated/managed habitats where vegetative cover is short enough for prey detection. Typically nests in scattered trees within grass, shrub or agricultural landscapes.
Ferruginous Hawk	Herbaceous; Shrubs/Early Successional	Open grassland with occasional trees for nesting.	Open short to medium tall native grasslands, sagebrush and pasture habitat. Typically nests in isolated trees but also uses cliff sites, utility poles, buildings and knolls. The species avoids parkland and agricultural habitats.
Golden Eagle	Herbaceous; Shrubs/Early Successional; Deciduous; Cultivated and Managed; Bare Area	Open and semi-open grassland and shrubland.	Breeds in a variety of habitats including grassland, shrubland, farmland, riparian habitats and partially forested habitats. Most foraging takes place in open habitats. Usually nests on cliffs but also in trees, on river banks and on human-made structures.

Table 5 continued

Common Name	Broad Habitat Classes	Landscape Habitat Description in BCR 11	Specific Habitat Description in BCR 11
Prairie Falcon	Herbaceous; Shrubs/Early Successional; Bare Area	Open grasslands with cliff sites for nesting.	Breeds in open short native grasslands, some habitats include sparsely scattered shrubs with interstitial grassland. Selects sandstone, clay or rock cliffs and outcrops for nest site.
Peregrine Falcon	Herbaceous; Wetlands; Deciduous; Mixed; Cultivated and Managed; Urban Areas Bare Areas	Wide variety of terrestrial habitats.	Flexible in habitat use and selects a range of open habitats (grasslands, wetlands, shrublands) as well as forested areas. In natural habitat selects cliffs for nesting but also nests and forages in urban (e.g., high-rise buildings) and other managed areas.
Long-eared Owl	Mixed; Deciduous; Shrubs/Early Successional; Herbaceous	Tal shrub or forested habitats mixed with open areas.	Select habitats consisting of a tall shrub or forest component (deciduous, mixed, coniferous) that is primarily used for nesting and roosting combined with open shrub and grassland habitat for foraging.
Short-eared Owl	Herbaceous; Shrubs/Early Successional; Cultivated and Managed	Open country consisting of grasslands, and marshes.	Medium to tall native grassland, mixed shrub-grassland with sparse shrub cover and grassy marshes with tall, dense grass. Will also forage in fields of graminoid or non-graminoid crops, pastures, retired cropland and stubble. Nests on the ground, typically in areas of taller graminoid vegetation.
Eastern Screech-Owl	Deciduous; Mixed; Cultivated and Managed	Young to mature deciduous and mixed woodlands.	Deciduous and mixed woodlands ranging from young to mature forest. In southern portions of BCR 11, these habitats are typically found along riparian areas as well as wooded urban sites and greenbelts.
Burrowing Owl	Herbaceous; Cultivated and Managed	Open, shortgrass habitats.	Dry, shortgrass and treeless prairie associated with mammals that provide burrows for nest sites. Often forages in medium grasslands (>30 cm) where prey abundance is higher. May also use grazed pastures and cultivated land as long as nest burrows are present.
Black-billed Cuckoo	Deciduous; Shrubs/Early Successional; Cultivated and Managed Areas	Deciduous groves and thickets often associated with water.	Deciduous groves, dense brushy thickets in coulees and riparian areas, and hedges/yards with thick surrounding vegetation.
Red-headed Woodpecker	Deciduous	Deciduous woodlands and parkland habitats.	Broadleaved deciduous high woodland including riparian and flooded woodlands, open forest groves with shrub layer, forest edges and woodland within urban areas and parks (e.g., orchards, farmyards). Also a species of semi-open country attracted to burns and partially cleared areas.
Northern Flicker	Deciduous; Mixed; Shrubs/Early Successional; Cultivated and Managed; Urban Areas	Forest edge and open woodland.	Mixed and deciduous woodlands with open areas for ground foraging. Woodland type variable including riparian areas, recently disturbed forests post harvest and post fire, regenerating forest, urban parks and open mixed wood forest. Large dead and dying trees and snags used for nesting, foraging and roosting.
Whip-poor-will	Deciduous; Mixed	Deciduous and mixed forest with an open understory.	Woodland with little understory adjacent to open areas used for foraging. Forest types include pine and oak barrens, open deciduous forest, aspen/birch forest regenerating after disturbance (e.g., fire), and patchy, semi-open forests with clearings. Generally prefers forests in early to mid stages of succession.
Common Nighthawk	Herbaceous; Bare Area;	Open habitats with	Breeding habitats are generally open but with variable ground substrates and

Table 5 continued

Common Name	Broad Habitat Classes	Landscape Habitat Description in BCR 11	Specific Habitat Description in BCR 11
	Shrubs/Early Successional; Deciduous; Mixed; Wetlands; Cultivated and Managed	variable levels of forest cover.	differing extent of forest cover. Habitats include grassland, sagebrush, open forest, dunes, burned and logged areas, artificial surfaces. May forage over wetlands but due to higher insect abundance rather than the presence of water.
Chimney Swift	Urban; Deciduous; Artificial Surfaces and Associated Areas; Wetland	Variable but often associated with urban or residential areas that provide roost sites.	Strictly an aerial forager and only dependent on terrestrial habitats for nesting and roosting. Most frequently observed near urban and residential areas where they use chimneys and other man-made structures for nest sites and communal roosts. Chimneys are also important during migration stopovers. In more remote regions, associated with deciduous forest where hollow trees, cavities and caves are used for nesting. Often forages above lakes and ponds but due to insect abundance rather than presence of water.
Olive-sided Flycatcher	Coniferous; Mixed	Coniferous and mixed forest interspersed with openings containing bogs or shrubby habitat.	Associated with coniferous forest across the range but this habitat type is rare in BCR 11. Only present in the north part of the BCR where it may be found in mixed coniferous-deciduous forest often near forest edge adjacent to openings consisting of bogs or post-fire shrub and early successional habitat.
Willow Flycatcher	Shrubs/Early Successional; Wetlands	Shrubby thickets almost always near water.	Generally associated with shrubby, wet habitats. In southern parts of BCR 11 this would include willow thickets in low-lying areas, riparian habitat and coulees. Along the northern extent of the range may select woodland edge adjacent to bogs and small wetlands.
Least Flycatcher	Deciduous; Mixed	Young to mature deciduous and mixed forest.	Young to old-growth deciduous and mixed forest with a moderate understory and well-developed canopy. Forest patch size appears to be variable. The species shows a strong tendency to form clusters of territories during the breeding season.
Horned Lark	Herbaceous; Cultivated and Managed Areas	Open sparsely vegetated grasslands and cultivated areas.	In non-agricultural regions, breeds in sparse, short grasslands with bare ground. In agricultural areas inhabits bare ground, stubble and fallow fields.
Black-billed Magpie	Deciduous; Herbaceous; Shrubs/Early Successional; Cultivated and Managed; Urban Areas	Mix of open or shrubby areas with patchy deciduous groves and riparian woodland.	Habitats typically contain a mix of high shrubland (e.g., thorny buffaloberry) or deciduous woods interspersed with open grassland and low shrubby areas. Often associated with parkland and riparian thickets or woodland. Also common in agricultural and urban habitats.
Bobolink	Herbaceous; Wetlands; Cultivated and Managed Areas	Medium to tall grasslands and wet meadows with dense vegetation.	Closed medium to tall grassland with dense vegetation. Often utilizes the transitional zone between wet and dry, but also common in wet meadows and temporarily flooded marshland. In agricultural areas uses hayfields, tame grassland/pasture, road-side ditches and weedy margins of cropland.
Western Meadowlark	Herbaceous; Cultivated and Managed Areas	Grasslands and agricultural areas with taller cover.	Native short to medium tall grasslands. Also agricultural areas with hay, tame pasture, road side ditches and weedy margins of cropland.
Rusty Blackbird	Coniferous; Mixed; Wetlands; Shrubs / Early Succesional	Bogs and small wetlands within coniferous forest.	Breeds in open wet coniferous and mixed forest with a ground layer containing wetlands (e.g., swamps, muskeg bogs, beaver ponds) and a shrubby understory (often willow or alder) along the wetland edge.

Table 5 continued

Common Name	Broad Habitat Classes	Landscape Habitat Description in BCR 11	Specific Habitat Description in BCR 11
Chestnut-collared Longspur	Herbaceous	Arid short grass prairie.	Short native grassland with vegetation height <20–30 cm and minimal shrub cover. Will use grazed tame pastures and other mowed areas (e.g., fields, airstrips) but native short grassland is the preferred habitat.
McCown's Longspur	Herbaceous; Bare Area	Sparse and arid short grass prairie.	Sparse, short native grasslands containing mixed areas of bare ground and occasional shrubs (e.g., sagebrush). Sympatric to Chestnut-collared Longspur but uses more barren microhabitats with sparser and shorter vegetation.
Baird's Sparrow	Herbaceous	Mixed-grass and fescue prairie.	Open mixed-grass (grasses, sedges) and fescue prairies with scattered low shrubs and residual vegetation. Preferred habitats >15 cm tall (~23 cm on average). Avoids heavily grazed areas and cropland but may use hayfields and pasture if the appropriate height and density.
Grasshopper Sparrow	Herbaceous; Cultivated and Managed Areas	Short to medium tall grasslands.	Open short to medium tall grasslands of moderate height and minimal shrubs with patches of bare ground. Types of grassland selected varies across the range; in BCR 11 often found in slightly wetter and denser vegetation within an overall shortgrass landscape. Shrub cover may be present in some areas but avoids landscapes with dense brushy cover. Pastures and hayfields used as long as they represent native cover in height and structure.
Le Conte's Sparrow	Herbaceous; Wetlands; Cultivated and Managed Areas	Tall wet grasslands and marshes.	Typically use dense, moist grasslands, wet marshes and boggy meadows with tall and thick herbaceous vegetation. Although many habitats are wetter, this does not seem to be a requirement as the species will use hayfields, fallow fields or upland sites with tall vegetation.
Nelson's Sparrow	Wetlands	Wet meadows, marshes and wetland edge	Freshwater grassy marshes, meadows and emergent vegetation (e.g., cattails, phragmites) along the edge of small to moderately sized perennial ponds and lakes.
Clay-colored Sparrow	Shrubs/Early Successional; Herbaceous; Deciduous; Cultivated and Managed Areas;	Shrubby or early successional habitats amidst open grassland or agricultural areas.	Preferred habitats are in uncultivated brushy areas with tall shrubs or small trees interspersed with grassy areas. In southern parts of BCR 11, they are found in mixed grassland-shrub areas including riparian areas and upland shrub thickets (e.g., snowberry, thorny buffaloberry). Further north they occupy parkland habitats with young stands of birch, poplar or aspen interspersed with open habitats. May occupy sites in agricultural regions as long as the appropriate structure is present.
Lark Bunting	Herbaceous; Shrubs/Early Successional; Cultivated and Managed Areas	Shortgrass prairie and sagebrush.	Grasslands of low to moderate height with dense cover, patches of bare ground and medium height shrub cover (typically sagebrush in BCR 11). Avoids heavily grazed areas but may be common in managed agricultural areas including hayfields, tame grasslands and roadside ditches.
Loggerhead Shrike	Herbaceous; Shrubs/Early Successional; Cultivated and Managed Areas	Open grasslands with patches of shrubs or small trees.	Open short (15 cm) to medium tall (>35 cm) native grassland or pasture with patches of medium high shrubs (e.g., thorny buffaloberry, willow, caragana) or small trees for nesting. Territories may contain other types of managed vegetation that are also used for hunting perches (e.g., shelterbelts, hedgerows, farmyards).
Golden-winged Warbler	Shrubs/Early Successional;	Shrubby successional	Only found in the very southeastern portion of BCR 11 where it selects open

Table 5 continued

Common Name	Broad Habitat Classes	Landscape Habitat Description in BCR 11	Specific Habitat Description in BCR 11
	Deciduous; Wetlands	habitats near deciduous woodland edge.	shrubby and early successional habitats near a forest edge. This may consist of broadleaved deciduous forest with natural openings (beaver ponds, marshes and streams), patchy regenerating forests and farmyards 4–15 years post-disturbance, road and transmission line right-of-ways, and bur-oak savannah habitats.
Common Yellowthroat	Wetlands; Shrubs/Early Successional; Deciduous; Mixed	Thick, shrubby vegetation typically in marshes and wetlands but also upland sites.	Most common in thick vegetation in marshes and along the edge of wetlands and riparian areas. However, as long as dense vegetation is present the species will also use drier sites including abandoned fields, hedgerows, drainage ditches, regenerating forest and shrubby openings in deciduous or mixed forest.
Sprague's Pipit	Herbaceous	Open grasslands of intermediate height and thickness.	Large (>150 ha) open tracts of native grassland of medium height (15-30cm) and intermediate thickness. Avoids landscapes with even low shrub densities. Hayfields and pasture used if they resemble native grassland in structure and patch size.
Sage Thrasher	Shrubs/Early Successional	Sage-brush shrubland.	Range barely enters into the Canadian portion of BCR 11 where it inhabits large expanses of shrub-steppe dominated by sagebrush and perennial grasses.
Brown Thrasher	Shrubs/Early Successional; Deciduous; Cultivated and Managed Areas	Dense, shrubby habitats within a landscape ranging from open to deciduous woodland.	Most commonly in closed medium-high shrub thickets within riparian woodland, wooded draws, shelterbelts and hedge rows. May be found in more open areas consisting of dense, patchy shrubs (chokecherry, thorny buffaloberry, willow shrubs) as well as dense shrub layers within open deciduous woodland.
Sedge Wren	Wetlands; Cultivated and Managed Areas; Herbaceous	Wet grassy and marshy habitats.	Selects dense, tall growth of sedges and grasses in ephemeral marshes, wet hayfields, retired croplands and drier margins of ponds. The species shows breeding mobility related to the ephemeral nature of preferred habitat.

Table 6. Breeding or migration stopover habitats of priority shorebird species in BCR 11 PNR.

Species followed by a (B) breed in BCR 11 PNR and the description refers to breeding habitat, while species followed by an (M) only pass through the region during migration and the description refers to stopover habitat. Information on breeding habitats for the latter species is provided in the plans for Bird Conservation Regions 3, 7 or 8. See Table 5 for additional information on table categories.

Common Name	Broad Habitat Class	Landscape Habitat Description in BCR 11	Specific Habitat Description in BCR 11
Red-necked Phalarope (M)	Wetlands; Waterbodies; Cultivated and Managed Areas	Open, shallow wetlands.	Wide variety of wetland types including ponds, large shallow lakes, alkaline lakes, ditches, evaporation ponds and flooded fields.
Wilson's Phalarope (B)	Wetlands; Herbaceous; Cultivated and Managed Areas	Wet prairie meadows and wetland edge.	For nest sites selects closed to open grassland on and adjacent to ephemeral, semi-permanent and seasonal wetlands including wet sedge meadows, damp grassy areas, hayfields and shallow alkali or freshwater wetland edges. Also in drier medium to tall grasslands within 100 m of wetland edge. Uses small to large wetlands for foraging.
American Avocet (B)	Wetlands; Waterbodies; Bare Areas	Shallow prairie wetlands.	Primarily forages in water 0–20 cm deep along shores, mudflats and shallow edges of alkaline lakes, natural ponds, evaporation ponds and impoundments. Most foraging sites have little vegetation. Nests on sparse, bare ground on islands or along drier areas on the edge of wetlands.
Wilson's Snipe (B)	Wetlands; Deciduous; Mixed; Shrubs/Early Successional	Marshy wetland edge in open or forested habitats.	Breeds along marshy edges of swamps, ponds and riparian zones but the location of such habitats varies throughout BCR 11. In central and southern regions, these habitats are found in wet prairies marshes and along the edge of larger wetlands in open areas. In northern regions uses bogs and shrubby, swampy areas (e.g., willow, alder swamps) amidst a landscape of deciduous or mixed forest.
Short-billed Dowitcher (M)	Wetlands; Cultivated and Managed Areas	Mudflats and flooded fields.	Forages on mudflats along the edge of natural and artificial wetlands (e.g., sewage ponds). Also uses flooded agricultural areas.
Long-Billed Dowitcher (M)	Wetlands; Cultivated and Managed Areas	Shallow wetlands, mudflats and flooded fields.	Shallow water (<20 cm depth) at edge of wetlands, shallow marshland, temporarily flooded fields and mudflats.
Stilt Sandpiper (M)	Wetlands; Cultivated and Managed Areas	Ponds, marshes and flooded fields.	Uses a variety of wetlands types include the edge of freshwater ponds, marshes, flooded fields and wet pastures.
Red Knot (M)	Wetlands; Waterbodies	Edges of prairie lakes, marshes and flooded fields.	Sandy or marshy flats along the edge of large freshwater or saline lakes. Also, marshes and flooded fields characterized by open undisturbed habitat.
Semipalmated Sandpiper (M)	Wetlands; Waterbodies	Edges of prairie ponds and lakes.	Shallow freshwater areas with little vegetation (e.g., silt/clay mudflats) along edge of large ponds and lakes.
Sanderling (M)	Wetlands; Waterbodies; Bare Area	Edges of alkaline, saline and freshwater lakes.	In Canadian prairies, the species particularly favors edges (sand, mudflats) of shallow saline or alkaline lakes (e.g., Chaplin Lake, SK), but also selects margins of freshwater ponds, lakes and reservoirs.

Table 6 continued

Common Name	Broad Habitat Class	Landscape Habitat Description in BCR 11	Specific Habitat Description in BCR 11
Marbled Godwit (B)	Wetlands; Herbaceous; Cultivated and Managed Areas	Open areas with a mix of wetlands and upland grasses.	For breeding select sparse to moderately vegetated landscapes containing a mix of upland native grassland, hay or pasture (short to intermediate height) and permanent or semi-permanent wetlands. Preferred wetlands contain short sparse vegetation along wetland edge and shallow water (5–13 cm) used for foraging. Avoids tilled and cropped areas.
Hudsonian Godwit (M)	Wetlands; Waterbodies; Cultivated and Managed Areas; Bare Area	Edges of prairie lakes, marshes and flooded fields.	Uses a variety of wetland habitats during stopovers including marshes, sewage ponds, wetland edge, mudflats, muddy or sandy shores of large ponds and lakes including saline lakes (e.g., Quill Lakes, SK), flooded fields.
Willet (B)	Wetlands; Herbaceous; Cultivated and Managed Areas	Shallow wetland mixed with sparse upland habitats.	In prairies, uses areas of short, sparse cover (<15 cm) in grasslands adjacent to wetlands. Prefers ephemeral, seasonal and alkali wetlands over semi-permanent and permanent ponds and lakes. Avoids tilled land but may breed in crop lands as long as the crop types represent the appropriate size and structure.
Upland Sandpiper (B)	Herbaceous; Cultivated and Managed Areas	Grasslands of short to medium height.	Open short to medium tall native grasslands with little bare ground and little to no woody cover. Less commonly uses tame grassland and hayfields, rare in crop land.
Buff-breasted Sandpiper (M)	Herbaceous; Wetlands; Waterbodies; Cultivated and Managed Areas	Short grasslands and marsh or wetland edge.	Short grasslands (including altered habitats such as well-grazed pastures, airports, lawns, etc.), damp margins of freshwater marshes or lakes, and fields of graminoid or non-graminoid crops (e.g., recently cut alfalfa and potatoes).
Spotted Sandpiper (B)	Wetlands; Waterbodies; Shrubs/Early Successional; Cultivated and Managed Areas; Bare Area	Variable as long as wetland or riparian edge is mixed with drier, habitat for nesting.	Breeds in a variety of landscape types but breeding territories typically contain access to wetland or riparian edge for foraging, semi-open habitats for nesting (e.g., sagebrush flats, sparsely vegetated grassland, bare rock and sand), and denser vegetation for brood cover.
Long-billed Curlew (B)	Herbaceous; Cultivated and Managed Areas	Open, short grassland.	Dry short to medium height native grassland for nesting. Often in taller and denser native grassland for brooding but not clear if this is the preferred habitat or reflects a declining availability of short grass later in the season. Avoids areas with trees and shrub cover. Less commonly uses managed habitats such as tame grassland/pasture, hayfields, stubble fields, crops.
Whimbrel (M)	Wetlands; Bare Area	Beaches, shores, grassland and meadows.	Closed to open grassland on temporarily flooded land, meadows and fields as well as sandy beaches, rocky shores and dunes.
Eskimo Curlew (M)	Unknown	Prairie grasslands.	Only spring migration brought large numbers of individuals through BCR 11 region (fall migration to the east). Stopover habitats used by the species in this region are largely unknown but further south in the U.S., they often selected mixed and tall grass prairies. Some reports from the late 19th century describe them in cultivated fields, abandoned fields and pastures.
Black-bellied Plover (M)	Wetlands; Waterbodies; Bare Area; Cultivated and Managed Areas	Edges of prairie lakes, marshes and flooded fields.	Primarily along edges of large lakes/reservoirs, shallow alkaline lakes and flooded fields.
American Golden-Plover (M)	Herbaceous; Cultivated and Managed Areas;	Upland sites with short vegetation and wetland	Uses a variety of stopover habitats including native prairie, short pasture land, cultivated fields, burned fields, golf courses, airports, mudflats, shorelines and beaches of lakes.

Table 6 continued

Common Name	Broad Habitat Class	Landscape Habitat Description in BCR 11	Specific Habitat Description in BCR 11
	Wetlands; Bare Area	edge (e.g., shores).	
Killdeer (B)	Herbaceous; Wetlands; Cultivated and Managed Areas; Bare Area; Artificial Surfaces and Associated Areas	Open habitats with short vegetation in native, urban and agricultural areas.	During the breeding season occupies a variety of open areas including mudflats, gravel bars, sandbars, open shorelines with sand/gravel or muddy substrates, open short grassland/heavily grazed pasture, urban fields, airports, cultivated fields and conventionally tilled and no-till cropland.
Piping Plover (B)	Wetlands; Waterbodies; Bare Area	Pebbly or sandy shores of large prairie lakes.	Sparsely vegetated shores (sand, gravel or pebble preferred) of larger prairie lakes, reservoirs and alkali lakes. Will also nest in similar habitats on islands of large, prairie rivers. Areas adjacent to these nesting sites typically consist of open short or mid-grass prairie and/or dunes.
Mountain Plover (B)	Herbaceous; Bare Area	Arid grasslands with sparse vegetation.	Prefers dry, arid regions with low, sparse vegetation interspersed with bare areas including overgrazed grasslands. Avoids landscapes with tree and shrub cover. Only present in the very south-central portion of BCR 11 in Canada.
Ruddy Turnstone (M)	Waterbodies; Wetlands; Bare Area	Shorelines of prairie lakes, flooded fields.	Shorelines, beaches and mudflats of freshwater lakes or saline lakes. Also use closed to open temporarily flooded land and plowed fields (e.g., Last Mountain Lake, SK).

Table 7. Habitat associations of priority waterbird species in BCR 11 PNR.
With the exception of Whooping Crane, all habitat descriptions refer to breeding habitat. See Table 5 for additional information on table categories.

Common Name	Broad Habitat Class	Landscape Habitat Description in BCR 11	Specific Habitat Description in BCR 11
Western Grebe	Wetlands; Waterbodies	Large wetlands with water and emergent vegetation.	Perennial large lake with extensive open water for foraging (must sustain fish populations) and emergent vegetation for nest sites (e.g., cattails, bulrushes). Selected lakes may be in open or semi-forested landscapes. Colonial breeder.
Clark's Grebe	Wetlands; Waterbodies	Large wetlands with water and emergent vegetation.	Perennial large lake with extensive open water for foraging (must sustain fish populations) and emergent vegetation for nest sites (e.g., cattails, bulrushes). Only occurs in the southern portion of Canadian BCR 11. Colonial breeder.
Red-necked Grebe	Wetlands; Waterbodies	Small to large wetlands with open water and emergent vegetation.	Perennial wetlands ranging from ponds/small lakes with emergent vegetation to large lakes with protected marshy areas and secluded bays. Most wetlands are dominated by open water (60–80%). Wetlands may be in open or forested landscapes.
Horned Grebe	Wetlands	Perennial ponds and small wetlands with emergent vegetation.	Perennial small lakes and ponds with emergent vegetation and open water. Wetlands may be in open or forested landscapes.
Eared Grebe	Wetlands	Perennial ponds or temporarily flooded marshland.	Marshy lakes and ponds with emergent vegetation and open shallow water. May use temporarily flooded marshland. Most wetlands are in open country or parkland landscapes. Semi-colonial breeder.
Pied-billed Grebe	Wetlands	Perennial ponds or temporarily flooded marshland.	Perennial or non-perennial pond/small lake with some open water combined with dense emergent and aquatic vegetation. Also in freshwater marshes with shallow water surrounded by dense emergent vegetation. Wetlands may be in open or forested landscapes.
Common Loon	Waterbodies	Large lakes within forested landscapes.	Perennial clear, large lakes, typically >10 m depth with an extensive and convoluted shoreline and sustaining prey fish populations. Most common in northern parts of BCR 11 within a mixed forest landscape. Nests on floating vegetation along sheltered lake edges.
Franklin's Gull	Wetlands; Cultivated and Managed Areas; Herbaceous	Large prairie marshes amidst agricultural fields and grassland.	Nests colonially in large prairie marshes containing shallow water with emergent vegetation or temporarily flooded marshland). Often forages in fields of graminoid or non-graminoid crops and pastures.
Bonaparte's Gull	Coniferous; Waterbodies; Wetlands	Coniferous forest for nesting combined with ponds and lakes for foraging.	Nests in small, scattered colonies in open, coniferous woodland near bogs, ponds and lakes. Often uses scattered trees on islands for nesting. Forages on a variety of wetlands from ponds with emergent vegetation to large lakes. Only present in very northern portions of BCR 11 where coniferous forest is present.
Caspian Tern	Wetlands; Waterbodies; Bare Area	Sparsely vegetated islands in large, prairie lakes.	Perennial large lakes where breeds colonially on bare (rock and sand) islands and sparsely vegetated beaches, muddy or pebbly shores. Forages on fish often in shallow parts of the lake.
Forster's Tern	Wetlands; Waterbodies	Prairie ponds and lakes with extensive marshy vegetation along edge.	Perennial pond/small lake or extensive marshy areas along fringe or islands of larger lakes and rivers. Also breeds in temporarily flooded marshlands with extensive vegetation. Most common in open prairie or parkland landscapes.

Table 7 continued

Common Name	Broad Habitat Class	Landscape Habitat Description in BCR 11	Specific Habitat Description in BCR 11
Common Tern	Wetlands; Waterbodies; Bare Area	Rocky islands in large lakes.	Breeds colonially on rocky islands (sometimes sandy or pebbly) in large lakes or rivers. Typically forages for prey fish in these same sites but may also extend foraging bouts to smaller ponds and lakes or flooded marsh land. Occupies lakes in a range of landscapes from open to continuous forest.
Black Tern	Wetlands	Extensive sloughs and ponds with considerable emergent vegetation.	Breeds in loose colonies in high density prairie wetland landscapes including sloughs, semi-permanent ponds and slow-moving rivers with emergent vegetation for nesting combined with smaller areas of open water for foraging. Appears to have high area requirements with a preference for wetland complexes containing numerous wetlands with variable water depths and vegetation structure.
American White Pelican	Waterbodies; Wetlands; Bare Area	Bare islands in large lakes and rivers.	Breeds colonially on bare islands (rock and sand) in perennial large lakes, artificial waterbodies (e.g., reservoirs) and rivers containing prey fish populations. Uses waterbodies in open and forested landscapes.
American Bittern	Wetlands; Herbaceous	Large wetlands with tall, emergent vegetation.	Inhabits shorelines and edges of wetlands (prefers larger wetlands) with open water in the center and a band of tall emergent vegetation around the periphery. Secretive, spends most time hidden in vegetation. Occasionally nests in upland habitats adjacent to wetlands as long as they are not disturbed by agriculture. Appears to have large area requirements, most common in areas with a high land-water edge density. Selected wetland complexes may be in prairie or forested landscapes.
Least Bittern	Wetlands	Wetlands with dense shoreline vegetation.	Freshwater marshes and swamps with open water and tall, dense vegetation along the edge including aquatic plants (e.g., cattails), and thick patches of woody shrubs or small trees. May be sympatric with American Bittern but uses denser vegetation.
Great Blue Heron	Wetlands; Waterbodies; Deciduous	Variety of wetlands and waterbodies.	Flexible in habitat use. Nests in trees, bushes, ground or artificial structures, usually near water and often on islands or other less accessible areas to minimize predation risk. Forages in a variety of wetlands including shallow marshes and along the edges of streams, rivers, ponds and lakes. May also use artificial waterbodies such as stocked ponds and hatcheries. Common in open and forested landscapes.
Black-crowned Night-Heron	Wetlands; Waterbodies; Herbaceous; Cultivated and Managed Areas	Variety of wetlands and waterbodies.	Flexible in habitat use. Occupies a wide variety of wetland types including marshes, streams, rivers, margins of ponds and lakes, irrigation and water impoundments, man-made ditches and canals, wet agricultural areas.
Whooping Crane (Migration stopover habitat)	Cultivated and Managed Areas; Wetlands		Often forages in cropland during stopover (barley particularly important), alternating with shallow lakes and marshy wetlands for roosting. Preferred wetlands often less than 0.5 ha and within 1 km of crop fields.
Virginia Rail	Wetlands	Marshes and small wetlands with emergent vegetation.	Found along the edge of marshes and smaller wetlands. Most important features for the species appear to be the presence of shallow water, emergent vegetation and substrates with a high invertebrate abundance. Where sympatric with Sora, tends to use drier areas of the marsh. In most of BCR 11, preferred habitats are located in open prairie or agricultural landscapes but they are found in forest swamps with emergent vegetation elsewhere. Further study is needed on their use of forested wetlands in northern portions

Table 7 continued

Common Name	Broad Habitat Class	Landscape Habitat Description in BCR 11	Specific Habitat Description in BCR 11
			of BCR 11.
Sora	Wetlands; Cultivated and Managed Areas	Small to moderate sized wetlands with emergent vegetation.	Small to moderately sized wetlands with emergent vegetation (e.g., cattails, bulrushes, sedges) and shallow to intermediate water depths. Often most abundant in shallower parts of the wetland with a range of vegetation height and structure. Selected ponds may be seasonal, semi-permanent or permanent. Will also use upland sites or crop fields adjacent to wetlands during brood rearing and post-breeding dispersal.
Yellow Rail	Wetlands	Ephemeral sedge marshes.	Primarily selects very shallow, ephemeral marshes dominated by sedges. Much less common in larger wetlands with taller emergent vegetation (e.g., cattails) or in areas with encroaching woody shrubs. Most study on habitat use has occurred in open or semi-open landscapes but the distribution includes continuously forested landscapes. The secretive nature of this species has made it difficult to study habitat preferences in other regions.

Table 8. Habitat associations for priority waterfowl species in BCR 11 PNR.

Species noted with a (B) breed in BCR 11 PNR and the habitat description refers to breeding habitat, although larger numbers may also pass through during migration. Species with an (M) breed north of BCR 11 PNR and the description refers to migratory stopover habitat. Information on breeding habitats for migratory species is provided in the plans for Bird Conservation Regions 3, 7 or 8. See Table 5 for additional information on table categories.

Common Name	Broad Habitat Class	Landscape Habitat Description in BCR 11	Specific Habitat Description in BCR 11
Mallard (B)	Wetlands; Waterbodies; Cultivated and Managed Areas; Herbaceous	Marshes to moderately sized wetlands and adjacent uplands in open, semi-open and forested landscapes.	Highest breeding densities associated with smaller wetlands and marshes with open water and emergent vegetation, less common on large lakes and wetlands with sparse vegetation. Nests placed in dense cover typically in upland habitat adjacent to wetlands (often within 150 m); includes grasslands, marshes, bogs, pastures, cropland, shrubs, roadside ditches and forest edge. Uses wetlands in open, semi-forested and forested landscapes in BCR 11.
Gadwall (B)	Wetlands; Waterbodies; Herbaceous; Shrubs/Early Successional; Cultivated and Managed Areas	Seasonal to semi-permanent wetlands and adjacent uplands in open and parkland landscapes.	During the breeding season, uses seasonal to semi-permanent small wetlands with an equal mix of water and emergent vegetation in open prairie and parkland landscapes. Nest sites placed near wetlands including grassland of medium to taller heights (variable species) as well as dense, brushy habitat with woody vegetation of lower stature (e.g., rose, snowberry). Will also nest in untilled cropland or hayfields in landscapes dominated by agriculture. Dense, emergent vegetation along wetland edge is important during brood-rearing stages.
American Wigeon (B)	Wetlands; Waterbodies; Cultivated and Managed Areas; Herbaceous; Shrubs/Early Successional	Seasonal to semi-permanent wetlands and adjacent uplands in open and parkland landscapes.	Breeding habitat consists of shallow sloughs, marshes, ponds and rivers with nest sites placed in adjacent uplands consisting of grassland, agriculture (e.g., hayfields, pasture, crops) or short shrubby habitats (e.g., snowberry, rose, sagebrush). Most abundant in prairie and parkland landscapes. Also present in forested landscapes further North. Selected wetlands range between 0.2 and 6.3 ha but most commonly <1.2 ha. These wetlands may be ephemeral, seasonal, semi-permanent or permanent.
Green-winged Teal (B)	Wetlands; Waterbodies; Deciduous; Herbaceous; Shrubs/Early Successional	Small ponds and marshes in deciduous parkland landscapes.	More frequently uses wetlands in deciduous parkland landscapes (in BCR 11) than other dabbling ducks. Most wetlands are small including marshes, forest ponds and wooded beaver ponds. Selected wetlands in these landscapes often contain patches of grasses, sedges and dense shrubs that are used for nesting. Further south in BCR 11, the species uses small wetlands in semi-open landscapes with adjacent habitats consisting of grassland, shrubs and aspen or birch stands.
Blue-winged Teal (B)	Wetlands; Waterbodies; Herbaceous; Cultivated and Managed Areas	Shallow seasonal or temporary wetlands with adjacent grassy habitat in open landscapes.	Prefer shallow prairie wetlands (marshes, weedy ponds, ditches) with an approximately equal mix of water and vegetative cover. Early in the season select seasonal and temporary wetlands but often move to semi-permanent wetlands as the season progresses. Most nests are in short to medium height grasses and other herbaceous vegetation within 150 m of the wetland (shrubs are rarely used). Blue-winged Teal often select shorter nesting cover than Mallard and Gadwall, which typically breed in similar landscapes.
Northern Shoveler (B)	Wetlands; Waterbodies;	Shallow seasonal or	Shallow wetlands (marshes, weedy ponds, sewage ponds) with an approximately

Table 8 continued

Common Name	Broad Habitat Class	Landscape Habitat Description in BCR 11	Specific Habitat Description in BCR 11
	Herbaceous	temporary wetlands with adjacent grassy habitat in open landscapes.	equal mix of water and emergent vegetative cover in open or parkland landscapes (native and agricultural habitats). Nests placed in grass or other herbaceous vegetation adjacent to wetlands.
Northern Pintail (B)	Wetlands; Herbaceous; Cultivated and Managed Areas	Shallow seasonal to semi-permanent wetlands with adjacent grassland or fields in open prairie landscapes.	Shallow ephemeral to semi-permanent wetlands (marshes, small ponds) in open country. Prefers wetlands with short emergent vegetation (e.g., sedges, grasses) and low adjacent upland cover. Nests often located in fields (e.g., hayfields), native grassland and pastures near wetlands but will nest up to 1–2 kilometres from wetlands.
Redhead (B)	Wetlands; Waterbodies	Small to large wetlands in open prairie and parkland landscapes.	Breeds in seasonally and semi-permanent wetlands (ponds, deep marshes) often >4 ha in size with submerged aquatic vegetation and/or emergent vegetation (e.g., cattail, bulrush, sedge). Proportions of water to vegetative cover often approximately 50:50. Also uses smaller, seasonal wetlands. Sites used for nesting often near larger lakes and reservoirs that are used later in the season for brood rearing.
Canvasback (B)	Wetlands; Waterbodies	Small to large wetlands in open prairie and parkland landscapes.	Breeds in permanent and semi-permanent wetlands of varying size including small lakes, deep water marshes, alkali lakes, sheltered bays on large lakes, large sloughs and rivers. Prefers wetlands with dense emergent vegetation and considerable open water. Nests are placed in dense vegetation (e.g., cattails, bulrushes) over open water. Selected wetlands are in both mixed-grass prairie and aspen parkland landscapes.
Lesser Scaup (B)	Wetlands; Waterbodies; Cultivated and Managed Areas; Herbaceous	Small to large wetlands primarily in parkland landscapes.	Seasonal, semi-permanent and permanent wetlands/lakes including wooded swamps and large beaver ponds with emergent vegetation (e.g., cattail, bulrush). More commonly breeds in parkland and boreal landscapes than open prairies. Most nests are placed in wet meadow habitat along the edge of wetlands although will also use nest sites in hayfields, grassland and sparse shrub patches in upland habitat adjacent to wetlands.
Ring-necked Duck (B)	Wetlands; Waterbodies	Shallow wetlands containing emergent or floating vegetation in deciduous or mixed forest landscapes.	Shallow wetlands in deciduous and mixed forest landscapes in northern sections of BCR 11. Types of wetlands include marshes, bogs, small lakes, wooded swamps and beaver ponds. A key feature of breeding wetlands is the presence of emergent, floating or submerged vegetation such as bulrush and pond lily. Nests are constructed on floating or emergent vegetation typically within 200 m of open water.
Bufflehead (B)	Deciduous; Wetlands; Waterbodies	Open ponds and small lakes in parkland or deciduous forest.	Permanent ponds or small lakes in parkland or deciduous forest landscapes. Preferred wetlands are open with little emergent vegetation and typically up to 3 m in depth. Buffleheads nest in cavities and thus require deciduous trees on the landscape (typically balsam poplar or trembling aspen woodlands).
White-winged Scoter (B)	Wetlands; Waterbodies; Shrubs/Early Successional;	Large lakes with islands for nesting habitat, primarily	Breeds on large lakes and permanent ponds typically in forested landscapes although low numbers also use prairie lakes. Highest numbers on lakes >50 ha, with lush

Table 8 continued

Common Name	Broad Habitat Class	Landscape Habitat Description in BCR 11	Specific Habitat Description in BCR 11
	Herbaceous	in forested landscapes.	aquatic vegetation, sandy bottoms and water depths between 1 and 5 m. Favored wetlands also contain islands with dwarf shrubland (e.g., rose, snowberry) or herbaceous vegetation used for nesting.
Ruddy Duck (B)	Wetlands; Waterbodies	Moderately sized semi-permanent and permanent wetlands in prairie landscapes.	Primarily selects larger semi-permanent and permanent wetlands (often >5 ha) in open, prairie landscapes. Wetlands contain extensive emergent vegetation and open water, with nests placed in emergent vegetation along the wetland edge. Very rarely nests on dry land.
Lesser Snow Goose (M)	Cultivated and Managed Areas; Wetlands; Waterbodies	Agricultural landscapes with crop fields for foraging and lakes/rivers for roosting.	Large numbers stage in the prairie pothole region during spring and fall. Flocks alternate between roosting sites on slow-moving rivers or lakes and foraging sites on graminoid or non-graminoid cropland (pea fields, plowed fields, pasture, small grain stubble fields).
Ross's Goose (M)	Cultivated and Managed Areas; Wetlands; Waterbodies; Herbaceous	Agricultural landscapes with crop fields for foraging and lakes/rivers for roosting.	Has similar stopover habitat selection as snow goose with which it is often found during migration through BCR 11. Roosts on lakes or rivers during the night and mid-day, then moves to fields of graminoid or non-graminoid crops to forage in morning and late afternoon (often wheat, barley and pea fields). Occasionally forages on wheat grass along shorelines of alkali lakes.
Greater White-fronted Goose (M)	Cultivated and Managed Areas; Wetlands; Waterbodies;	Wetlands of varying size and structure in agricultural landscapes.	Uses a variety of wetlands for roosting and foraging during migration including shallow or deep open-water zones of ponds and lakes, artificial waterbodies (impoundments and catchments), large marshes dominated by cattails, bulrush and sedge marshes, and in spring, temporary freshwater, snowmelt ponds in fields and pastures. Also forages in fields of graminoid or non-graminoid crops.
Canada Goose (B)	Cultivated and Managed Areas; Urban Areas; Herbaceous; Wetlands; Waterbodies	Uses a variety of nesting habitats wetlands and waterbodies in open, parkland and forested landscapes.	Uses a broad range of habitats in open, forested and parkland landscapes (including native, agricultural and urban habitats). Nest sites are usually placed in exposed sites allowing a surrounding view including grassy or shrubby islands, gravel bars, muskrat houses, agricultural fields, city parks and nest platforms. Nests usually placed near wetlands such as rivers, marshes, streams, small ponds with emergent vegetation (cattails, bulrushes), sewage lagoons, large lakes and reservoirs. Large numbers also pass through BCR 11 during migration where like other geese they roost on small to large wetlands and forage in cut crop fields.
Cackling Goose (M)	Cultivated and Managed Areas; Wetlands; Waterbodies;	Agricultural landscapes with crop fields for foraging and wetlands/waterbodies for roosting.	Uses prairie stopover habitats in agricultural landscapes during migration alternating between roost sites on marshes, lakes or rivers and foraging sites in nearby fields of graminoid crops.
Tundra Swan (M)	Cultivated and Managed Areas; Wetlands; Waterbodies		Uses shallow ponds and lakes in agricultural landscapes for staging. Roost sites tend to be on larger lakes with mostly open water but forages on aquatic plants on small ponds (e.g., sago pondweed).
Trumpeter	Cultivated and Managed		Stage on a variety of wetland types including marshes, ponds, lakes and rivers. In

Table 8 continued

Common Name	Broad Habitat Class	Landscape Habitat Description in BCR 11	Specific Habitat Description in BCR 11
Swan (M)	Areas; Wetlands; Waterbodies		spring selects sites that are free of ice earlier in the season including inlets, outlets and exposed lakes.

Habitat Loss, Degradation and Disturbance: Key Conservation Issues in BCR 11 PNR

Birds of prairie grasslands and sagebrush are among those showing the steepest and most consistent population declines of any major ecosystem in North America (Vickery and Herkert 2001, Sauer et al. 2006). Within Canada, the Greater Prairie Chicken, a bird of tallgrass prairie, has been extirpated. Several other avian species that are endemic to grassland or sagebrush habitats are listed as endangered, threatened or Special Concern in Canada including Greater Sage-Grouse, Long-billed Curlew, Mountain Plover, Burrowing Owl, Ferruginous Hawk, Sprague's Pipit, Chestnut-collared Longspur and McCown's Longspur. These species typically require extensive areas of native habitat and their declines are largely attributed to the conversion of grasslands, mixed shrub-grasslands and/or sagebrush communities to cropland. Although ways of defining different grassland habitats vary, the overall pattern is that all grassland types have declined considerably over the past two centuries. Tallgrass prairie has suffered the greatest decline largely because of its high suitability for agriculture. This habitat type, which in Canada was only present in Manitoba, formerly consisted of approximately 600 000 hectares, but only about 300 ha remained as of 1994, a 99.9% decline (Samson and Knopf 1994). Tallgrass prairie communities are more extensively distributed throughout the United States, but the pattern is similar with only about 1% of the pre-European tallgrass prairie community remaining. In Canada, the mixed and shortgrass prairie habitats have fared better but the picture is still bleak; approximately 20–40% of mixed-grass prairie and about 20% of shortgrass prairie remained as of 1994 (Samson and Knopf 1994), and habitat loss continues today.

For bird populations, the loss of upland habitats to agriculture has been further exacerbated by other forms of habitat disturbance including oil and gas development, the expansion of urban and industrial development and mining (particularly potash mining). The case of Greater Sage-Grouse is an example of how cumulative effects from multiple sources can influence populations. Populations of this species have declined throughout their range over the last few decades, largely because of the loss of sagebrush habitat (Knick et al. 2003), but in recent years, the expansion of oil and gas development has become an added stressor leading to further declines in some areas (Walker et al. 2007, Naugle et al. 2011). A similar example occurs with Sprague's Pipit; habitat loss due to cultivation and overgrazing have been the principal cause of population declines throughout the species' range (Samson and Knopf 1994), but fragmentation of continuous tracts of native prairie, the introduction of exotic plants and the encroachment of shrubs and trees into grasslands have exacerbated declines in some regions (Robbins and Dale 1999, Prescott and Davis 2000, Davis 2004, Davis et al. 2006).

Wetlands are another key component within BCR 11 PNR and provide critical breeding habitat for a number of species from all bird groups. Over the past century, wetlands were often drained to increase area for agricultural cropland, and by the early 1990s, this loss combined with drought led to a reduction in populations of many wetland-dependent birds. This decline was most strongly recognized among waterfowl, where populations of several species had plummeted including Pintail, Mallard and Blue-winged Teal, all of which are hunted and provide

a significant economic benefit in Canada and the United States (Prairie Habitat Joint Venture 2008). Abundance of wetlands is an important driver of population size among these species, as evidenced by a strong correlation between the number of ponds and the number of birds counted on the Breeding Population and Habitat Survey. Many waterfowl and other wetland dependent birds also require upland habitats adjacent to wetlands for nesting, and the loss of this habitat has contributed to population declines (Prairie Habitat Joint Venture 2008).

Loss of wetlands to agriculture and other forms of development is still a concern. However, wetland conservation has received substantial attention in recent decades from organizations such as Ducks Unlimited Canada, Alberta NAWMP, Saskatchewan Watershed Authority, Manitoba Habitat Heritage Corporation, the Prairie Habitat Joint Venture and others. These organizations have focused on identifying important wetland habitats and securing these habitats through direct purchase or conservation easements. Much of the funding for these projects originates from the hunting community, and these efforts have secured millions of acres of wetland habitat across Alberta, Saskatchewan and Manitoba. More recently, these groups have focused on upland habitats, alongside conservation groups such as the Nature Conservancy (McCready et al. 2005, www.natureconservancy.ca). Federal and provincial governments add varying levels of protection to both upland and wetland habitats. These levels range from complete protection from any development (e.g., national parks) to sites that allow some disturbance for activities such as oil and gas development, livestock grazing or recreation (e.g., National Wildlife Areas, Provincial or federal community pastures, provincial parks; see Fig. 2).

Key sites for birds during breeding or migration may also be recognized as Important Bird Areas or Western Hemisphere Shorebird Reserve Network sites, but unless combined with other designations such as Migratory Bird Sanctuaries, these designations do not confer any formal protection. Stewardship programs targeting individual landowners have also been successful in maintaining habitat for birds. These programs are typically directed by non-profit organizations such as Nature Saskatchewan and the Alberta Fish and Game Association. Some examples of successful stewardship programs include: Operation Burrowing Owl, Operating Grassland Community and Shrubs for Shrikes.

Although considerable effort is now directed towards habitat protection in the prairies, habitat loss continues and much additional work is needed, particularly for native grasslands and sagebrush communities, which have only recently received conservation attention. It is important to recognize that habitat loss is not only a concern for birds that use habitats in BCR 11 PNR during the breeding season. The prairie region of Canada provides critical migration staging areas for a number of shorebird, waterfowl and waterbird species including the endangered Whooping Crane. Most staging areas are associated with wetlands, and some stopover sites are recognized as Important Bird Areas or Western Hemisphere Shorebird Reserve Network sites. Landbird migrants also pass through the prairie region, but unlike the other bird groups, landbirds typically migrate in a broad front, making it more difficult to identify important stopover sites. Further research on this topic is needed.

Due to the harshness of prairie winters, only a few landbird species over-winter in the Canadian portion of BCR 11, but these do include some listed as priority species on the breeding grounds in northern BCRs (e.g., Snowy Owl, Bohemian Waxwing, Hoary Redpoll). Habitat protection programs need to consider the importance of over-wintering habitats for these species, although in many cases, efforts to protect breeding habitat will also benefit species during the winter period.

Hunting

While habitat loss is the most serious concern in the prairies, a number of non-habitat related issues are also a threat to prairie bird populations. In the 19th and early 20th centuries, over-hunting was a serious issue for many bird species in North America and led to severe population declines or even extinction. In some cases this over-harvest was the result of market demand; for example, an estimated 2 million Eskimo Curlew were killed annually during their migration in the 1870s and 1880s, and overhunting is the principal reason for the probable extinction of the species, although habitat loss also likely played a role (Gill Jr. et al. 1998). In other cases, species were hunted for the fashion trade, particularly white-plumaged waterbirds such as egrets and terns, which led to population declines (Nisbet 2002). Fortunately, legislation protecting migratory birds was enacted in the early 20th century, allowing populations of most species to rebound. Today, hunting is closely regulated in Canada and is no longer the risk that it was a century ago. However, on smaller scales, illegal harvest of some species may still occur; this needs to be monitored and enforcement action taken as appropriate. The most notable case of this occurs with species that are believed to compete with natural resource economies. For example, species such as Double-crested Cormorants, American White Pelicans and Common Terns may be illegally targeted in areas where they are seen to compete with fisheries (e.g., Keith 2005). Similarly, birds of prey such as Red-tailed Hawks or Great Horned Owls may be illegally shot by hunters who view them as competition for game, and eagles may be shot or poisoned for their feathers. In all cases, increased education and awareness of the importance of these species to the ecosystem, combined with enforcement, would help to limit illegal hunting.

Introduced Species

Introduced species pose two types of risks to birds in BCR 11 PNR. First, non-native plants can invade native plant communities, leading to the alteration of structure and function of natural grassland and wetland habitats (Seabloom 2003). Second, introduced birds or mammals, including domestic cats (see Widespread Issues section), pose a direct threat to birds via predation or competition.

As in most regions, the threats that priority species in BCR 11 PNR face are extensive but can be categorized into several broad threats and sub-threats (Tables 9-15). Some threats operate through effects on quality or quantity of habitat, while others influence demographic parameters such as survival or reproductive success more directly. In this and other BCR strategies, some issues such as predation by cats and collisions with human-made structures are classified as widespread issues and are considered in a subsequent section (see Section 3: Additional Issues).

Table 9. Threats to priority species of BCR 11 PNR related to effects of agriculture, including habitat loss and degradation.

The table includes a description of the threat, the objective and its category, the action recommended to deal with the threat and its category, and justification for the recommended action. "Potential groups of priority species affected" is meant to include representative bird groups or species that are expected to be affected by the threat. This list is based on species that have received study and is not meant to be exhaustive. Additional study on other groups and species is required.

Threat Description	Objective Sub-category	Recommended Action	Justification for Recommended Action	Action Sub-category	Potential Groups/Priority Species Affected
Agriculture **Threat 2.1: Annual and Perennial Non-timber Crops, Threat 2.3: Livestock Farming and Ranching** Habitats affected: All prairie and parkland habitats					
Agricultural development can lead to the loss and fragmentation of natural upland habitat leading to declines of bird populations. (Classen et al. 2001; Smith-Fargey 2004; Canadian Prairie Partners in Flight 2004; Askins et al. 2007, Cuddington 2008; PHJV 2008)	1.2 Maintain the size, shape and configuration of habitat within the natural range of variation: Maintain existing tracts of native grassland and re-establish natural grassland habitats.	Financially support the spatially targeted securement of privately owned high value conservation lands through the use of conservation easement agreements and fee simple purchase by eligible land trusts or governments.	Purchase of land is warranted for highly ecologically significant areas. Conservation easements are adequate protection for less significant areas and for highly significant areas that cannot be purchased.	1.1. Site/area protection	Landbirds, Shorebirds, upland nesting Waterbirds and Waterfowl
		Provide incentives for the retention of natural habitat on private lands through land retirement programs.		1.2. Resource and habitat protection	
		Develop and improve sustainable land use policies for BCR 11. Retain publicly held high value conservation lands as natural habitat and strengthen land use policies governing provincial crown land leased for agricultural use to prevent loss of natural habitat.	A substantial amount of natural habitat within BCR 11 is provincially owned and leased to livestock producers for grazing. Effective provincial crown land policy would prevent the sale of high value conservation land into private ownership, monitor range health on land supporting natural habitat, manage timing, duration and intensity of grazing for healthy rangelands, restrict the conversion of natural habitat to other land uses (e.g.,	5.1. Legislation	

Table 9 continued

Threat Description	Objective Sub-category	Recommended Action	Justification for Recommended Action	Action Sub-category	Potential Groups/Priority Species Affected
			cropland, residential development), and limit the amount and spatial extent of fragmentation (e.g., petroleum development, roads) on crown lands that support natural habitat.		
		Implement public education and awareness initiatives about the importance of native prairie grassland to grassland bird and species at risk populations.	Focus on importance of and general public role in prairie conservation to help build support. Non-game priority bird species and their habitat have less direct support than game birds.	4.3. Awareness and communication	
		Develop market based incentive tools such as conservation or biodiversity offsets and transferable development rights and enact enabling legislation at the provincial and federal levels.	Much of the land base in BCR 11 is privately managed for agriculture. Market based incentives are used in such situations because they are better accepted by landowners and they are successful and cost-effective for governments.	5.1. Legislation	
		Encourage grazing practices that maintain healthy grasslands and result in structural heterogeneity of vegetation.	Maintenance of ranches that allow grazing of native prairie and perennial forages can provide suitable habitat for priority bird species and keep habitat from being converted to cropland or other uses not compatible with bird conservation. Livestock grazing can be used to control succession and maintain habitat in native prairie and tame pastures. In the short term, grazing can be used to create the mosaic of short and tall grasses that these birds require, and in the long term, grazing can reduce the encroachment of woody vegetation and invasive plants into grassland areas.	2.3. Habitat and natural process restoration	
		Implement cross compliance	Cross compliance policies combine	5.1. Legislation	

Table 9 continued

Threat Description	Objective Sub-category	Recommended Action	Justification for Recommended Action	Action Sub-category	Potential Groups/Priority Species Affected
		programs which require native grassland habitat retention as a criteria before farm support programs can be triggered to help achieve a no-net loss of silver sagebrush habitat.	restrictive regulation with incentive programs and are thought to be the most effective types of policy (least costly and still attractive to participants as long as incentive payments are high enough) to achieve environmental goals.		
		Define critical habitat for species at risk.	Critical habitat for many species at risk has not yet been defined. Therefore, habitat that has not been defined under the federal *Species at Risk Act* is not being protected by the legislation and associated regulations.	5.2. Policies and regulation	
Farming and haying activity during nesting and brood rearing season can reduce bird productivity. (Dechant et al. 2003)	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat: Maintain functionality of agricultural habitat for breeding birds.	Defer hay harvesting operations until nesting and brood-rearing are complete.		3.1. Species management	Landbirds, Shorebirds, Waterbirds, Waterfowl
		Encourage the use of winter cereal production and low-till summer fallow in locations where these farming practices are feasible.	Winter cereal production and summerfallow are farming practices that do not require farming activity during the nesting season for many bird species.	3.4. Ex situ conservation	
Construction of shelterbelts on cultivated land can have variable effects on bird communities, depending on the habitat in which they are built. (Winter et al. 2005; Kelsey et al. 2006)		Develop guidelines for Agriculture and Agri-food Canada Farm shelterbelt program to discourage shelterbelt establishment on farmland or hay land adjacent to high priority wetlands or native prairie.	The majority of shelterbelt establishment in prairie Canada is supported through the provision of trees from the Prairie Shelterbelt Program administered by the Agriculture and Agri-food Canada Farm (AAFC) Shelterbelt Centre. Implementation of restrictions to the provision of trees for shelterbelts on native prairie would reduce the negative impact of shelterbelts on bird populations.	3.4. Ex situ conservation	Landbirds, Shorebirds, Waterbirds, Waterfowl
Wetland draining and degradation has resulted in	1.1 Ensure land and resource-use policies and	Financially support the spatially targeted securement of privately owned high value conservation lands	Purchase of land is warranted for highly ecologically significant areas. Conservation easements are adequate	1.1. Site/area protection	Landbirds, Shorebirds, Waterbirds,

Table 9 continued

Threat Description	Objective Sub-category	Recommended Action	Justification for Recommended Action	Action Sub-category	Potential Groups/Priority Species Affected
insufficient amounts of wetland habitat suitable for bird population recovery (Lynch-Stewart et al. 1999; Cox and Grose 2000; PHJV 2008; Saskatchewan NAWMP Technical Committee 2008; Rubec and Hanson 2009)	practices maintain or improve bird habitat: Minimize draining and loss of wetlands. Retain functional wetland and waterbody habitat.	through the use of conservation easement agreements and fee simple purchase by eligible land trusts or governments.	protection for less significant areas and for highly significant areas that cannot be purchased.		Waterfowl
		Retain publicly held lands with high value wetlands as natural habitat.	The most cost effective conservation measure providing the greatest environmental benefit is the protection of existing natural wetlands. In addition it can take 8 to 50 years for restored wetlands to provide the same functions as natural wetlands.	5.1. Legislation	
		Strengthen land use policies governing provincial crown land leased for agricultural use to prevent loss of high value wetlands.		5.1. Legislation	
		Implement cross compliance programs which require natural wetland retention as a criteria before farm support programs, or other incentive programs, can be triggered to help achieve a no-net loss of wetlands.	Cross compliance policies combine restrictive regulation with incentive programs and are thought to be the most effective types of policy (least costly and still attractive to participants as long as incentive payments are high enough) to achieve environmental goals. The United States Swampbuster Program is a potential model.	5.1. Legislation	
		Improve the effectiveness and applicability of existing federal and provincial wetland policies.	To improve retention or protection plus encourage restoration, improvements are required to the Federal Wetland Policy and AB, SK & MB Wetland Policy. Optimally the policies would (1) define a wetland and use a science based wetland classification (2) recognize the ecological functions provided by wetlands (3) set a goal for no-net loss	5.2. Policies and regulation	

Table 9 continued

Threat Description	Objective Sub-category	Recommended Action	Justification for Recommended Action	Action Sub-category	Potential Groups/Priority Species Affected
			of wetland functions on private and Crown lands (4) link to enforcement legislation for the protection of all wetland classes (5) assess cumulative impact of drainage and restoration project proposals at a watershed scale (6) require a province-wide inventory for watershed planning (7) monitor wetland loss and degradation by watershed (8) create a wetland mitigation decision framework based on avoidance, minimization of loss or degradation and compensation (9) support stewardship on private and crown lands and commit to developing an ecological goods and services compensation for wetland retention and restoration (10) implement public education programming to retain and restore wetlands (11) engage all government departments for the respective provincial or federal government and (12) encourage partnership development with individuals, non-government organizations, local municipalities and watershed managers.		
Trampling by livestock may reduce nest success of ground-nesting birds. (Canadian Prairie Partners in Flight 2004)	2.9 Reduce nest destruction: Reduce mortality caused by livestock trampling.	Defer grazing until after nesting and brood rearing.		3.1. Species management	Landbirds, Shorebirds, Waterbirds, Waterfowl
Insufficient amount and	1.1 Ensure land and resource-	Encourage implementation of agricultural practices that are	Agricultural practices such as grazing can allow the maintenance of quality	1.1. Site/area protection	Greater Sage-Grouse, Sharp-

Table 9 continued

Threat Description	Objective Sub-category	Recommended Action	Justification for Recommended Action	Action Sub-category	Potential Groups/Priority Species Affected
connectivity of sagebrush habitat for the maintenance of sage brush specialists (Canadian Prairie Partners in Flight 2004; North American Grouse Partnership 2004)	use policies and practices maintain or improve bird habitat: Improve connectivity and quality of sagebrush habitat.	beneficial to species that require sage brush habitats.	of sage brush for priority bird species if done correctly (i.e., avoid over-grazing and minimize numbers of livestock to avoid trampling). Beneficial agricultural practices have been developed for the Greater Sage-grouse for the Canadian prairies.		tailed Grouse, Sage Thrasher
		Implement cross compliance programs which require natural sagebrush habitat retention as a criteria before farm support programs can be triggered to help achieve a no-net loss of silver sagebrush habitat.	Cross compliance policies combine restrictive regulation with incentive programs and are thought to be the most effective types of policy (least costly and still attractive to participants as long as incentive payments are high enough) to achieve environmental goals.	5.1. Legislation	
	1.2 Maintain the size, shape and configuration of habitat within the natural range of variation: Retain functional blocks of intact natural woody shrubs in riparian and upland habitat	Financially support the spatially targeted securement of privately owned high value conservation lands through the use of conservation easement agreements and fee simple purchase by eligible land trusts or governments, including long term investment in land trust sustainability.	Purchase of land is warranted for highly ecologically significant areas. Conservation easements are adequate protection for less significant areas and for highly significant areas that cannot be purchased.	1.1. Site/area protection	Landbirds, Shorebirds, Waterfowl

Table 10. Threats to priority species of BCR 11 PNR related to effects of energy production and mining.
See Table 9 for additional details.

Threat Description	Objective Sub-category	Recommended Action	Justification for Recommended Action	Action Sub-category	Potential Groups / Priority Species Affected
Energy Production and Mining **Threat 3.1: Oil and Gas Drilling** Habitats Affected: All prairie and parkland habitats					
Oil and gas development causes disturbance and can lead to habitat loss and degradation. (Lynch-Stewart et al. 1999, Canadian Prairie Partners in Flight 2004, Rubec and Hanson 2009)	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat: Reduce or limit the footprint of oil and gas drilling particularly in sensitive areas. Aim for no net loss of upland and wetland habitats due to oil and gas activities.	Determine the tolerance levels of each priority species for fragmentation by petroleum development and set aside core habitat based on that information.	Reduce or limit the expansion of industrial and commercial sites within core biodiversity conservation areas or the supporting network of remaining natural cover.	1. Land/Water Protection – All subcategories	Landbirds, Shorebirds, Waterbirds, Waterfowl
		Encourage provincial governments in AB, SK, MB to establish protected areas within core biodiversity conservation areas above.		1. Land/Water Protection – All subcategories	
		Promote municipal or regional land use planning and zoning to protect effective habitat.	Land trusts are of primary importance in protecting habitat on private lands.	5.2. Policies and regulation	
		Define critical habitat for species at risk.	Critical habitat for many species at risk has not yet been defined. Therefore, habitat that has no been defined under the federal *Species at Risk Act* is not being protected by the legislation and associated regulations.	5.2. Policies and regulation	
		Encourage corporations and industry groups to develop policy statements that addresses the maintenance of functioning habitat through avoidance, timing, setbacks and other		5.3. Private sector standards and codes	

Table 10 continued

Threat Description	Objective Sub-category	Recommended Action	Justification for Recommended Action	Action Sub-category	Potential Groups / Priority Species Affected
		mitigation.			
		Develop and implement comprehensive guidelines for the design of industrial developments.		5.3. Private sector standards and codes	
		Incorporate mitigation provisions into provincial wetland policy.	Most jurisdictions use a hierarchy of wetland mitigation policy that includes avoidance, minimization and compensation for unavoidable impacts. Incorporation of the hierarchy in policy is particularly important for SK, which has no provisions for mitigation.	5.2. Policies and regulation	
		Implement and enforce policies that require avoidance of sagebrush habitat		5.2. Policies and regulation	
Threat 3.2: Mining and Quarrying Habitats Affected: All prairie and parkland habitats					
The potential area impacted by mining is significantly greater than the size of the mine itself through creation of associated infrastructure, increasing fragmentation, altering hydrology, and increased	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat: Minimize the loss and degradation of important habitat through regulations on the creation of	Design new mines using best possible environmental practices with high standards for environmental impact assessment; retain highly trained environmental staff through all stages of planning, construction and monitoring. Ensure clean up and remediation is conducted immediately following closure, using best available science and technology.		2.1. Site/Area Management	Landbirds, Shorebirds, Waterbirds, Waterfowl
		Minimize footprint when planning for a new mine using existing infrastructure where		2.1. Site/Area Management	

Table 10 continued

Threat Description	Objective Sub-category	Recommended Action	Justification for Recommended Action	Action Sub-category	Potential Groups / Priority Species Affected
pollution. (Wayland et al. 2007)	new mines and monitoring effects of existing mines on the surrounding landscape.	possible. Consider the cumulative effects of other industry on birds when planning for a new mine.			
		Ensure ongoing research into mitigating effects of mines. Implement adaptive management practices based on results.	Toxicity has been observed in birds as a result of elevated concentrations of elements of concern in birds (e.g., selenium-toxicity in waterfowl associated with coal mine effluent). Aquatic invertebrates incorporate metals into their bodies and these metals can bioaccumulate up the food chain.	8. Research needs and/or monitoring needs	

Table 11. Threats to priority species of BCR 11 PNR related to biological resource use.
See Table 9 for additional details.

Threat Description	Objective Sub-category	Recommended Action	Justification for Recommended Action	Action Sub-category	Potential Groups/Priority Species Affected
Biological Resource Use **Threat 5.1: Hunting and Collecting Terrestrial Animals**					
Illegal killing of birds of prey because of perceived competition with game bird hunting (Bevan et al. 2002) or for feathers.	2.8 Reduce mortality from legal or illegal hunting, and persecution: Limit illegal hunting of raptors.	Determine the amount and source of illegal hunting mortality, increase enforcement and design a targeted education and awareness program.		5.4. Compliance and enforcement	Swainson's Hawk Golden Eagle Prairie Falcon Peregrine Falcon
Accidental overharvest of sharp-tailed grouse or accidental shooting of Greater Sage-Grouse if mistaken for Sharp-tailed Grouse	2.8 Reduce mortality from legal or illegal hunting, and persecution: Monitor harvest of sharp-tailed grouse during hunting season and use education to help prevent mis-identification of Greater Sage-Grouse among hunters.	Increase enforcement of bag limits and raise awareness among hunters about the importance of regulations and conservation to maintain sustainable populations.		5.4. Compliance and enforcement	Sharp-tailed Grouse, Greater Sage-Grouse
Fish-eating waterbirds may	2.8 Reduce mortality from	Determine the amount and source of illegal hunting		3.2. Species recovery	Western Grebe, Double-crested

Table 11 continued

Threat Description	Objective Sub-category	Recommended Action	Justification for Recommended Action	Action Sub-category	Potential Groups/Priority Species Affected
be persecuted if perceived as competitors with fishery operations. (Bevan et al. 2002)	legal or illegal hunting, and persecution: Closely monitor and enforce illegal persecution of waterbirds.	mortality, increase enforcement and design a targeted education and awareness program.			Cormorant, American White Pelican, Great Blue Heron, Common Tern
		Increase enforcement in areas containing large waterbird populations and sites of known conflict.		5.4. Compliance and enforcement	
Waterfowl may be illegally overhunted during hunting season.	2.8 Reduce mortality from legal or illegal hunting, and persecution: Limit illegal harvest.	Increase enforcement of bag limits and raise awareness among hunters about the importance of regulations and conservation to maintain sustainable populations.		5.4. Compliance and enforcement	Waterfowl
Threat 5.3: Logging and Wood Harvesting Habitats Affected: Deciduous, Mixed Deciduous/Coniferous, Cultivated, Wetlands, Waterbodies					
Removal of trees around wetlands results in habitat loss, water level drawdowns and wetland habitat degradation. (Schmiegelow et al. 2006)	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat: Maintain large, contiguous areas of natural wetlands surrounded by intact forest	Create a system of protected areas that represent the size, shape, and spatial arrangement of all waterbody ecosites at a regional scale.	The underrepresentation of parks within this ecoregion warrants the establishment of additional protected areas. Protected areas should represent and include: 1) the size, shape, and spatial arrangement of all forest types; 2) the important attributes of forest types (e.g., forest composition, forest structure, coarse woody debris, standing dead trees, soil organic layer).	1.1. Site/area protection	Waterfowl, Waterbirds
		Retain natural buffer zones along all waterbodies.	The minimum width of the buffer zone should depend on the hydrology of the surrounding landscape, taking into account factors such as waterbody type and slope (steeper areas should have	2.1. Site/Area Management	

Table 11 continued

Threat Description	Objective Sub-category	Recommended Action	Justification for Recommended Action	Action Sub-category	Potential Groups/Priority Species Affected
	throughout the region, within the natural range of variation (size, shape, spatial arrangement of all habitat types).		wider buffers for erosion control).		
		Avoid harvesting activities during nesting and brood rearing periods.	This will allow for broods to fledge prior to commencement of harvesting activities and avoidance of incidental bird mortality.	2.1. Site/Area Management	
		Avoid clear cutting in favour of more selective harvesting practices to mimic patterns of natural disturbance (e.g., fire, insect outbreaks) and maintain forested habitat adjacent to waterbodies.		2.1. Site/Area Management	
Removal of mature and older seral deciduous trees results in direct habitat loss and indirect effects of habitat fragmentation and isolation. (Schmiegelow et al. 2006)	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat: Need to maintain stands of deciduous forest in naturally occurring areas.	Maintain a system of static habitat reserves on crown lands to ensure protection of mature and older deciduous forest and function as ecological benchmark areas.	The underrepresentation of parks within this ecoregion warrants the establishment of additional protected areas. Protected areas should represent and include: 1) the size, shape, and spatial arrangement of all forest types; 2) the important attributes of forest types (e.g., forest composition, forest structure, coarse woody debris, standing dead trees, soil organic layer).	1.1. Site/Area Protection	Bufflehead, Red-headed Woodpecker, Chimney Swift, Eastern Screech Owl, Least Flycatcher,
		Develop land use/management policy that balances economic development with biodiversity conservation and other values.		5.1. Policies and Regulations	
		Define critical habitat for species at risk.	Critical habitat for many species at risk has not yet been defined. Therefore, habitat that has not been defined under the Federal Species at Risk Act is not being protected by the legislation and associated regulations.	5.2. Policies and regulation	

Table 12. Threats to priority species of BCR 11 PNR related to residential and commercial development.
See Table 9 for additional details.

Threat Description	Objective Sub-category	Recommended Action	Justification for Recommended Action	Action Sub-category	Potential Groups / Priority Species Affected
Residential and Commercial Development **Threat 1.1: Housing and Urban Areas, Threat 1.2: Commercial and Industrial Areas** Habitats Affected: All prairie and parkland habitats					
Residential and commercial development can lead to the loss and fragmentation of natural upland habitat leading to declines of bird populations. (Askins et al. 2007)	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat: Reduce or limit the expansion of urban/ suburban areas and industrial/ commercial sites within core biodiversity conservation areas or the supporting network of remaining natural cover.	Identify all areas classified as 1) core biodiversity conservation areas and/or 2) within the supporting network of remaining natural cover.	Reduce or limit the expansion of urban/suburban areas as well as industrial and commercial sites within core biodiversity conservation areas or the supporting network of remaining natural cover.	1. Land/Water Protection – All subcategories	Landbirds, Shorebirds
		Promote municipal or regional land use planning and zoning to protect effective habitat.		5.2. Policies and regulation	
		Build capacity for existing land trusts and new local land trusts.	Land trusts are of primary importance in protecting habitat on private lands.	7.1. Institutional and civil society development	
		Provide incentives for urban developers to increase density of housing units.	Incentives such as tax breaks can be used to encourage high density housing construction.	6.4. Conservation payments	
	1.1 Ensure land and resource-use policies and practices maintain or	Implement legislation or policy that incorporates conservation security to facilitate the support of natural capital and enable the use of market based incentive	Conservation security legislation is fundamental to the development of policies and tools that promote land, water and biodiversity conservation.	5.1. Legislation	

Table 12 continued

Threat Description	Objective Sub-category	Recommended Action	Justification for Recommended Action	Action Sub-category	Potential Groups / Priority Species Affected
	improve bird habitat: Facilitate the implementation of policies and programs that utilize incentives for habitat conservation.	programming to support bird conservation.			
		Encourage the use of market based incentives such as transferable development credits.	Transferable development credits can be used in conjunction with zoning bylaws to keep developments away from important bird habitat by allowing owners of high quality habitat to share in development profits while restricting development.	6.3. Market forces	

Table 13. Threats to priority species of BCR 11 PNR related to natural systems modification.
See Table 9 for additional details.

Threat Description	Objective Sub-category	Recommended Action	Justification for Recommended Action	Action Sub-category	Potential Groups/Priority Species Affected
Natural Systems Modification **Threat 7.1: Fire and Fire Suppression** Habitats Affected: All prairie and parkland habitats					
Disruption of natural fire regimes affect structure and community composition(Beyersbergen et al. 2004)	1.3 Ensure the continuation of natural processes that maintain bird habitat: Need to maintain natural variation in habitat types in response to fire and fire suppression.	Allowing natural fires and prescribed burns could help limit extreme fires (need to avoid burns during nesting and brood-rearing periods).	Years of fire suppression can result in encroachment of woody vegetation and a buildup of fuel for potential fire that would not build up naturally.	2.3. Habitat and natural process restoration	Landbirds, Shorebirds, Waterbirds, Waterfowl
		Limit fire suppression so as to reduce the encroachment of woody vegetation.		2.3. Habitat and natural process restoration	
Threat 7.2: Dams and Water Management Habitats Affected: Herbaceous, Mixed Shrub-Grassland, Sagebrush Shrub, Wetlands, Waterbodies					
Changes in flow regimes may reduce water available to recharge wetlands, may reduce spring floods required for suitable habitat or may stabilize	1.3 Ensure the continuation of natural processes that maintain bird habitat: Improve riparian health along watercourses with controlled flows	Encourage implementation of wetland riparian health beneficial management practices through incentives.	Management of riparian areas for health can offset changes in water flow regimes to a certain extent.	6.4. Conservation payments	Landbirds, Shorebirds, Waterbirds, Waterfowl
		Manage water flows on controlled watercourses to meet in-stream flow needs of riparian vegetation.	Instream flow needs (volumes and timing) need to be defined for different riparian habitat types (e.g., mixedwood riparian forest, cottonwood forest) and implemented.	2.3. Habitat and natural process restoration	
		Discourage practices that involve	Leaving a natural riparian buffer around	1.2. Resource	

Table 13 continued

Threat Description	Objective Sub-category	Recommended Action	Justification for Recommended Action	Action Sub-category	Potential Groups/Priority Species Affected
water levels which can have a negative effect on suitable habitat for species that require slowly declining water levels over the growing season. (Fitch et al. 2001)	and maintain nesting habitat.	tilling and cropping riparian areas of wetlands.	wetlands will control erosion and help ensure continuation of natural wetland processes. The minimum width of the buffer zone should depend on the hydrology of the surrounding landscape, taking into account factors such as wetland type and slope (steeper areas should have wider buffers for erosion control). GIS/remote sensing- based precision conservation tools can help determine buffer area and extent.	and habitat protection	
		Allow seasonal and overland water flows to shrub habitat.	Implement policy that limits new dam and dugout construction to sites that do not change the runoff flow regime to dense shrub habitat.	2.3. Habitat and natural process restoration	
Insufficient flow to maintain shrub habitat along riparian areas and wetlands. (Lungle and Pruss 2008)	1.3 Ensure the continuation of natural processes that maintain bird habitat: Maintain riparian areas along wetlands and waterbodies.	Implement policy that limits new dam and dugout construction to sites that do not change the flow regime in wetlands and waterbodies.	Federal (Environmental Farm Plans) and provincial programs provide incentives for new permanent water sources. Sitting restrictions associated with these programs could reduce impacts on riparian vegetation.	5.2. Policies and regulation	Landbirds, Shorebirds, Waterbirds, Waterfowl
Threat 7.3: Other Ecosystem Modifications Habitats Affected: Herbaceous Grassland, Mixed Shrub-Grassland, Wetlands, Waterbodies					
Reduced availability of burrows and prey due to pest control activities. (Holroyd et al.	2.8 Reduce mortality from legal or illegal hunting, and persecution:	Implement beneficial agricultural practices that have been designed for Burrowing Owl.	Programs similar to Greencover are cost effective in that payment does not need to cover the complete opportunity cost of foregone crop production because grazing and haying are still permitted. Transaction costs are also low because this type of	3.2. Species recovery	Burrowing Owl

Table 13 continued

Threat Description	Objective Sub-category	Recommended Action	Justification for Recommended Action	Action Sub-category	Potential Groups/Priority Species Affected
2001)	Limit persecution of burrowing mammals and help to develop and maintain artificial burrow sites.		program can be monitored by remote imagery.		
		Create regulations to minimize persecution of prairie dogs and other burrowing mammals.	Burrowing mammals provide beneficial services aside from providing nesting habitat for species such as the Burrowing Owl.	5.4. Compliance and enforcement	
Habitat modifications for waterfowl may be detrimental to some grassland birds.	7.4 Improve understanding of causes of population declines: Need to understand what comprises quality nesting habitat and maintain those habitats.	Understand optimal nesting habitat for these species and how it differs from dense nesting cover planted for duck breeding.		8. Research and/or monitoring needs	Willet, Marbled Godwit, Long-billed Curlew, Horned Lark
		Manage herbaceous and riparian areas to represent the natural range of variation of habitat ecotypes (size, shape, spatial and temporal arrangement) or the closest approximation if NROV is no longer an achievable target within highly modified landscapes.		2.1. Site/area management	

Table 14. Threats to priority species of BCR 11 PNR related to invasive and problematic species.
See Table 9 for additional details.

Threat Description	Objective Sub-category	Recommended Action	Justification for Recommended Action	Action Sub-category	Potential Groups/Priority Species Affected
Invasive and other Problematic Species **Threat 8.1: Invasive Non-native and Alien Species**					
Increasing abundance of some native species (e.g., avian species such as cowbirds and gulls, mammalian predators and bacteria) as a result of human activities is presenting a threat to other native species. (Soos and Wobeser 2006)	7.4 Improve understanding of causes of population declines: Understand the extent to which individual problematic native species limit bird populations. Utilize population control if necessary.	Establish and support invasive species cooperatives.	Invasive species cooperatives operate as partnerships in a localized area. These groups of organizations and individual concerned with invasive species can use a variety of tools to manage and prevent invasions based on local issues and local threats.	7.1. Institutional and civil society development	Landbirds, Shorebirds, Waterbirds, Waterfowl
		Implement public education and awareness initiatives on threat posed by invasive species and mitigation measures.		4.3. Awareness and communication	
		Research the extent to which individual problematic native species and birds compete for the same resources and investigate options for mitigation. Understand reasons that some populations of native species are increasing. Targeted control may be necessary in select cases.		8.1 Research	

Table 15. Threats to priority species of BCR 11 PNR related to human intrusions and disturbance.
See Table 9 for additional details.

Threat Description	Objective Sub-category	Recommended Action	Justification for Recommended Action	Action Sub-category	Potential Groups / Priority Species Affected
Human Intrusions and Disturbance **Threat 6.1: Recreational Activities, Threat 6.3: Work and Other Activities**					
Disturbance from recreational activities reduces breeding opportunities and causes abandonment of nests as well as direct mortality. (Beyersbergen et al 2004; Grasslands Conservation Council of BC 2004)	4.2 Reduce disturbance from industrial or work activity: Reduce disturbance during nesting and brood rearing seasons.	Encourage recreational user groups to develop and distribute best practices designed to reduce impacts to birds.	Particularly relevant to off highway vehicle users (e.g., quads, dirt bikes, dune buggies, jet boats, jet skis). Best practices can be designed for recreation such as those for grasslands in BC.	5.3. Private sector standards and codes; 4.3. Awareness and communication	Landbirds, Waterbirds, Shorebirds, Waterfowl
Many species are sensitive to disturbances from resource extraction and research activities. (Canadian Prairie Partners in Flight 2004)		Develop and implement guidelines for industry and research institutions designed to reduce impacts to birds.	Conservative setbacks, timing restrictions, noise restrictions etc. can reduce the potential for lek, nest and brood abandonment.	5.2. Policies and regulations	Landbirds
		Encourage industry and industry groups to develop policy statements that address disturbance of sensitive bird species.	Industries that develop policy statements targeted to specific conservation issues are thought to be more likely to incorporate these precautions into their planning and development.	5.2. Policies and regulations; 5.3. Private sector standards and codes;	

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

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 less 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 from 16.1–42.2 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. See Table 16 for conservation objectives and actions.

Wind Turbines

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

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

At the 43 wind farms in Canada for which data are available, total habitat loss per turbine is 1.23 ha on average. Based on this average, the predicted total habitat loss for wind farms nationwide is 3 635 ha. Using published estimates of nest densities, the total number of affected nests, not accounting for construction that might occur outside the breeding season, is approximately 5 700 (Zimmerling et al. 2013). See Table 16 for conservation objectives and actions.

Communication Towers

There are currently almost 8 000 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 16; Longcore et al. 2012).

Neotropical migrants in the families Parulidae (wood-warblers) and Vireonidae (vireos) are the species most commonly killed by communication towers. These families include threatened species and many that are of conservation concern in Canada and/or the United States. When considered in concert with mortality at towers in the United States (which is 20 times higher due to the larger number and greater height of towers in the United States), and the mortality from other stationary structures, mortality from collisions with communications towers may negatively affect the population trends of some birds. See Table 16 for conservation objectives and actions.

Power Lines

Birds may be killed by colliding with power lines, or they may be electrocuted. Species with high wing-loading and thus low manoeuvrability, 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 16 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), which are often bordered by fences and vegetation that 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 vehicles likely pose the largest collision-based risk to some priority species in BCR 11 because the landscape is heavily bisected with gravel roads and these roads tend to attract prey items. Gravel roads provide easily travelled corridors for prey, and therefore avian species, particularly owls, tend to congregate around these roads, resulting in a higher rate of vehicle collisions. Unfortunately, because of the dispersed nature of vehicle collisions, it is difficult to estimate the level of mortality. See Table 16 for conservation objectives and actions.

Predation by Domestic Cats

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

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

Without detailed study of the individual species affected, it is difficult to assess whether mortality caused by cat predation impacts population trends of birds in Canada. Nevertheless, it is likely that many species of birds are potentially vulnerable to population effects at the local scale in southern Canada. See Table 16 for conservation objectives and actions.

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. See Table 16 for conservation objectives and actions.

Pesticides

The most recent estimate suggests that 0.96–4.4 million birds are killed by pesticides annually in Canada (Mineau 2010). Provinces such as Saskatchewan, which have a large agricultural land base, account for the majority of the estimated kill, and pesticides are thought to be an important contributor to the decline in grassland bird species in Canada (Mineau 2010). Pesticides can kill birds rapidly following contact or may have sub-lethal 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 16 for conservation objectives and actions.

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 16 for conservation objectives and actions.

Table 16. 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	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 (develop aesthetically acceptable solutions for preventing birds from striking windows of homes) - Eliminate unnecessary night-lighting of commercial structures, especially during migration periods - Favour strobe beacons over steady burning beacons for tall structures.	2.1 Site/area management	All species
	1.2 Commercial and industrial areas				5.3 Private sector standards and codes	
Collisions with wind turbines cause bird mortality.	3.3 Renewable energy	Reduce incidental mortality from collisions with wind turbines	2.7 Reduce incidental mortality from collisions.	Follow beneficial management practices for reducing bird mortality when designing and locating wind turbines.	5.3 Private sector standards and codes	All species, especially raptors
				Utilize techniques such as radar monitoring to determine pre-construction flight paths and assess the degree to which wind farms present migration barriers, and infrared camera systems to quantify strike rates.	8.2 Monitoring	
				Implement the USFWS's guidelines for turbine siting, design and monitoring	5.2 Policies and regulations	
				Determine scale of mortality from wind turbine collisions to ensure that mitigation measures are appropriate	8.2 Monitoring	

Table 16 continued

Threats Addressed	Threat Category	Objective	Objective Category	Recommended Actions	Action Category	Example Priority Species Affected
				Mitigate the loss of birds to wind farm development and operation through rigorous environmental assessment considering design and placement of wind farms. Wind farms should be placed away from important bird nesting, migration and staging areas. Regulate current windmill technology, including replacement of old windmills that do not match current standards.	5.2. Policies and regulation	
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.	2.1 Site/area management	All species
				Switch off solid lights on existing towers and ensure that remaining lights have a synchronized, complete dark phase.	5.3 Private sector standards and codes	
				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.		
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 is minimized. In new developments, locate transmission lines underground.	2.1 Site/area management	Raptors, Shorebirds, Waterfowl, Waterbirds
				Use markers or paint to increase visibility of power lines in high-strike 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.	2.1 Site/area management	Landbirds, Shorebirds

Table 16 continued

Threats Addressed	Threat Category	Objective	Objective Category	Recommended Actions	Action Category	Example Priority Species Affected
				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.	1.1 Site/area protection	
Population effects of collisions are unknown.	12.1 Information lacking	Improve understanding of population effects of mortality from collisions	7.4 Improve understanding of causes of population declines.	Assess the biological importance of bird kills from all sources of collisions.	8.1 Research	All species
Predation by Domestic Cats						
Predation by domestic and feral cats.	8.1 Invasive non-native/ alien species	Reduce mortality from domestic and feral cats	2.4 Reduce incidental mortality.	Implement a "Cats Indoors!" Campaign following the guidelines of the American Bird Conservancy.	5.3 Private sector standards and codes	Ground nesting or ground foraging species; species attracted to feeders; species inhabiting suburban or urban areas
				Work to reduce feral cat overpopulation through cat control regulations.	5.2 Policies and regulations	
Population effects of cat predation are unknown.	12.1 Information lacking	Improve understanding of population effects of cat predation	7.4 Improve understanding of causes of population declines.	Evaluate which species are most vulnerable to cat predation.	8.1 Research	Ground nesting or ground foraging species; species attracted to feeders; species inhabiting

Table 16 continued

Threats Addressed	Threat Category	Objective	Objective Category	Recommended Actions	Action Category	Example Priority Species Affected
						suburban or urban areas
				Investigate the population-level effects of cat predation through better monitoring of kill rates and the number of feral cats.	8.2 Monitoring	
				Continue to monitor bird populations so changes in numbers and distributions can be identified and management of cats can be altered to reflect these changes.		
				Conduct effectiveness monitoring to evaluate if mitigation activities are achieving the desired results.		
Environmental Contaminants						
Mortality from ingestion of lead shot or tackle.	5.1 Hunting & collecting terrestrial animals	Reduce mortality and sub-lethal effects of lead shot and fishing tackle on birds	2.2 Reduce mortality and/or sub-lethal effects from exposure to contaminants.	Work with hunters, anglers and industry to eliminate the exposure of birds to shot, sinkers and jigs made of lead.	4.3 Awareness and communications	Waterfowl, Waterbirds
	5.4 Fishing & harvesting aquatic resources			Continue to enforce the use of non-toxic shot in waterfowl hunting, and encourage adoption of non-toxic alternatives in target shooting, upland game bird hunting, and fishing.	5.4 Compliance and enforcement	
Birds may be impacted by lethal or sublethal toxic effects of water-born pollutants from sewage and wastewater, as well as by indirect effects such as changes to habitats.	9.1 Household sewage and urban wastewater	Reduce contaminant loads in waterbodies stemming from urban sources.	2.2 Reduce mortality and/or sub-lethal effects from exposure to contaminants	Use adaptive management programs to assess the impacts of water-born environmental contaminant loads on waterbirds and waterfowl, and determine potential measures to minimize those effects.	8.2 Monitoring	Waterfowl, Waterbirds

Table 16 continued

Threats Addressed	Threat Category	Objective	Objective Category	Recommended Actions	Action Category	Example Priority Species Affected
Mortality from heavy metals and other contaminants.	9.2 Industrial & military effluents	Reduce mortality from heavy metals and other contaminants	2.2 Reduce mortality and/or sub-lethal effects from exposure to contaminants.	Work with industry and policy makers to reduce the quantity of heavy metals and other contaminants released into the environment.	5.3 Private sector standards and codes	Shorebirds, Waterbirds, Waterfowl
				Implement and enforce legislation that prevents or minimizes spills and release of industrial pollution into waterbodies, particularly those that are heavily used for nesting and migratory staging sites.	5.1.Legislation	
				Require corporations and industry groups to develop policy statements that address the prevention of effluent releases and emergency response plans in the event of a release.	5.2.Policies and regulations	
Mortality, sub-lethal effects, reductions in prey populations and habitat alteration caused by exposure to/use of pesticides.	9.3 Agricultural & forestry effluents	Reduce mortality and sub-lethal effects of pesticides on birds	2.1 Reduce mortality and/or sub-lethal effects from pesticide use.	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.	5.2 Policies and regulations	Landbirds, Shorebirds, Waterbirds, Waterfowl
				Continue to implement and enforce legislation that discourages spills and release of agricultural and forestry pollution into waterbodies.	5.4. Compliance and enforcement	
				Retain natural buffer zones along all wetlands and waterbodies	5.3. Habitat and natural process restoration	
		Reduce the effects of pesticides on prey species	5.1 Maintain natural food webs and prey sources.	Improve regulation of pesticides/rodenticides/herbicides in Canada to reduce bird mortality.	5.3 Private sector standards and codes	

Table 16 continued

Threats Addressed	Threat Category	Objective	Objective Category	Recommended Actions	Action Category	Example Priority Species Affected
Birds may be impacted by lethal or sublethal toxic effects of air-borne pollutants, as well as by indirect effects such as changes to habitats.	9.5 Air-borne Pollutants	Reduce emissions of pollutants capable of long range transport.	2.2 Reduce mortality and/or sub-lethal effects from exposure to contaminants.	Use adaptive management to identify the levels of exposure and the impacts of air borne pollutants on reproductive output and survival of priority species.	8.2 Monitoring	All species
				Introduce taxes through legislation/policies forcing polluters to pay the true cost of emissions, rather than allowing industries to externalize these costs. Setting optimal tax levels will require extensive effort in determining the economic and social costs of environmental damage caused by industrial pollution.	5.1 Legislation; 5.2 Policy and regulations; 6.3 Market forces	
				Encourage the agricultural sector to employ beneficial management practices that limit the negative effects of airborne pollutants on priority species. For example, spatial and climatic modeling can be used to minimize emissions during times or at locations when pollution would be most damaging.	5.3. Private sector standards and codes	
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 affects of PBDEs and other chemicals on vital rates in birds.	8.1 Research	All species
				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.		

Climate Change

The effects of climate change are already measurable in many bird habitats and have resulted in range shifts and changes in the timing of migration and breeding in some species (National Audubon Society 2009, North American Bird Conservation Initiative, U.S. Committee 2009). Birds in all habitats will be affected by climate change. The most vulnerable are predicted to be those that are dependent on oceanic ecosystems and those found in coastal, island, grassland, arctic and alpine habitats (North American Bird Conservation Initiative, U.S. Committee 2010). Changing climate may also facilitate the spread of disease, the introduction of new predators and the invasion of non-native species that alter habitat structure and community composition (North American Bird Conservation Initiative, U.S. Committee 2009, Faaborg et al. 2010). See Tables 17 and 18 for a summary of impacts of climate change and conservation objectives.

A recent exercise used bioclimatic modeling to predict changes in bird species ranges based on anticipated climate change for different time periods and under different emissions scenarios (Lawler et al. unpublished; Lawler et al. 2009). Bioclimatic models use statistical associations between the current range of a species and a suite of climate variables to predict future ranges under new climate conditions. The study focused on bird species currently found within BCRs in Canada. The results suggest that bird species turnover in Canada will be highest in northern BCRs as species ranges continue to shift northward in the coming decades. A scientist at the University of Alberta (D. Stralberg, Stralberg et al. 2013) is modeling the detailed climate niche currently used by birds and examining how it will change in the future. Areas of overlap between existing ranges and future ranges would be candidates for conservation areas.

In the Canadian prairies, the most serious threats associated with climate change relate to water scarcity. Projections from global climate models predict lower summer stream flows, reduced water levels in standing wetlands, and increased soil and surface water deficits (Sauchyn and Kulshreshtha 2008). The inter-annual variability in climate is also expected to increase with more frequent droughts and severe flooding, both of which could lower quality of wetland and upland habitats. Flooding due to increased storm events may be especially severe for ground-nesting priority species. Models of vegetation zonation predict an overall northward shift of the prairie-aspen transition in BCR 11 by 2050. Such changes are expected to occur via two mechanisms: 1) in more heavily forested areas, regeneration failure and a reduction in tree growth will lead to a loss of tree cover and expansion of grassland patches, 2) in the aspen parkland, there will be a reduction in the size and extent of aspen groves as well as reduced invasion of grassland patches by shrubs and poplar sprouts (Vandall et al. 2006, Sauchyn and Kulshreshtha 2008). Such changes suggest an increase in habitat for species that select grasslands and a decrease for those that select forest and parkland habitats.

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 17. 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	Piping Plover, Least Flycatcher
Extended breeding season	Canada Goose, Bobolink
Habitat loss as a result of ecosystem changes (e.g., changing hydrology of wetlands)	Long-billed Curlew, Yellow Rail
Increase in severe weather events	Golden-winged Warbler, Horned Lark
Introduction of new predators and competitors	Red-necked Grebe
Range shifts	Mountain Plover, Sage Grouse
Thawing of permafrost and increased evaporation will result in vegetation shifts and loss of wetlands in arctic habitat	Birds migrating through BCR 11 including Rusty Blackbird, Yellow Rail, and Hudsonian Godwit

Table 18. Proposed conservation objectives and actions to address climate change.

Threats Addressed	Threat Sub-category	Objective	Objective Category	Recommended Actions	Action Category	Priority Species Affected
Climate change 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	All
	11.2 Droughts	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	
	11.3 Temperature Extremes			Manage buffer areas and the matrix between protected areas to enhance movement of species across the landscape.	2.1 Site/area management	
	11.4 Storms and Flooding			Manage ecosystems to maximize carbon storage and sequestration while simultaneously enhancing bird habitat.	5.2 Policies and regulations	
				Include and encourage the inclusion of natural biological carbon sinks as eligible carbon offsets within greenhouse gas mitigation schemes.		
				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).		
				Incorporate the retention and protection of natural areas as an integral component of climate change adaptation strategies. Include buffers around core habitats within protected areas to allow for natural migration of plant communities under changing environmental conditions.	1.1 Site/area protection	
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.	8.1 Research	All
				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.		
				Using best available science and technology, conduct long-term research and modeling exercises on predicted effects of climate change at different scales in order to implement adaptive management with regards to land use planning.		
				Continue to monitor bird populations so changes in numbers and distributions can be identified.	8.2 Monitoring	
				Undertake monitoring to evaluate the effectiveness of mitigation activities.		

Research and Population Monitoring Needs

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.

Identification of population trends requires sufficient temporal coverage to have the statistical power to detect a trend and sufficient spatial coverage to be representative of the population (Williams et al. 2002, Bart et al. 2004). In BCR 11 PNR, only a few surveys meet these requirements for priority species. Trends are perhaps best understood for prairie waterfowl due to the efforts of the Breeding Population and Habitat Survey conducted since 1955 on air-ground transects across the prairie region. These surveys were instrumental in highlighting declines of several species of dabbling ducks in the 1980s and 1990s (Prairie Habitat Joint Venture 2008). While populations of some species such as Mallard and Blue-winged Teal have largely recovered, others such as Northern Pintail are still depressed, and further conservation efforts are needed. Arctic breeding geese are also well studied through surveys on the Arctic breeding grounds as well as other parts of the migratory and winter ranges. Numbers of certain Snow Goose and Canada Goose populations have increased dramatically over the past two decades, and efforts such as more liberal hunting seasons are being used to try to control expanding snow goose populations.

Considerable effort is allocated to monitoring population size of some endangered species such as the Greater Sage-Grouse (Fig. 18), Piping Plover and Whooping Crane. In the latter case, biologists typically know the exact population size and the number of new recruits added to the population each year. For most other landbirds, shorebirds and waterbirds, we have a far more limited understanding of population trends in the region.

One of the principal methods used to estimate trends for all birds is the North America Breeding Bird Survey (BBS), a volunteer-based survey initiated in 1966 and conducted annually on 25 mile (40 km) road transects throughout North America (Sauer et al. 2006). The BBS has been invaluable for understanding trends of many species throughout the continent, but it does have limitations for surveying species that are secretive or that are less common near roads. BBS coverage may also be poor in areas with fewer volunteers to cover a large geographic area, as is the case in Saskatchewan and Manitoba. Despite these limitations, the method does reliably survey several priority species in BCR 11 PNR (B. Collins unpublished data) and we show

trends for representative groups in Figures 19 and 20. Precision of trend estimates may increase in the future; Hierarchical Bayesian techniques are currently being applied to BBS data, and preliminary analyses suggest that this approach has greater power to detect trends compared to earlier methods.

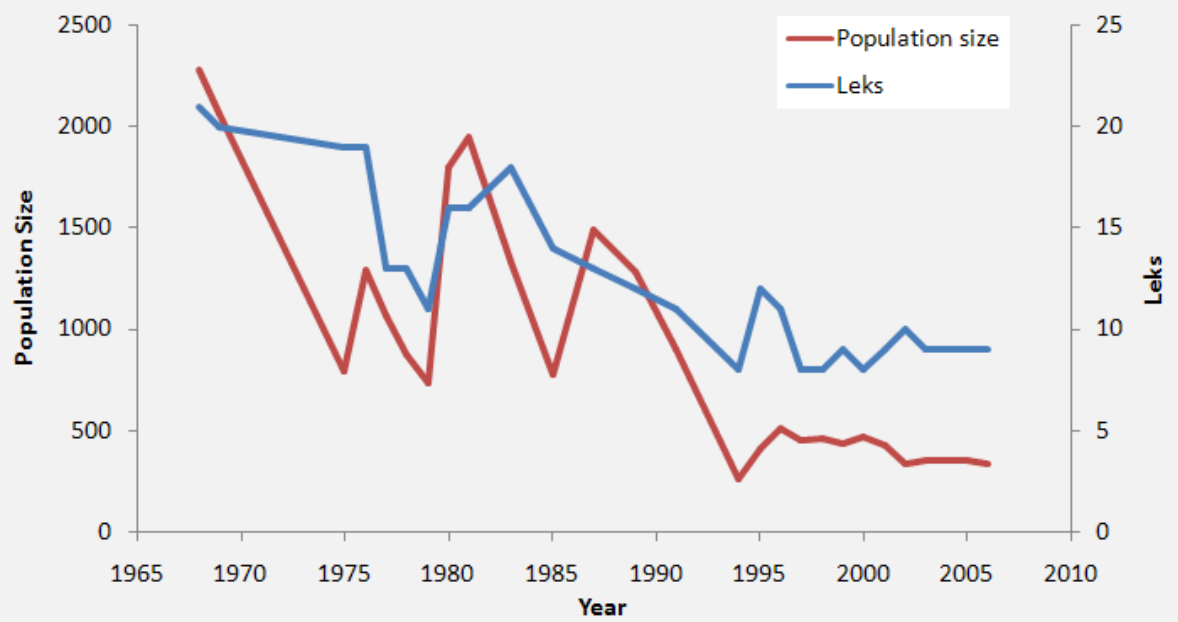

Figure 18. Greater Sage-Grouse population size and active lek numbers in Alberta from surveys conducted by Alberta Fish and Wildlife Division and Alberta Sustainable Resource Development (2006) as presented in COSEWIC (2008).

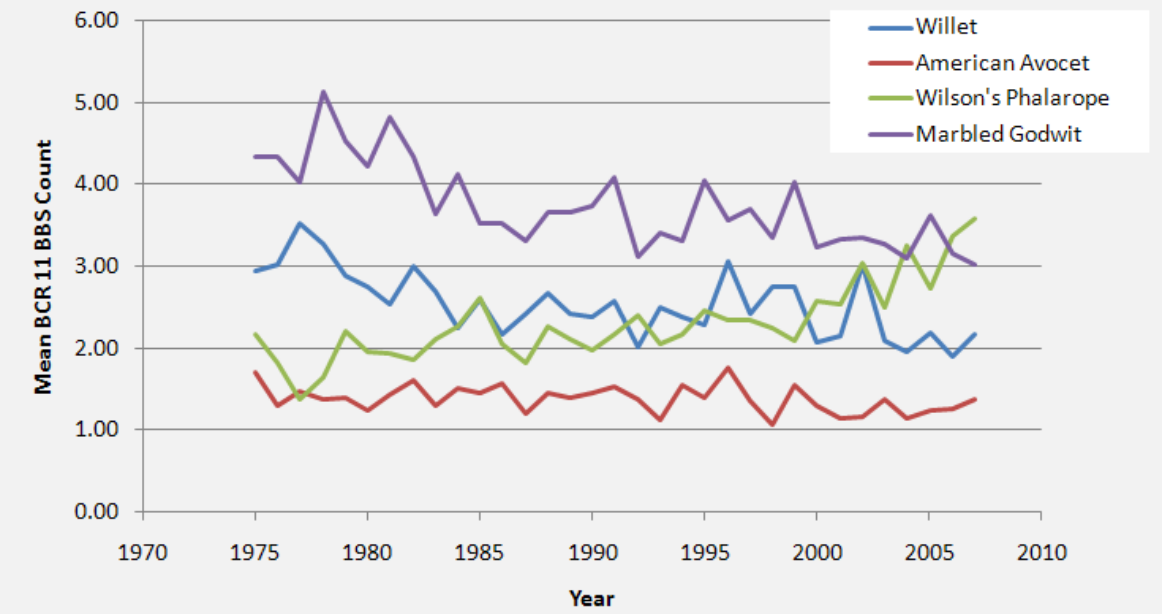

Figure 19. Breeding bird survey population trends for four wetland dependent prairie shorebirds in BCR 11 PNR. The population size shown here is the average of the low and high estimated size.

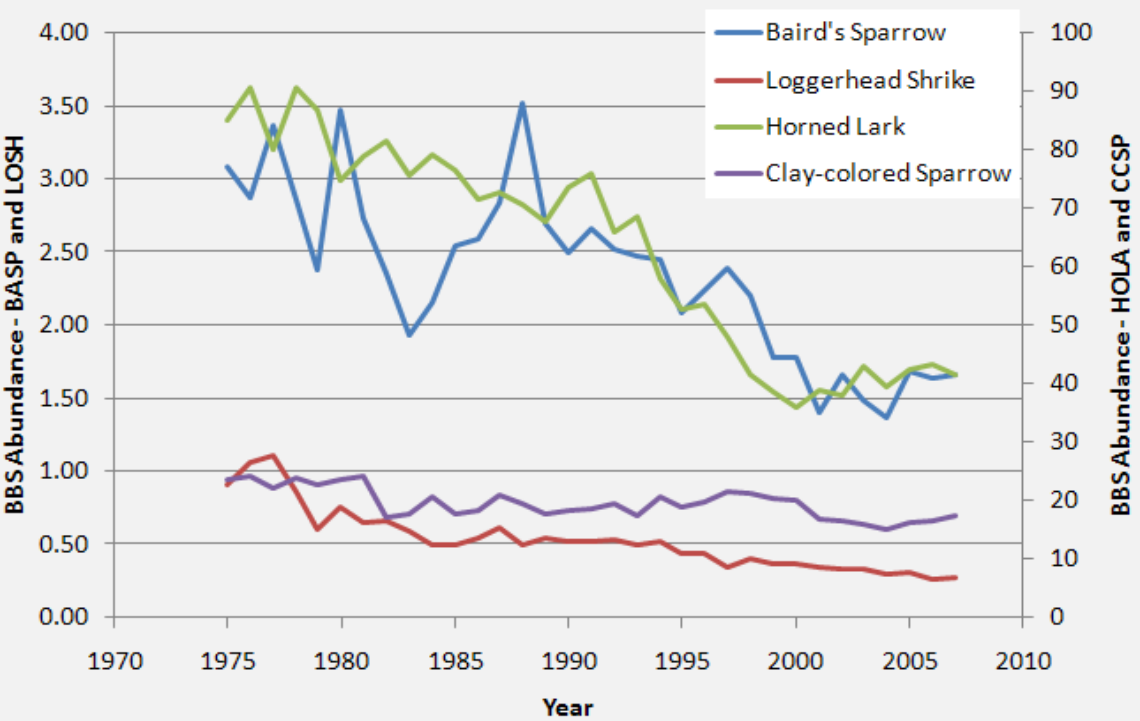

Figure 20. Breeding bird survey population trends for four grassland or mixed shrub-grassland passerines in BCR 11 PNR. Because of absolute differences in abundance, Baird's Sparrow (BASP) and Loggerhead Shrike (LOSH) are shown on the primary vertical axis, while Horned Lark (HOLA) and Clay-colored Sparrow (CCSP) are shown on the secondary vertical axis.

Alternative monitoring methods are needed for species that are not well surveyed by the BBS. In BCR 11 PNR, appropriate monitoring methods for colonial waterbirds, secretive marshbirds and some grassland passerines are particularly lacking. In 2008, Bird Studies Canada implemented the Prairie and Parkland Marsh Monitoring Program, which uses a standardized protocol (Conway 2009) employed in marshbird monitoring throughout North America. The program is primarily focused on understanding landscape level habitat associations at present but with additional years of data collection could be a key method for surveying trends in abundance as well. Other methods have been designed for particular species, such as a Canadian range-wide survey of Franklin's Gulls conducted by the Canadian Wildlife Service in 2005-2007 (G. Beyersbergen and W. Calvert, unpublished report). Repeated surveys in the future can then provide information on trends.

In cases where obtaining trends on the breeding grounds is difficult, biologists can also use wintering ground surveys if available. If declines are detected on the wintering grounds, knowledge of migratory connectivity can then relate those declines to specific breeding populations (Webster et al. 2002). In BCR 11 PNR, Western Grebes and Bonaparte's Gulls are two examples of species whose breeding behaviour and habitat preferences make them difficult to monitor on the breeding grounds, but winter surveys such as the Audubon Christmas Bird Count appear to capture trends in abundance well.

Population Monitoring Needs

The most important conservation need in BCR 11 is to protect upland and wetland habitats from further loss, and encourage re-establishment of native habitats. Beyond this objective, there is a range of monitoring and research needs that would be beneficial for the protection and management of priority species. There are several species for which we are uncertain whether populations are increasing, stable or declining. These are typically species that are not surveyed by long-term monitoring programs such as the Breeding Bird Survey or the May Waterfowl Survey and include 1) species at risk, 2) species not well-captured by roadside surveys, 3) wetland-associated species, 4) colony-nesting species and 5) species not well-captured by traditional surveys due to low detection during daylight hours (e.g., Yellow Rail). For BBS data, Hierarchical Bayesian approaches (Link and Sauer 2011) may improve our ability to detect trends for species where power is currently limited. However, the BBS is ultimately dependent on survey effort, and we need to ensure that surveys are continued throughout the region. Other approaches such as the Prairie and Parkland Marsh Monitoring Program as well as individual surveys for colonial birds or species at risk will be useful for species that are not adequately monitored at present. Surveys along migration routes (e.g., migration monitoring of songbirds and raptors) or on the wintering grounds (e.g., Christmas Bird Count) may also provide sufficient information on population trends for some of these species.

While much of our current information on trends comes from large-scale, long-term surveys, these methods also require a large effort in order to provide a sufficiently long time series of data and over a spatial area representative of the species. If these data do not exist already, we may not have sufficient time or resources to develop new trend monitoring programs to quickly inform conservation decisions. As noted earlier, trend data requires many years to accumulate and must cover the majority of the species range to allow us to infer regional population change for a species. Moreover, this type of surveillance monitoring will rarely provide information on why populations are declining, thus limiting our ability to determine how to protect a population even when a decline is observed. If we are to conserve priority bird species in BCR 11 PNR, we must go beyond surveillance monitoring alone and adopt effective monitoring approaches (Nichols and Williams 2006, Lindenmayer 2010a,b) where our objectives and actions are established in such a way as to address the impacts of different threats on populations and identify management methods that meet the conservation goals of Environment Canada's Migratory Bird Program.

A number of effective monitoring approaches would be particularly useful in BCR 11 PNR. A general summary of these are provided here with additional detail in Table 19. Agriculture, oil and gas, and mining operations all impact habitats and species across the prairie region. Programs to assess these effects could use an adaptive management framework (Walters 1986) to examine how abundance and demography (reproduction, survival, dispersal) of different species are impacted by varying levels of disturbance from each industry. This type of information would be critical for environmental assessments and decisions on the extent of development that can be allowed in an area depending on the species present. Similarly, the prairie region contains many areas that are afforded different levels of protection, and by

comparing abundance and demography across these gradients, we could determine the extent to which habitat protection benefits individual species. In both cases, we also need to measure the landscape and micro-habitat associations of priority species and their flexibility in habitat use, particularly as it relates to disturbance.

Protecting populations requires that conservation efforts be directed at all stages of the annual cycle, but we currently have a limited understanding of the degree of migratory connectivity for many populations or the factors affecting them during the migration or winter periods. A better understanding of this topic may be especially critical for some landbirds (e.g., Sillett and Holmes 2002) and shorebirds (Baker et al. 2004). Another topic of concern across Canada is the recent declines of aerial insectivores. It is currently unclear what is causing these declines, but agricultural practices (Ghilain and Belisle 2008) and climate change (Dionne et al. 2008) are both possibilities. As with the cases above, this may be addressed in part by an adaptive management framework, and Rioux et al. (2010) provide an example of how effective monitoring was applied to conservation efforts for Chimney Swifts in Quebec, Canada.

A recent Environment Canada review (Avian Monitoring Review Steering Committee 2012) of avian monitoring programs in Canada made recommendations for needed improvements to monitoring for each of the four main species groups. These recommendations reflect monitoring priorities at the national level; some are consistent with the more specific recommendations above, while others apply primarily to other regions. The key recommendations are:

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

- complete a first round of Arctic PRISM breeding shorebird surveys to obtain reliable population estimates and baseline distribution information across the Arctic;
- develop more reliable sampling methods for counting shorebirds in migration to address concerns about bias; and
- increase Latin American involvement in monitoring shorebirds on the wintering grounds, including Red Knot.

Waterbirds

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

Waterfowl

- develop strategies to reduce expenditures on the prairie and eastern waterfowl breeding surveys, while retaining acceptable precision in population estimates;
- review the information needs and expenditures for arctic goose and duck banding programs;
- reduce the number of Greater Snow Goose survey components;
- redesign the Trumpeter Swan surveys; and
- realign resources for eider and scoter monitoring to a more efficient suite of surveys.

Table 19. Specific monitoring needs for priority species in BCR 11.
The objectives include programs whose purpose is to identify population trends over time (surveillance monitoring) and use science-based approaches combined with adaptive management to identify declines and the causal factors behind them (effective monitoring).

Objective	Actions	Justifications
Develop or maintain monitoring programs for all birds in BCR 11 including identifying population trends, causal mechanisms behind population change and determining population targets and goals to achieve conservation objectives.	Increase monitoring effort for landbirds and shorebirds, specifically species with poor trend data (low precision of Breeding Bird Survey (BBS) trends – SE of 20 yr trend >0.02 or trends based on Christmas Bird Count trend graphs).	First step is to increase the precision of BBS data by re-initiating surveys on vacant routes (for the BBS and Grassland Monitoring programs) and employing Bayesian statistical approaches with greater power to control variability and detect trends. 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. New programs will need to be considered for species that are not adequately monitored or not monitored using existing monitoring programs (e.g., irruptive species, nomadic species, woodpeckers, grouse, diurnal raptors); and species at risk (federal, provincial/territorial).
	Identify the impacts of development and disturbance from agriculture, oil and gas, mining and recreation on habitat use, demography and abundance of birds in BCR 11.	Many species have already been identified as being negatively affected by the actions of these industries, most notable the loss of habitat that results. Proper protection for priority species will require us to evaluate the extent to which demography and abundance of different species are influenced by these forms of development and what types of habitat protection will be necessary to prevent any further declines. This effort will require collaboration among various scientists – wildlife biologists, climatologists, geologists, land use planners. Also requires collaborative partnerships between scientists, managers, and industry.
	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; see Walters 1986).	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.
	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 BCR 11 species monitored and the number of stations in Canada's	Research is needed on analytical methods and precision estimation. Analysis and reporting should be conducted annually. Currently The Canadian Migration Monitoring Network (CMMN) monitors 150 species of landbirds at 20 stations across Canada.

Table 19 continued

Objective	Actions	Justifications
	prairie provinces.	
	Specific Action: Continue to expand and improve migration monitoring for raptors by supporting RPI (Raptor Population Index).	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.
	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.
	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 effort in order to assess distribution, abundance, status, population trend and mechanisms behind population decline.
	Specific Action: Improve quality of data for species which can be most easily monitored on temperate wintering grounds by conducting additional winter surveys (e.g., Christmas Bird Count).	Research is needed on analytical methods and precision estimation. Analysis and reporting should be conducted annually. Many landbird species cannot be monitored solely with temperate breeding season surveys but may be monitored with temperate wintering ground surveys. Knowledge of migratory connectivity (see below) can help relate wintering and breeding populations.
	Specific Action: Develop a sampling design for non-colonial waterbird species (e.g., Pied-billed Grebe, Horned Grebe, Black-crowned Night Heron, American Bittern, Sora, Virginia Rail).	The sampling protocol for non-colonial waterbirds (including 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 and timing of surveys; type of census procedure (ground; passive, call-playback, combination of passive and call-playback). The Prairie and Parkland Marsh Monitoring Program covers these objectives and survey techniques at present.
	Specific Action: Develop a specific sampling protocol for monitoring breeding colonial waterbirds in the prairies.	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.
	General Action: Increase monitoring effort for waterfowl,	Aerial breeding waterfowl surveys are conducted across PNR BCRs (FWS, CWS) but only widely

Table 19 continued

Objective	Actions	Justifications
	specifically species with poor trend data (e.g., PT score=3) or species not monitored by U.S. Fish and Wildlife Service (FWS) and Canadian Wildlife Service (CWS).	distributed and abundant species are surveyed. Additional monitoring effort is required to adequately survey some diving ducks (e.g., scoters) and cavity-nesting ducks (e.g., mergansers) in BCR 11.
Periodically assess the ability of programs to monitor populations and identify causes of declines. Effort and funds may need to be shifted among programs depending on productivity and efficiency to collect required data.	Complete all phases of Environment Canada's Avian Monitoring Review; Phase 1 – develop the review process, Phase 2 – assess current monitoring programs (compare programs to Migratory Bird program needs), Phase 3 – conduct detailed quantitative assessment of select monitoring programs, Phase 4 – discuss, recommend, and re-design monitoring programs, Phase 5 – implement select monitoring program shifts.	The Avian Monitoring Review will evaluate existing monitoring programs against MB program needs to determine: cancellation of programs, enhancement or adjustment to programs to meet MB program needs, re-design of programs to increase effectiveness and reduce costs, and creation of new programs to address key MB program needs. This works needs to be completed before a Coordinated Bird Monitoring (CBM) plan can be put in place.
	Develop a Coordinated Bird Monitoring (CBM) plan for Canada.	CBM is a comprehensive approach to monitoring that will provide information on all non-game bird species. The goal of CBM is to increase the efficiency and utility of bird monitoring through improved coordination. Federal, provincial, NGO need to work together to design continental and regional programs to monitor bird abundance. The objectives of CBM are to: 1) define a small number of survey programs, 2) reach agreement on methods, and 3) convince federal agencies and national organizations to take leadership roles in coordinating and conducting these surveys. Opportunities include a single directory of existing programs; common goals (e.g., accuracy targets); communication between initiatives about surveys for which additional species should be recorded; shared procedures for data management; and coordinated funding and reporting procedures.
	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	NABCI offers a vehicle for scientific organizations to direct activities, in collaboration with management organizations, toward meeting avian conservation goals.

Table 19 continued

Objective	Actions	Justifications
	adaptive approach to bird conservation.	
	General Action: 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.
	Specific Action: Modify existing monitoring programs or identify new monitoring programs that maximize shorebird survey effort and funds in the prairie region.	Ground-based wetland surveys during the breeding season include waterfowl surveys and Marsh Bird Monitoring surveys in May-June. Recommendations: determine which shorebird species could be effectively monitored using these protocols in BCR 11.
	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.
	General Action: Develop and implement a shorebird and waterbird monitoring strategy within PNR with the goal of monitoring the health of populations (distribution; abundance; population trends); understanding the effects of human activities on birds (habitat relationships; demography); and understanding regional population dynamics in relation to natural and anthropogenic factors in upland and wetland habitats.	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). There is currently very little information on secretive marsh birds or colonial waterbirds in BCR 11. Programs should use an adaptive management framework where possible.
Develop studies to further our knowledge on how species abundance varies across the range in relation to habitat quality and how individual fitness and demography vary with habitat.	Combine detailed field studies of habitat selection with spatial modeling to predict occurrence and distribution for priority species across BCR 11.	For many of our species, we still have a poor understanding on their exact habitat needs and how reproduction, survival and dispersal vary across habitat types. Once habitat requirements are identified at landscape and microhabitat scales, that knowledge combined with satellite imagery can be used to predict species presence and abundance at large spatial scales in BCR 11. Any predictions using this approach should be followed up with ground-truthing to test the accuracy of models. After models have been tested, their predictions could be used to

Table 19 continued

Objective	Actions	Justifications
		identify key areas for protection for particular priority species.
		Habitat selection can consider hierarchical approaches 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.
	Develop guidelines for the development of consistent habitat mapping across all landscapes using a variety of modeling 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 modeling 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.
	Identify the effects of certain habitat enhancement programs on productivity for grassland birds.	We need to ensure that conservation efforts for some species are not detrimental to others. Waterfowl enhancement programs may attempt to modify nesting habitat in a manner that is detrimental to grassland landbirds or shorebirds which require sparse, short vegetation for nesting. Programs for these different need to work together to find an optimal solution that meets the habitat requirements for waterfowl, landbirds and shorebirds.
	Identify important habitat and promote approaches that integrate habitat conservation and economic sustainability.	In BCR 11, partnerships between stakeholders are key to 1) identifying, and 2) conserving high priority avian conservation areas. Specific conservation planning tools like Marxan can be used to identify high value avian conservation areas for prairie species. These potential conservation areas can be included in land use models as possible mitigation or conservation strategies needed to compensate for or counteract high intensity resource activities.
Implement programs to understand declines in aerial insectivores	Combine monitoring with demographic studies and population modeling to examine which species are declining, where declines are occurring and attempt to identify	Effective monitoring based on adaptive management can be used with existing programs to help infer causes of declines. Specific studies in both breeding and wintering areas might also be used to further our understanding of the mechanisms affecting populations.

Table 19 continued

Objective	Actions	Justifications
	covariates associated with population change.	

Research Needs

The focus of this section is to outline the main areas where a lack of information hindered our 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 (Table 20). 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.

Table 20. General research objectives in BCR 11 PNR.

Note that in many cases it is not possible to distinguish certain monitoring programs (particularly effective monitoring, Nichols and Williams 2006) from research programs.

Objective	Actions	Justifications
Determine the extent of connectivity among populations on the breeding grounds.	Identify the frequency and scale of dispersal among populations across species ranges to define population units.	Need to determine whether local-scale population change (increase or decrease) is due to: simple shifts in abundance (immigration and emigration), changes in mortality or reproduction at the local site, or changes in abundance at regional or continental scales. Understanding the link between population trends, habitat changes, and the extent of population declines may be difficult without some understanding of the spatial scale associated with a species population dynamics. For example, understanding the scale and frequency of dispersal and factors influencing dispersal will assist in defining biologically meaningful population units. This is a key research gap.
Improve knowledge of migratory connectivity to relate winter population trends to breeding populations.	Utilize isotopes, rare elements, genetics, geolocators or satellite telemetry (including combinations of these) to further our understanding of migratory connectivity for priority species in BCR 11.	Some priority species in BCR 11 are difficult to monitor on the breeding grounds due to behaviour or breeding habitat. If these species are easier to survey on the wintering grounds then knowledge of migratory connectivity can help relate trends for wintering populations back to specific breeding areas.
Organize research and monitoring efforts in 5 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	Support basic research into avian life history and bird-habitat relationships at appropriate spatial scales (e.g., regional or sub-regional). Support collaborative partnerships	These 5 priority areas represent the general needs of scientists, managers, and policy makers for meeting avian conservation objectives. Recommendations are based on outcomes from U.S. Geological Survey (USGS) workshop-Science for Avian Conservation: Understanding, Modeling, and Applying Ecological Relationships in 2000.

Table 20 continued

Objective	Actions	Justifications
populations; 3) integration of information-develop and use models like habitat, population, habitat-population dynamics, land use, conservation planning;	to develop and use models. Support implementation of Canadian BCR plans. Improve communication of avian conservation objectives to stakeholders and the general public.	

Threats Outside Canada

Many bird species found in Canada spend a large portion of their lifecycle outside of the country (Fig. 21). Of the 118 priority species in BCR 11 PNR, only 1 (the Canada Goose) winters in appreciable numbers within the BCR. The remainder are migratory and spend part of their annual cycle—up to half the year or more—outside Canada. Many of the wetland-dependent species overwinter in the southern U.S. and northern Mexico or along the Pacific Coast of Canada and the United States. Many shorebird species migrate even further to overwintering sites in the Caribbean, Central America or South America. Landbirds display a range of migration strategies with many remaining in the United States, particularly members of Emberizidae (sparrows, longspurs, juncos and buntings) and Fringillidae (finches). A few passerines are Neotropical migrants and over-winter in the Caribbean or Central and South America. In particular, these include members of Apodidae (swifts), Tyrannidae (flycatchers) and Parulidae (warblers). Raptors also show a diverse range of wintering areas with some remaining in the central and southern United States (e.g., Short-eared Owl) while others migrate as far as southern South America (e.g., Swainson's Hawk).

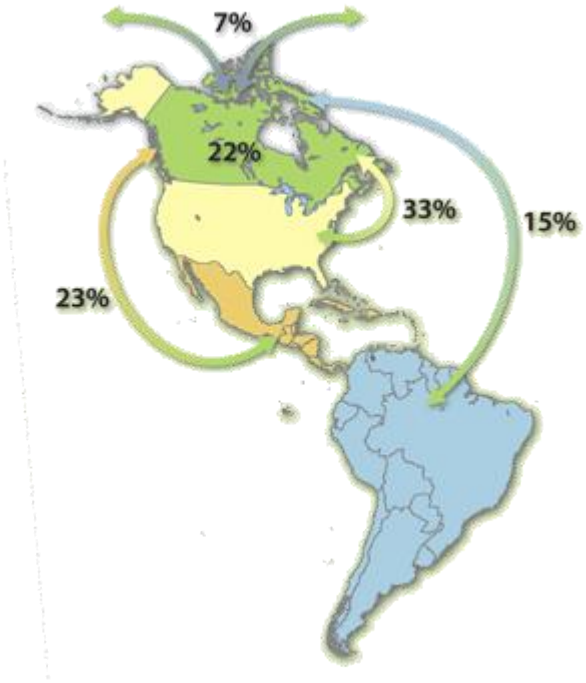

Figure 21. Percent of Canadian breeding birds that migrate to regions outside of Canada for part of their life cycle (North American Bird Conservation Initiative 2012).

Population studies of many species traditionally focused on the breeding grounds, and for some groups such as waterfowl, this appears to be the most influential period of the annual cycle (Prairie Habitat Joint Venture 2008). However, for other groups such as landbirds and shorebirds, we now realize that the non-breeding season may have a greater influence on

population change (Sillett and Holmes 2002, Baker et al. 2004, Calvert et al. 2009). Conservation efforts therefore need to be directed at all stages of the annual cycle.

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 of the United States may have been missed. An absence of threats in a region may reflect that the necessary research has not yet been conducted (or may not be published in English). Because information on bird distributions during the non-breeding season is limited, we were unable to assess the scope and severity of threats to priority species while they are outside of Canada.

Many of the threats that species face on the non-breeding grounds are similar to those on the breeding grounds, with habitat loss being one of the most influential. Deforestation is a problem throughout many parts of the Neotropics (Wright 2005) and poses a threat to species such as Olive-sided Flycatcher and Golden-winged Warbler (Martin and Finch 1995, Altman and Salabanks 2000). Many coastal habitats are threatened by development, a serious concern for species such as Blue-winged Teal and Black-crowned Night Heron that over-winter in mangroves (Petit et al. 1993), as well as many species that require coastal beaches and rocky areas, including Sanderling, Whimbrel and Willet (Senner and Howe 1984). Many grassland birds utilize open habitats on their wintering grounds in the southern US and northern Mexico, and although they are typically more flexible in their habitat use during this period, the loss of certain habitat types can negatively impact populations (Samson and Knopf 1994). As on the breeding grounds, habitat loss from agriculture, forestry, oil and gas development, mining, hydro operations, and urbanization may also be a problem in specific areas.

A few threats are relatively more influential on the non-breeding grounds than on the breeding grounds in BCR 11 PNR. Many countries in the Caribbean and, Central and South America do not regulate hunting to the same extent as Canada and the United States, and therefore illegal harvest may be a serious issue for some species (Fig. 22). In addition, there are many species for which hunting is prohibited in Canada but allowed in other countries (e.g., most shorebirds). As in parts of Canada, the persecution of species viewed as competitors with fisheries is a problem for some waterbirds that breed in BCR 11 PNR.

Another issue that may be more severe during the non-breeding period is pollution, which can take several forms. Oil spills such as the BP spill that occurred off the Louisiana coast in 2010 are a threat to waterbirds, shorebirds, waterfowl and marsh landbirds that over-winter in

coastal habitats. Certain pesticides that are now banned in Canada are still permitted in parts of Central or South America. For example, a major cause of declining populations of Swainson's Hawks in the 1980s and 1990s was the use of pesticides such as DDT and monocrotophus by farmers on the wintering grounds in Argentina (Goldstein et al. 1996). Groups within the U.S. and Canada have since worked with Argentine farmers to resolve this issue.

The effects of climate change may also manifest differently across the wintering range for species in BCR 11. Predicted effects on entire ecosystems include reduced dry-season precipitation throughout the Caribbean (Neelin et al. 2006) and Amazon (Betts et al. 2008), both of which will lead to habitat alteration, loss of cloud forest habitat in Central America (McCarty 2001) and increased severity of hurricanes in the Atlantic (Elsner 2006).

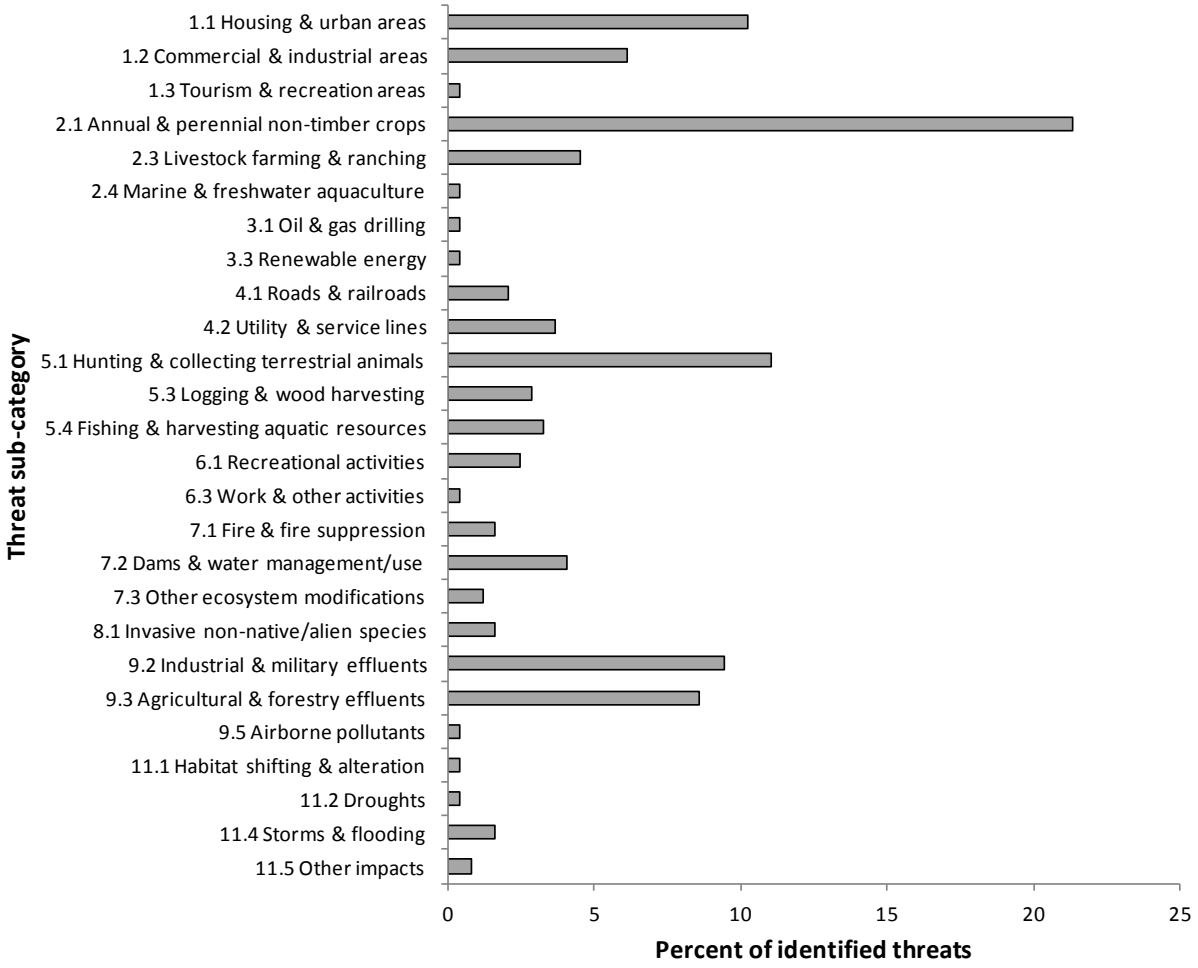

Figure 22: Percent of identified threats to priority species (by threat sub-category) in BCR 11 PNR when they are outside Canada.
Magnitudes could not be assigned for threats outside Canada due to lack of information on scope and severity.

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, NGOs and citizens will benefit from the information. BCR strategies can be used in many different ways depending on the needs of the user, who may focus on one or more of the elements of the strategy to guide their conservation projects.

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

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Appendix 1

List of All Bird Species in BCR 11 PNR

Table A1. Complete list of species in BCR 11 PNR in taxonomic order, their priority status and whether they primarily use BCR 11 for breeding, breeding and overwintering, or during migration. Species that use the BCR during the breeding or wintering seasons were not included in the migrant column.

Taxon	Scientific Name	Breeding	Migrant	Wintering	Priority Species?
Greater White-fronted Goose	*Anser albifrons*		Yes		Yes
Lesser Snow Goose (Mid-Continent)	*Chen caerulescens caerulescens*		Yes		Yes
Lesser Snow Goose (Western Arctic)	*Chen caerulescens caerulescens*		Yes		Yes
Lesser Snow Goose (Western Central Flyway)	*Chen caerulescens caerulescens*		Yes		Yes
Lesser Snow Goose (Wrangel Island)	*Chen caerulescens caerulescens*		Yes		Yes
Snow Goose	*Chen caerulescens*		Yes		
Ross's Goose	*Chen rossii*		Yes		Yes
Cackling Goose	*Branta hutchinsii*		Yes		
Cackling Goose (Richardson's)	*Branta hutchinsii hutchinsii*		Yes		
Cackling Goose (Shortgrass Prairie)	*Branta hutchinsii*		Yes		Yes
Cackling Goose (Tallgrass Prairie)	*Branta hutchinsii*		Yes		Yes
Canada Goose	*Branta canadensis*	Yes			
Canada Goose (Eastern Prairie)	*Branta canadensis*	Yes		Yes	Yes
Canada Goose (Hi-Line)	*Branta canadensis*	Yes			Yes
Canada Goose (Rocky Mountain)	*Branta canadensis*	Yes			
Canada Goose (Temperate-breeding in Eastern Canada)	*Branta canadensis*	Yes			Yes
Canada Goose (Western Prairie and Great Plains)	*Branta canadensis*	Yes			Yes
Trumpeter Swan	*Cygnus buccinator*	Yes			
Trumpeter Swan (Interior)	*Cygnus buccinator*	Yes			Yes
Trumpeter Swan (Rocky Mountain)	*Cygnus buccinator*	Yes			Yes
Tundra Swan	*Cygnus columbianus*		Yes		Yes
Tundra Swan (Eastern)	*Cygnus columbianus*		Yes		
Tundra Swan (Western)	*Cygnus columbianus*		Yes		
Wood Duck	*Aix sponsa*	Yes			
Gadwall	*Anas strepera*	Yes			Yes
American Wigeon	*Anas americana*	Yes			Yes
American Black Duck	*Anas rubripes*	Yes			
Mallard	*Anas platyrhynchos*	Yes		Yes	Yes
Blue-winged Teal	*Anas discors*	Yes			Yes
Cinnamon Teal	*Anas cyanoptera*	Yes			
Northern Shoveler	*Anas clypeata*	Yes			Yes

Table A1 continued

Taxon	Scientific Name	Breeding	Migrant	Wintering	Priority Species?
Northern Pintail	*Anas acuta*	Yes			Yes
Green-winged Teal	*Anas crecca*	Yes			Yes
Canvasback	*Aythya valisineria*	Yes			Yes
Redhead	*Aythya americana*	Yes			Yes
Ring-necked Duck	*Aythya collaris*	Yes			Yes
Greater Scaup	*Aythya marila*	Yes			
Lesser Scaup	*Aythya affinis*	Yes			Yes
White-winged Scoter	*Melanitta fusca*	Yes			Yes
Bufflehead	*Bucephala albeola*	Yes			Yes
Common Goldeneye	*Bucephala clangula*	Yes		Yes	
Barrow's Goldeneye	*Bucephala islandica*	Yes			
Hooded Merganser	*Lophodytes cucullatus*	Yes			
Common Merganser	*Mergus merganser*	Yes			
Red-breasted Merganser	*Mergus serrator*	Yes			
Ruddy Duck	*Oxyura jamaicensis*	Yes			Yes
Gray Partridge	*Perdix perdix*	Yes		Yes	
Ring-necked Pheasant	*Phasianus colchicus*	Yes		Yes	
Ruffed Grouse	*Bonasa umbellus*	Yes		Yes	
Greater Sage-Grouse (urophasianus)	*Centrocercus urophasianus urophasianus*	Yes		Yes	Yes
Dusky Grouse	*Dendragapus obscurus*	Yes		Yes	
Sharp-tailed Grouse	*Tympanuchus phasianellus*	Yes		Yes	Yes
Greater Prairie-Chicken	*Tympanuchus cupido*	Yes		Yes	Yes
Common Loon	*Gavia immer*	Yes			Yes
Pied-billed Grebe	*Podilymbus podiceps*	Yes			Yes
Horned Grebe	*Podiceps auritus*	Yes			Yes
Red-necked Grebe	*Podiceps grisegena*	Yes			Yes
Eared Grebe	*Podiceps nigricollis*	Yes			Yes
Western Grebe	*Aechmophorus occidentalis*	Yes			Yes
Clark's Grebe	*Aechmophorus clarkii*	Yes			Yes
Double-crested Cormorant	*Phalacrocorax auritus*	Yes			
American White Pelican	*Pelecanus erythrorhynchos*	Yes			Yes
American Bittern	*Botaurus lentiginosus*	Yes			Yes
Least Bittern	*Ixobrychus exilis*	Yes			Yes
Great Blue Heron	*Ardea herodias*	Yes			Yes
Great Egret	*Ardea alba*	Yes			
Cattle Egret	*Bubulcus ibis*	Yes			
Green Heron	*Butorides virescens*	Yes			

Table A1 continued

Taxon	Scientific Name	Breeding	Migrant	Wintering	Priority Species?
Black-crowned Night-Heron	*Nycticorax nycticorax*	Yes			Yes
White-faced Ibis	*Plegadis chihi*	Yes			
Turkey Vulture	*Cathartes aura*	Yes			
Osprey	*Pandion haliaetus*	Yes			
Bald Eagle	*Haliaeetus leucocephalus*	Yes			
Northern Harrier	*Circus cyaneus*	Yes			Yes
Sharp-shinned Hawk	*Accipiter striatus*	Yes			
Cooper's Hawk	*Accipiter cooperii*	Yes			
Northern Goshawk	*Accipiter gentilis*	Yes			
Broad-winged Hawk	*Buteo platypterus*	Yes			
Swainson's Hawk	*Buteo swainsoni*	Yes			Yes
Red-tailed Hawk	*Buteo jamaicensis*	Yes			
Ferruginous Hawk	*Buteo regalis*	Yes			Yes
Rough-legged Hawk	*Buteo lagopus*			Yes	
Golden Eagle	*Aquila chrysaetos*	Yes		Yes	Yes
American Kestrel	*Falco sparverius*	Yes			
Merlin	*Falco columbarius*	Yes			
Gyrfalcon	*Falco rusticolus*			Yes	
Peregrine Falcon	*Falco peregrinus*	Yes			Yes
Prairie Falcon	*Falco mexicanus*	Yes			Yes
Yellow Rail	*Coturnicops noveboracensis*	Yes			Yes
Virginia Rail	*Rallus limicola*	Yes			Yes
Sora	*Porzana carolina*	Yes			Yes
American Coot	*Fulica americana*	Yes			
Sandhill Crane	*Grus canadensis*	Yes			
Whooping Crane	*Grus americana*		Yes		Yes
Black-bellied Plover	*Pluvialis squatarola*		Yes		Yes
American Golden-Plover	*Pluvialis dominica*		Yes		Yes
Snowy Plover	*Charadrius nivosus*	Yes			
Semipalmated Plover	*Charadrius semipalmatus*		Yes		
Piping Plover	*Charadrius melodus*	Yes			Yes
Killdeer	*Charadrius vociferus*	Yes			Yes
Mountain Plover	*Charadrius montanus*	Yes			Yes
Black-necked Stilt	*Himantopus mexicanus*	Yes			
American Avocet	*Recurvirostra americana*	Yes			Yes
Spotted Sandpiper	*Actitis macularius*	Yes			Yes
Solitary Sandpiper	*Tringa solitaria*	Yes			

Table A1 continued

Taxon	Scientific Name	Breeding	Migrant	Wintering	Priority Species?
Greater Yellowlegs	*Tringa melanoleuca*		Yes		
Willet	*Tringa semipalmata*	Yes			Yes
Lesser Yellowlegs	*Tringa flavipes*		Yes		
Upland Sandpiper	*Bartramia longicauda*	Yes			Yes
Eskimo Curlew	*Numenius borealis*		Yes		Yes
Whimbrel	*Numenius phaeopus*		Yes		Yes
Long-billed Curlew	*Numenius americanus*	Yes			Yes
Hudsonian Godwit	*Limosa haemastica*		Yes		Yes
Marbled Godwit	*Limosa fedoa*	Yes			Yes
Ruddy Turnstone	*Arenaria interpres*		Yes		Yes
Red Knot	*Calidris canutus*		Yes		Yes
Sanderling	*Calidris alba*		Yes		Yes
Semipalmated Sandpiper	*Calidris pusilla*		Yes		Yes
Western Sandpiper	*Calidris mauri*		Yes		
Least Sandpiper	*Calidris minutilla*		Yes		
White-rumped Sandpiper	*Calidris fuscicollis*		Yes		
Baird's Sandpiper	*Calidris bairdii*		Yes		
Pectoral Sandpiper	*Calidris melanotos*		Yes		
Dunlin	*Calidris alpina*		Yes		
Stilt Sandpiper	*Calidris himantopus*		Yes		Yes
Buff-breasted Sandpiper	*Tryngites subruficollis*		Yes		Yes
Short-billed Dowitcher	*Limnodromus griseus*		Yes		Yes
Long-billed Dowitcher	*Limnodromus scolopaceus*		Yes		Yes
Wilson's Snipe	*Gallinago delicata*	Yes			Yes
Wilson's Phalarope	*Phalaropus tricolor*	Yes			Yes
Red-necked Phalarope	*Phalaropus lobatus*		Yes		Yes
Bonaparte's Gull	*Chroicocephalus philadelphia*	Yes			Yes
Franklin's Gull	*Leucophaeus pipixcan*	Yes			Yes
Ring-billed Gull	*Larus delawarensis*	Yes			
California Gull	*Larus californicus*	Yes			
Herring Gull	*Larus argentatus*	Yes			
Caspian Tern	*Hydroprogne caspia*	Yes			Yes
Black Tern	*Chlidonias niger*	Yes			Yes
Common Tern	*Sterna hirundo*	Yes			Yes
Forster's Tern	*Sterna forsteri*	Yes			Yes
Rock Pigeon	*Columba livia*	Yes		Yes	
Eurasian Collared-Dove	*Streptopelia decaocto*	Yes		Yes	

Table A1 continued

Taxon	Scientific Name	Breeding	Migrant	Wintering	Priority Species?
Mourning Dove	*Zenaida macroura*	Yes			
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Yes			Yes
Eastern Screech-Owl	*Megascops asio*	Yes		Yes	Yes
Great Horned Owl	*Bubo virginianus*	Yes		Yes	
Snowy Owl	*Bubo scandiacus*			Yes	
Burrowing Owl	*Athene cunicularia*	Yes		Yes	Yes
Barred Owl	*Strix varia*	Yes		Yes	
Great Gray Owl	*Strix nebulosa*	Yes		Yes	
Long-eared Owl	*Asio otus*	Yes		Yes	Yes
Short-eared Owl	*Asio flammeus*	Yes		Yes	Yes
Northern Saw-whet Owl	*Aegolius acadicus*	Yes			
Common Nighthawk	*Chordeiles minor*	Yes			Yes
Common Poorwill	*Phalaenoptilus nuttallii*	Yes			
Eastern Whip-poor-will	*Caprimulgus vociferus*	Yes			Yes
Chimney Swift	*Chaetura pelagica*	Yes			Yes
Ruby-throated Hummingbird	*Archilochus colubris*	Yes			
Calliope Hummingbird	*Stellula calliope*	Yes			
Rufous Hummingbird	*Selasphorus rufus*	Yes			
Belted Kingfisher	*Megaceryle alcyon*	Yes			
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Yes			Yes
Yellow-bellied Sapsucker	*Sphyrapicus varius*	Yes			
Red-naped Sapsucker	*Sphyrapicus nuchalis*	Yes			
Downy Woodpecker	*Picoides pubescens*	Yes		Yes	
Hairy Woodpecker	*Picoides villosus*	Yes		Yes	
American Three-toed Woodpecker	*Picoides dorsalis*	Yes		Yes	
Black-backed Woodpecker	*Picoides arcticus*	Yes		Yes	
Northern Flicker	*Colaptes auratus*	Yes		Yes	Yes
Pileated Woodpecker	*Dryocopus pileatus*	Yes		Yes	
Olive-sided Flycatcher	*Contopus cooperi*	Yes			Yes
Western Wood-Pewee	*Contopus sordidulus*	Yes			
Eastern Wood-Pewee	*Contopus virens*	Yes			
Yellow-bellied Flycatcher	*Empidonax flaviventris*	Yes			
Alder Flycatcher	*Empidonax alnorum*	Yes			
Willow Flycatcher	*Empidonax traillii*	Yes			Yes
Least Flycatcher	*Empidonax minimus*	Yes			Yes
Dusky Flycatcher	*Empidonax oberholseri*	Yes			
Eastern Phoebe	*Sayornis phoebe*	Yes			

Table A1 continued

Taxon	Scientific Name	Breeding	Migrant	Wintering	Priority Species?
Say's Phoebe	*Sayornis saya*	Yes			
Great Crested Flycatcher	*Myiarchus crinitus*	Yes			
Western Kingbird	*Tyrannus verticalis*	Yes			
Eastern Kingbird	*Tyrannus tyrannus*	Yes			
Loggerhead Shrike	*Lanius ludovicianus*	Yes			Yes
Northern Shrike	*Lanius excubitor*			Yes	
Blue-headed Vireo	*Vireo solitarius*	Yes			
Warbling Vireo	*Vireo gilvus*	Yes			
Philadelphia Vireo	*Vireo philadelphicus*	Yes			
Red-eyed Vireo	*Vireo olivaceus*	Yes			
Blue Jay	*Cyanocitta cristata*	Yes		Yes	
Gray Jay	*Perisoreus canadensis*	Yes		Yes	
Black-billed Magpie	*Pica hudsonia*	Yes		Yes	Yes
American Crow	*Corvus brachyrhynchos*	Yes		Yes	
Common Raven	*Corvus corax*	Yes		Yes	
Horned Lark	*Eremophila alpestris*	Yes		Yes	Yes
Purple Martin	*Progne subis*	Yes			
Tree Swallow	*Tachycineta bicolor*	Yes			
Violet-green Swallow	*Tachycineta thalassina*	Yes			
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	Yes			
Bank Swallow	*Riparia riparia*	Yes			
Cliff Swallow	*Petrochelidon pyrrhonota*	Yes			
Barn Swallow	*Hirundo rustica*	Yes			
Black-capped Chickadee	*Poecile atricapillus*	Yes		Yes	
Boreal Chickadee	*Poecile hudsonica*	Yes		Yes	
Red-breasted Nuthatch	*Sitta canadensis*	Yes		Yes	
White-breasted Nuthatch	*Sitta carolinensis*	Yes		Yes	
Brown Creeper	*Certhia americana*	Yes		Yes	
Rock Wren	*Salpinctes obsoletus*	Yes			
Winter Wren	*Troglodytes hiemalis*	Yes			
House Wren	*Troglodytes aedon*	Yes			
Sedge Wren	*Cistothorus platensis*	Yes			Yes
Marsh Wren	*Cistothorus palustris*	Yes			
Golden-crowned Kinglet	*Regulus satrapa*	Yes			
Ruby-crowned Kinglet	*Regulus calendula*	Yes			
Eastern Bluebird	*Sialia sialis*	Yes			
Mountain Bluebird	*Sialia currucoides*	Yes			

Table A1 continued

Taxon	Scientific Name	Breeding	Migrant	Wintering	Priority Species?
Townsend's Solitaire	*Myadestes townsendi*			Yes	
Veery	*Catharus fuscescens*	Yes			
Swainson's Thrush	*Catharus ustulatus*	Yes			
Hermit Thrush	*Catharus guttatus*	Yes			
American Robin	*Turdus migratorius*	Yes			
Gray Catbird	*Dumetella carolinensis*	Yes			
Sage Thrasher	*Oreoscoptes montanus*	Yes			Yes
Brown Thrasher	*Toxostoma rufum*	Yes			Yes
European Starling	*Sturnus vulgaris*	Yes			
American Pipit	*Anthus rubescens*		Yes		
Sprague's Pipit	*Anthus spragueii*	Yes			Yes
Bohemian Waxwing	*Bombycilla garrulus*			Yes	
Cedar Waxwing	*Bombycilla cedrorum*	Yes			
Lapland Longspur	*Calcarius lapponicus*			Yes	
Smith’s Longspur	*Calcarius pictus*		Yes		
Chestnut-collared Longspur	*Calcarius ornatus*	Yes			Yes
McCown's Longspur	*Rhynchophanes mccownii*	Yes			Yes
Snow Bunting	*Plectrophenax nivalis*			Yes	
Ovenbird	*Seiurus aurocapilla*	Yes			
Northern Waterthrush	*Parkesia noveboracensis*	Yes			
Golden-winged Warbler	*Vermivora chrysoptera*	Yes			Yes
Black-and-white Warbler	*Mniotilta varia*	Yes			
Tennessee Warbler	*Oreothlypis peregrina*	Yes			
Orange-crowned Warbler	*Oreothlypis celata*	Yes			
Nashville Warbler	*Oreothlypis ruficapilla*	Yes			
Connecticut Warbler	*Oporornis agilis*	Yes			
MacGillivray's Warbler	*Geothlypis tolmiei*	Yes			
Mourning Warbler	*Geothlypis philadelphia*	Yes			
Common Yellowthroat	*Geothlypis trichas*	Yes			Yes
American Redstart	*Setophaga ruticilla*	Yes			
Northern Parula	*Setophaga americana*				
Magnolia Warbler	*Setophaga magnolia*	Yes			
Bay-breasted Warbler	*Setophaga castanea*	Yes			
Blackburnian Warbler	*Setophaga fusca*	Yes			
Yellow Warbler	*Setophaga petechia*	Yes			
Blackpoll Warbler	*Setophaga striata*	Yes			
Palm Warbler	*Setophaga palmarum*	Yes			

Table A1 continued

Taxon	Scientific Name	Breeding	Migrant	Wintering	Priority Species?
Chestnut-sided Warbler	*Setophaga pensylvanica*	Yes			
Yellow-rumped Warbler	*Setophaga coronata*	Yes			
Black-throated Green Warbler	*Setophaga virens*	Yes			
Townsend's Warbler	*Setophaga townsendi*	Yes			
Canada Warbler	*Cardellina canadensis*	Yes			
Wilson's Warbler	*Cardellina pusilla*	Yes			
Yellow-breasted Chat	*Icteria virens*	Yes			
Spotted Towhee	*Pipilo maculatus*	Yes			
Eastern Towhee	*Pipilo erythrophthalmus*	Yes			
Brewer's Sparrow	*Spizella breweri*	Yes			
American Tree Sparrow	*Spizella arborea*			Yes	
Chipping Sparrow	*Spizella passerina*	Yes			
Clay-colored Sparrow	*Spizella pallida*	Yes			Yes
Field Sparrow	*Spizella pusilla*	Yes			
Vesper Sparrow	*Pooecetes gramineus*	Yes			
Lark Sparrow	*Chondestes grammacus*	Yes			
Lark Bunting	*Calamospiza melanocorys*	Yes			Yes
Savannah Sparrow	*Passerculus sandwichensis*	Yes			
Grasshopper Sparrow	*Ammodramus savannarum*	Yes			Yes
Baird's Sparrow	*Ammodramus bairdii*	Yes			Yes
Le Conte's Sparrow	*Ammodramus leconteii*	Yes			Yes
Nelson's Sparrow	*Ammodramus nelsoni*	Yes			Yes
Fox Sparrow	*Passerella iliaca*		Yes		
Song Sparrow	*Melospiza melodia*	Yes			
Lincoln's Sparrow	*Melospiza lincolnii*	Yes			
Swamp Sparrow	*Melospiza georgiana*	Yes			
White-throated Sparrow	*Zonotrichia albicollis*	Yes			
Harris's Sparrow	*Zonotrichia querula*		Yes		
White-crowned Sparrow	*Zonotrichia leucophrys*	Yes			
Dark-eyed Junco	*Junco hyemalis*	Yes			
Western Tanager	*Piranga ludoviciana*	Yes			
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	Yes			
Indigo Bunting	*Passerina cyanea*	Yes			
Dickcissel	*Spiza americana*	Yes			
Bobolink	*Dolichonyx oryzivorus*	Yes			Yes
Red-winged Blackbird	*Agelaius phoeniceus*	Yes			
Western Meadowlark	*Sturnella neglecta*	Yes			Yes

Table A1 continued

Taxon	Scientific Name	Breeding	Migrant	Wintering	Priority Species?
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	Yes			
Rusty Blackbird	*Euphagus carolinus*	Yes			Yes
Brewer's Blackbird	*Euphagus cyanocephalus*	Yes			
Common Grackle	*Quiscalus quiscula*	Yes			
Brown-headed Cowbird	*Molothrus ater*	Yes			
Orchard Oriole	*Icterus spurius*	Yes			
Baltimore Oriole	*Icterus galbula*	Yes			
Gray-crowned Rosy-Finch	*Leucosticte tephrocotis*			Yes	
Pine Grosbeak	*Pinicola enucleator*			Yes	
Purple Finch	*Carpodacus purpureus*	Yes			
Cassin's Finch	*Carpodacus cassinii*	Yes			
House Finch	*Carpodacus mexicanus*	Yes			
Red Crossbill	*Loxia curvirostra*	Yes			
White-winged Crossbill	*Loxia leucoptera*			Yes	
Common Redpoll	*Acanthis flammea*			Yes	
Hoary Redpoll	*Acanthis hornemanni*			Yes	
Pine Siskin	*Spinus pinus*	Yes			
American Goldfinch	*Spinus tristis*	Yes			
Evening Grosbeak	*Coccothraustes vespertinus*	Yes			
House Sparrow	*Passer domesticus*	Yes			

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.[1]

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

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

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

- 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.

Within BCR 11, some additional species were added to the priority species list based on the following approach. Species were added based on Provincial GS ranks and expert opinion. The GS rank is a numerical ranking system that represents a species' province-specific status and is reassessed every five years. Species were assessed on GS ranks from 2005, as the 2010 ranks were not yet available. A species must have a GS rank ≤3 in a province that overlaps the species' range within BCR 11 in order to be included as a priority species. Visit wildspecies.ca for more information on GS ranks. In addition to provincial GS ranks, the opinions of BCR-specific experts in each of the four bird groups were used to assess species' priority status. Species were added or removed based on these expert opinions and in all cases, the reasoning behind these decisions were 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, nor 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 (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 (e.g., marine habitats). Species often are assigned to more than one of these coarse habitat classes. To retain the link to regional spatial data (e.g., provincial forest inventories, etc.), or to group species into regionally relevant habitat classes, individual BCR strategies may 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.

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 *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. 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.

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 following 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 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.

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.

Appendix 3

Figures A1-A10. The following figures show Breeding Bird Survey population indices in Canada for 10 priority species showing the strongest declines over the period 1968–2009.
For all figure captions, values in brackets indicate the 95% credible intervals around % annual change.

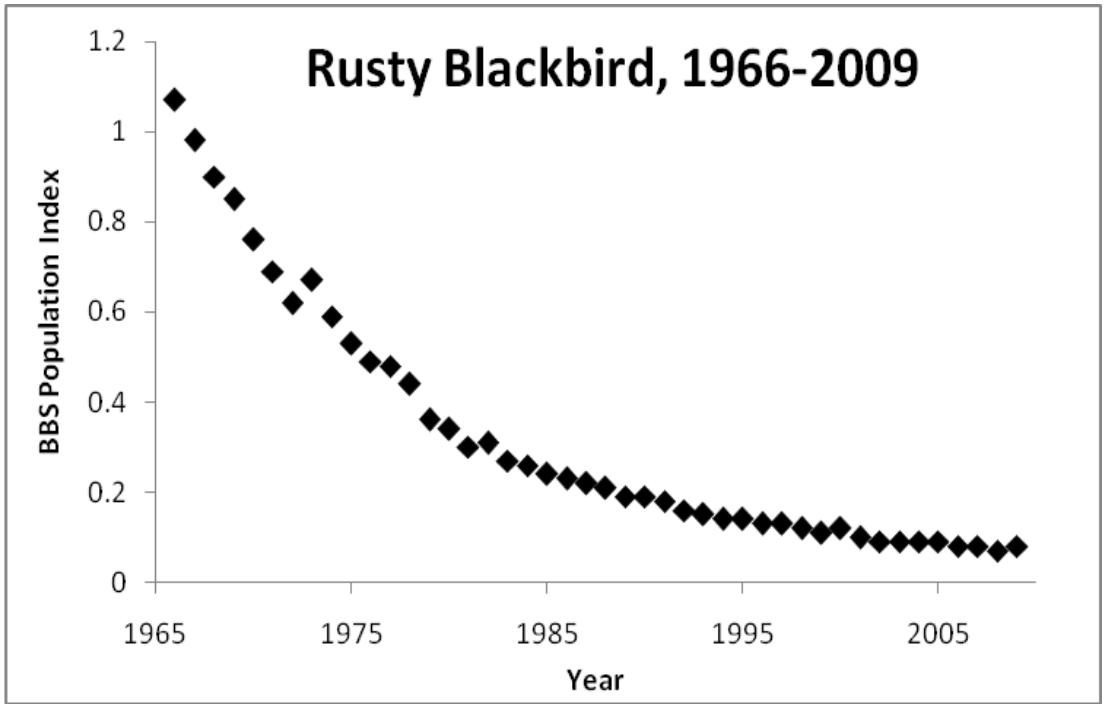

Figure A1. Annual BBS population index for Rusty Blackbird. Annual percent change: -5.7 (-10.83, -0.52).

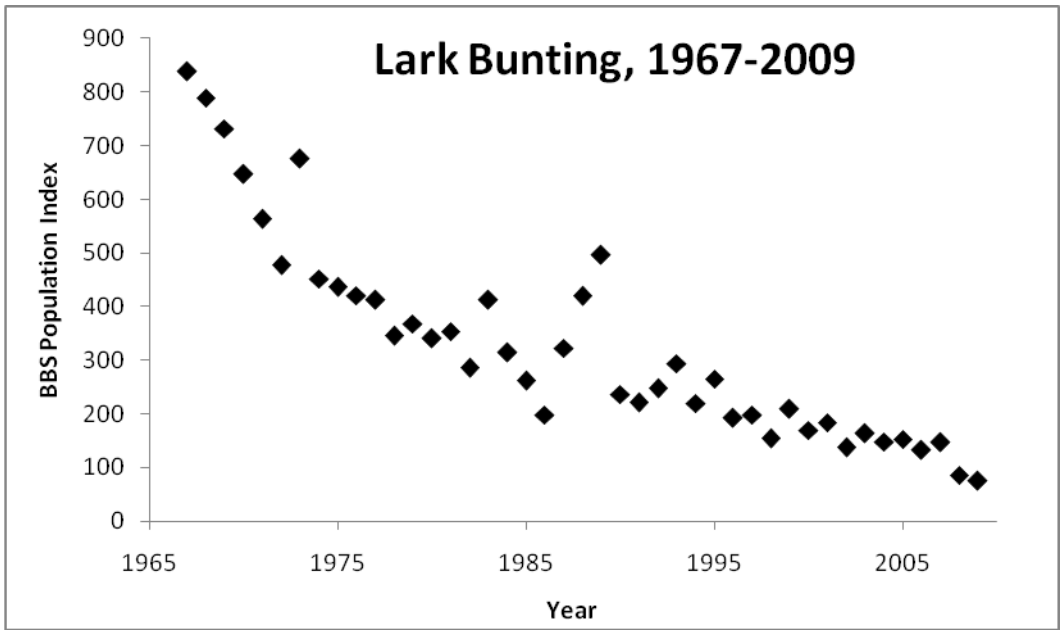

Figure A2. Annual BBS population index for Lark Bunting. Annual percent change: -5.67 (-8.24, -2.93).

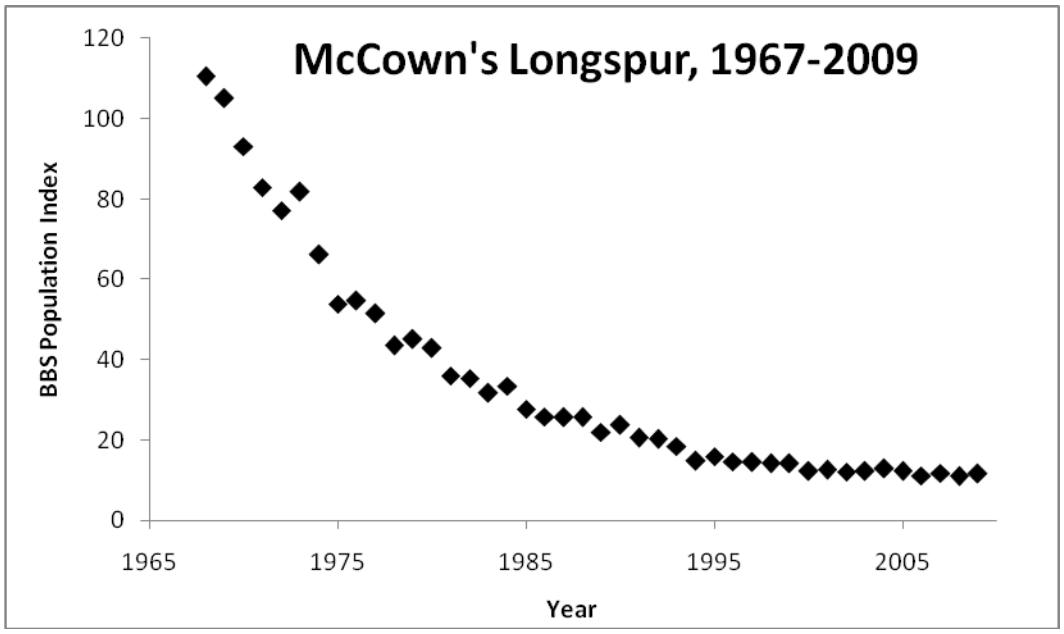

Figure A3. Annual BBS population index for McCown's Longspur. Annual percent change: -5.45 (-8.32, -2.31).

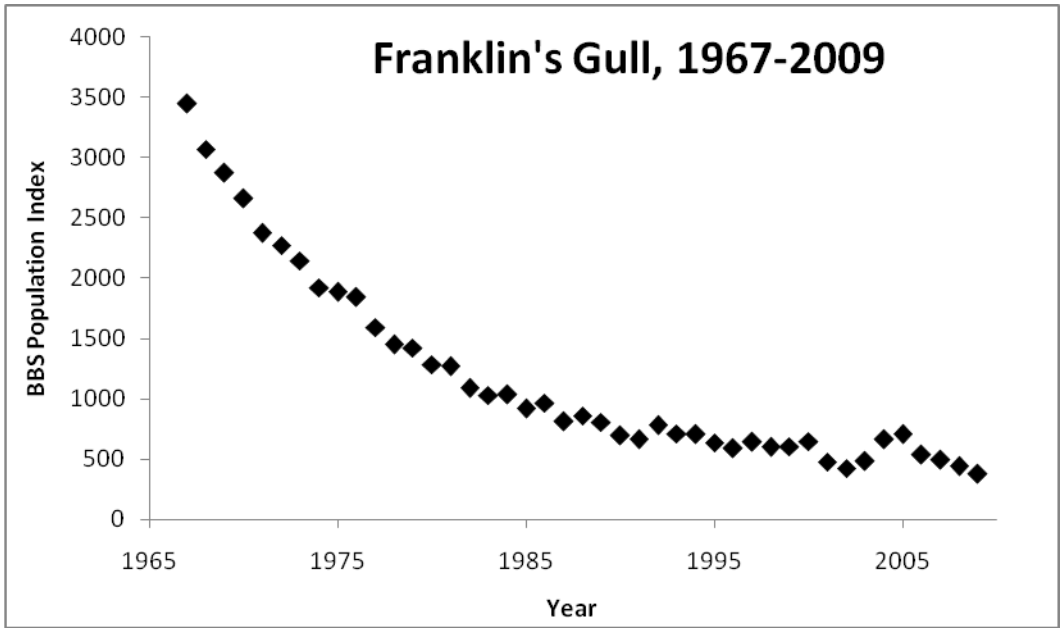

Figure A4. Annual BBS population index for Franklin's Gull. Annual percent change: -4.99 (-8.63, -3.00).

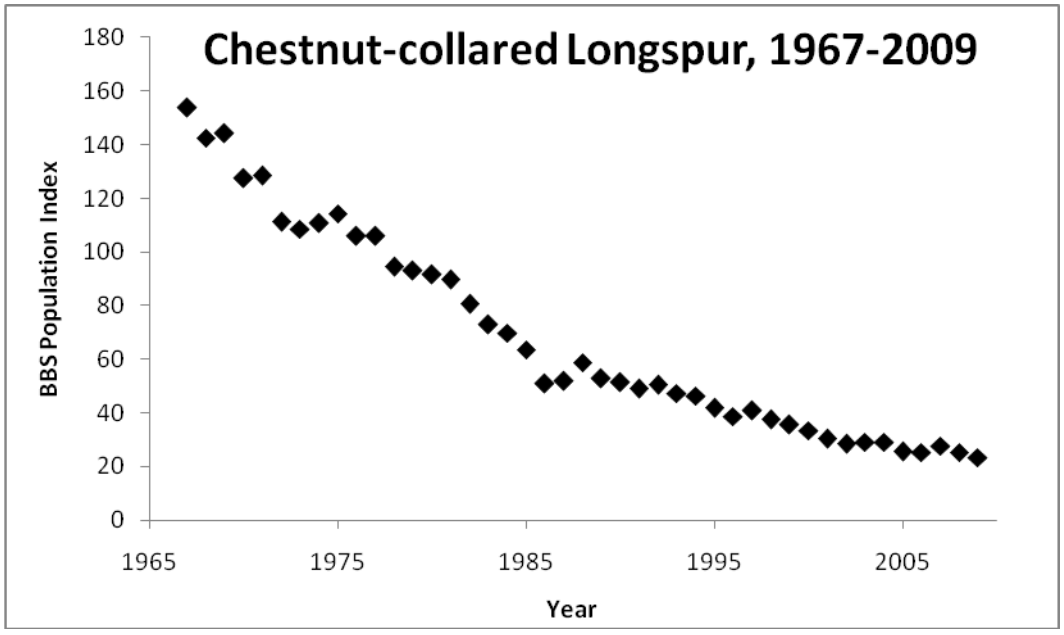

Figure A5. Annual BBS population index for Chestnut-collared Longspur. Annual percent change: -4.42 (-5.36, -3.41).

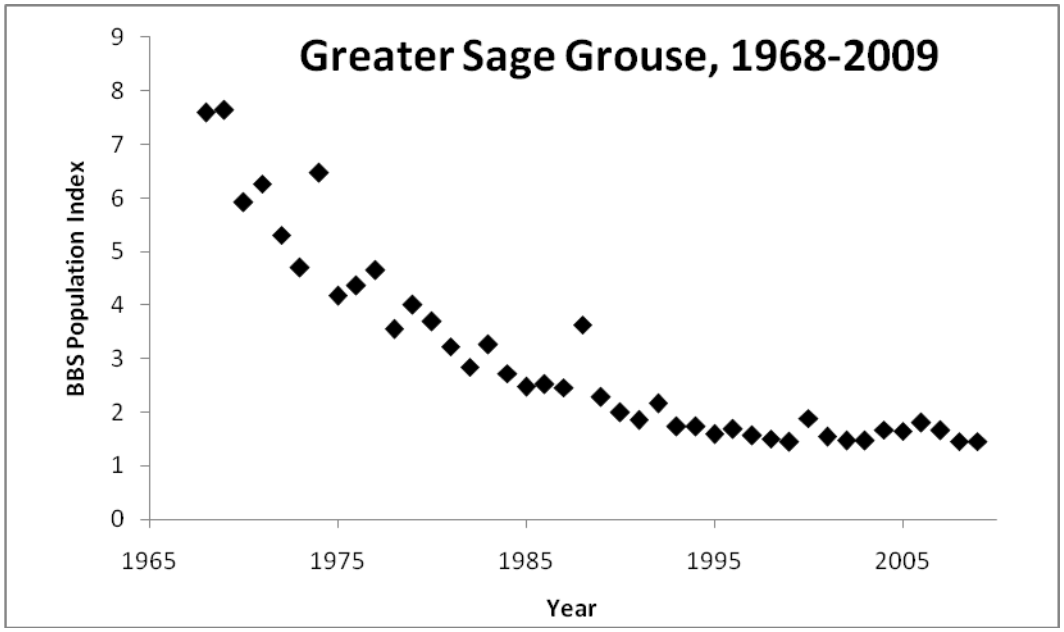

Figure A6. Annual BBS population index for Greater Sage-Grouse. Annual percent change: -4.09 (-7.99, -1.36).

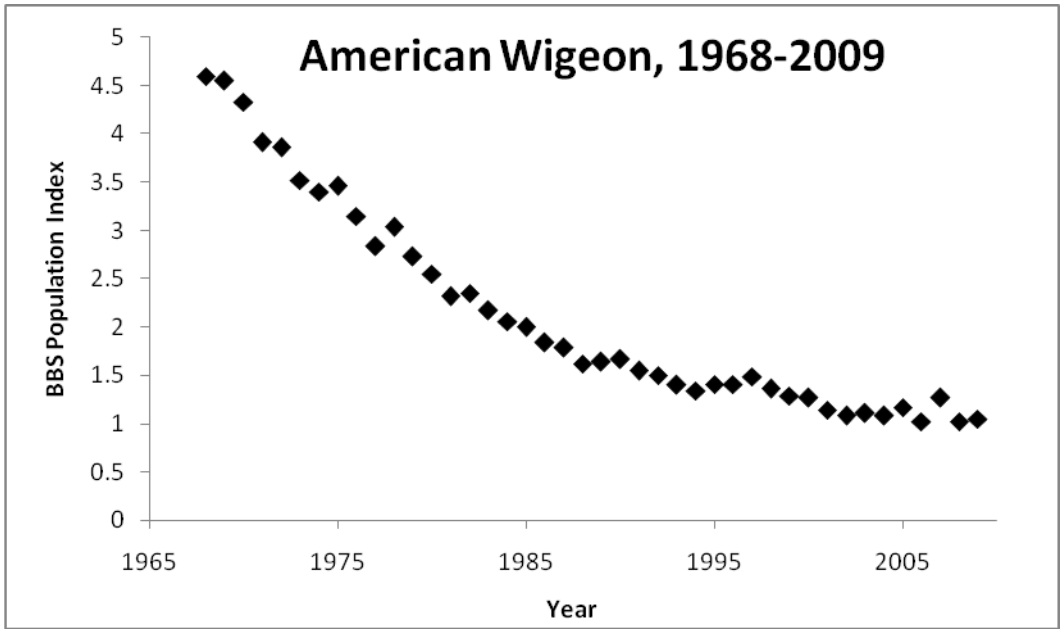

Figure A7. Annual BBS population index for American Wigeon. Annual percent change: -3.62 (-5.42, -2.21).

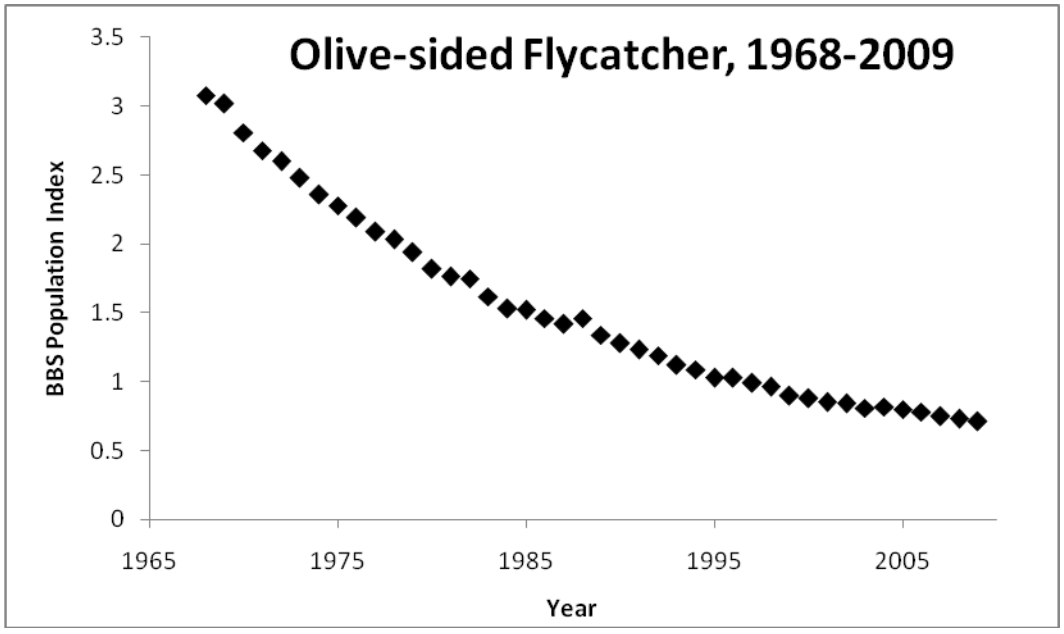

Figure A8. Annual BBS population index for Olive-sided Flycatcher. Annual percent change: -3.48 (-4.52, -2.85).

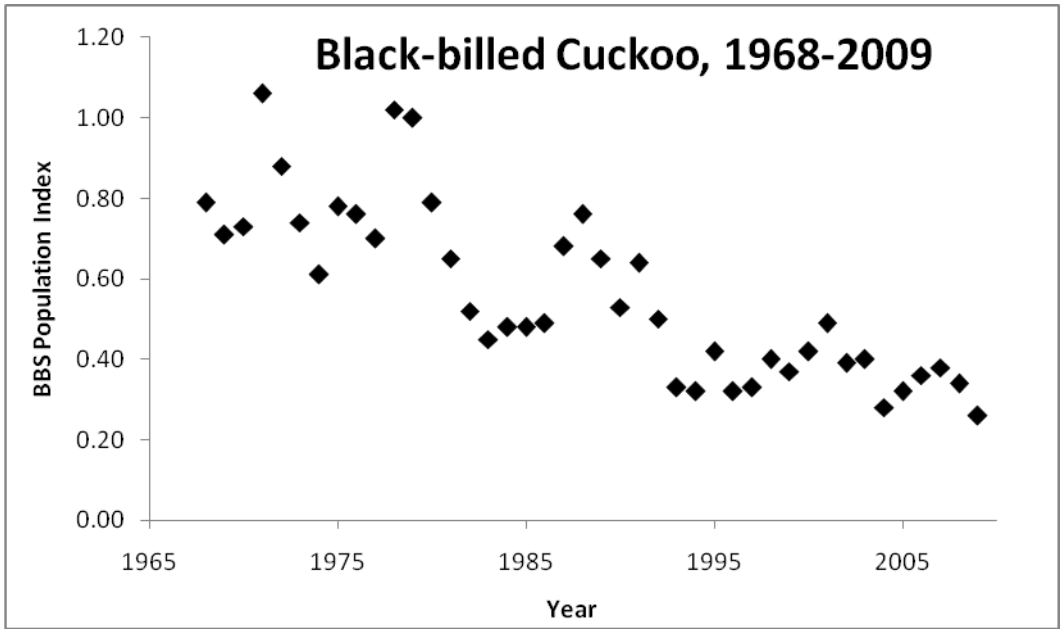

Figure A9. Annual BBS population index for Black-billed Cuckoo. Annual percent change: -3.26 (-8.98, -2.28).

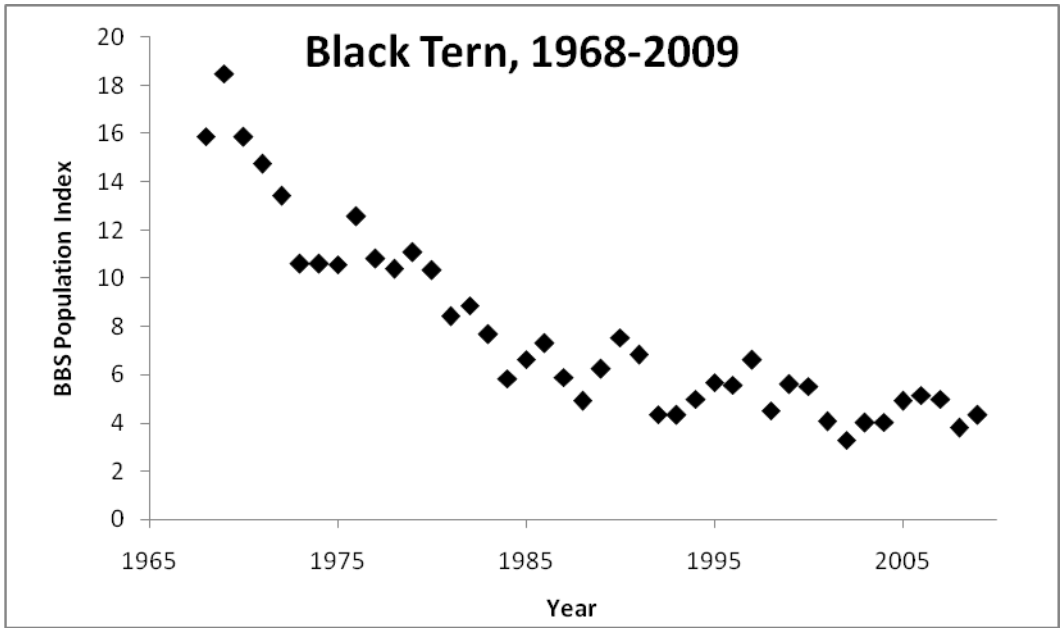

Figure A10. Annual BBS population index for Black Tern. Annual percent change: -3.19 (-6.33, -1.45).

www.**ec.gc.ca**

Additional information can be obtained at:

Environment Canada
Inquiry Centre
10 Wellington Street, 23rd Floor
Gatineau QC K1A 0H3
Telephone: 1-800-668-6767 (in Canada only) or 819-997-2800
Fax: 819-994-1412
TTY: 819-994-0736
Email: enviroinfo@ec.gc.ca