Environment Canada Environnement Canada

Bird Conservation Strategy for Bird Conservation Region 4 in Canada: Northwestern Interior Forest

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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 essential, as is their collaboration in implementing their recommendations.

Environment Canada has developed national standards for these strategies to ensure consistency of approach across BCRs. Bird Conservation Strategies will provide the context from which specific implementation plans can be developed within 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 for developing guidelines and beneficial management practices that support compliance with regulations under the *Migratory Birds Convention Act, 1994*.

Acknowledgements

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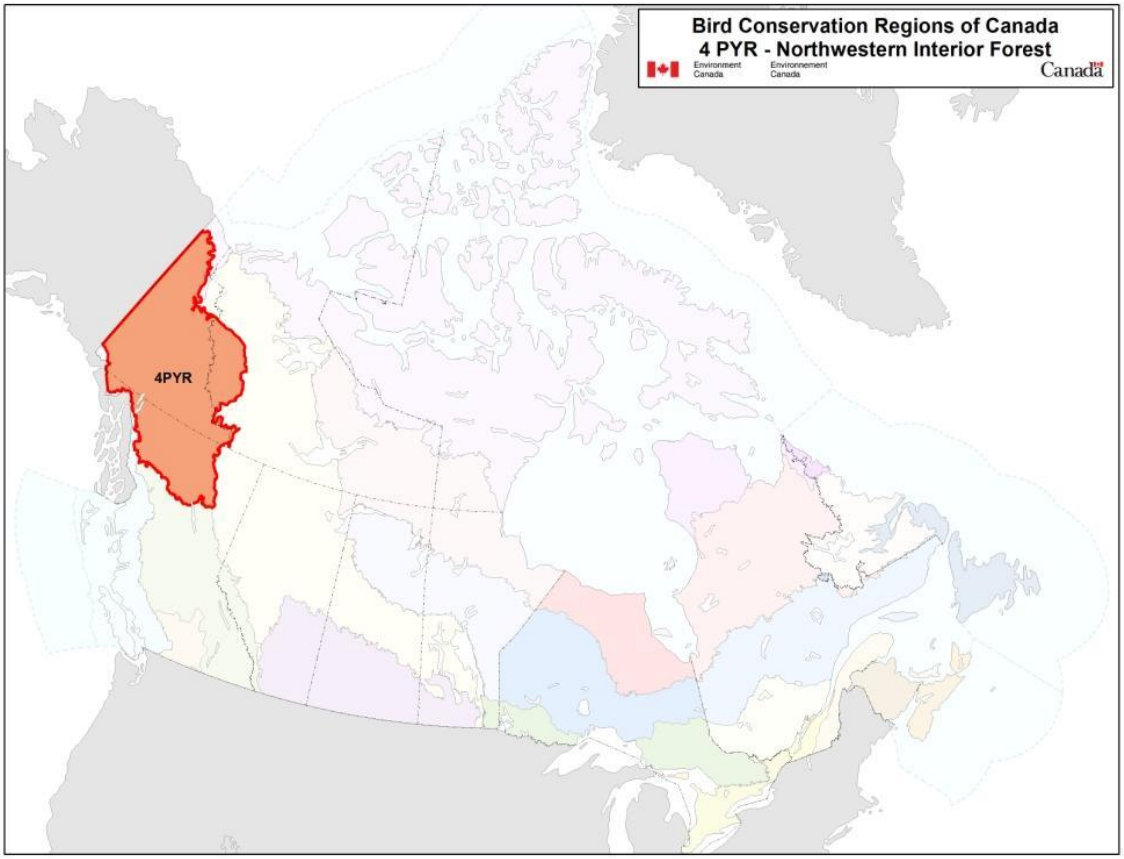
Bird Conservation Strategy for Bird Conservation Region 4 in Canada: Northwestern Interior Forest



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Executive Summary

The Northwestern Interior Forest, Bird Conservation Region 4 (BCR 4), is North America's westernmost boreal bird conservation region, encompassing interior Alaska and Yukon, and reaching into western Northwest Territories and northern British Columbia. Within Canada, BCR 4 overlaps with the traditional territories of 23 First Nations. This strategy is a first attempt to identify, prioritize and begin to address conservation issues for all birds of Canada's portion of this remote region.

The Northwestern Interior Forest region is a mosaic of boreal forest, taiga and alpine tundra, with wetlands and waterbodies sparsely distributed but of high importance to birds. The human population is very small, and many parts of the region are remote and difficult to access; as a result, information on the ecology and population status of birds in this region is limited. The Canadian portion of BCR 4 features 211 regularly occurring bird species, including 201 that breed in the region and 10 that occur only as migrants; only 37 species are resident all year, while 174 depart during the winter. Species assessment identified 77 priority species for bird conservation in BCR 4.

Regional population trends for most priority species in BCR 4 are unknown, and as a result, the population objective for most species is to "assess and maintain" populations. However, even in this relatively undisturbed region, there are seven priority species with evidence of regional declines within BCR 4, and the population objective for these is to increase regional populations.

An assessment of threats to birds in BCR 4 showed that eight priority species face threats of high magnitude. These include seven alpine species threatened by reduction in alpine tundra due to climate change; and Black Tern (*Chlidonias niger),* which breeds at only one small lake in BCR 4. In general, the greatest known threats in BCR4 are climate-related habitat changes and increased frequency of severe weather, affecting alpine species in particular. Forest harvest, including salvage logging and firewood harvest, is affecting birds in certain coniferous forest habitats. Encroachment, disturbance and water-level changes are affecting birds in wetlands and riparian areas.

Conservation objectives focus on ensuring adequate habitat, managing the effects of climate change, and in certain areas, reducing human disturbance. Recommended actions to address threats to birds in BCR 4 include: ensuring that protected areas systems are well-designed, with protected areas including important habitats and large enough to buffer against habitat losses, mortality and nest failure from climate change effects, and linked by movement corridors; site management to reduce disturbance of birds; site management to retain important features of old-growth and burned forest; increasing public awareness of bird conservation issues; and supporting policies to

reduce greenhouse gas emissions. Threats to BCR 4 birds while they are outside of the region, as well as research and monitoring needs, are also discussed.

This is a working document that will be periodically revised and updated. Currently in BCR 4, industrial development is limited, and most threats to birds are of low magnitude. In the Northwestern Interior Forest, we still have many opportunities for proactive conservation, keeping common species common, protecting large areas of intact roadless habitat, and avoiding the path of habitat destruction and degradation followed by expensive species recovery programs. New threats to BCR 4 birds will undoubtedly develop, and emerging threats such as those from climate change will be better understood; some existing threats will increase in magnitude; and new actions will be recommended in future versions of the strategy. The goal of this first version is to present a framework, using the best information currently available, for effective conservation of all native bird species of the Northwestern Interior Forest in Canada.

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 sub-regional level. Section 2 provides more detail on the threats, objectives and actions for priority species grouped by each of the broad habitat types in the subregion. Section 3 presents additional widespread conservation issues that are not specific to a particular habitat or were not captured by the threat assessment for individual species, as well as research and monitoring needs, and threats to migratory birds while they are outside 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 4

The BCR 4 Environment

Bird Conservation Region (BCR) 4, the Northwestern Interior Forest, is an inland mountainous area of forest, taiga, shrub flats and tundra that corresponds roughly with the Taiga Cordillera and Boreal Cordillera ecozones. BCR 4 is divided approximately in half by the U.S./Canada (i.e., Alaska/Yukon) border. The subregion that this strategy addresses is the Canadian portion of BCR 4, which encompasses most of the Yukon Territory, the Northern Boreal Mountains ecoprovince of British Columbia, and the mountainous western region of the Northwest Territories (Fig. 1). Throughout this document, reference to BCR 4 means this Canadian subregion.

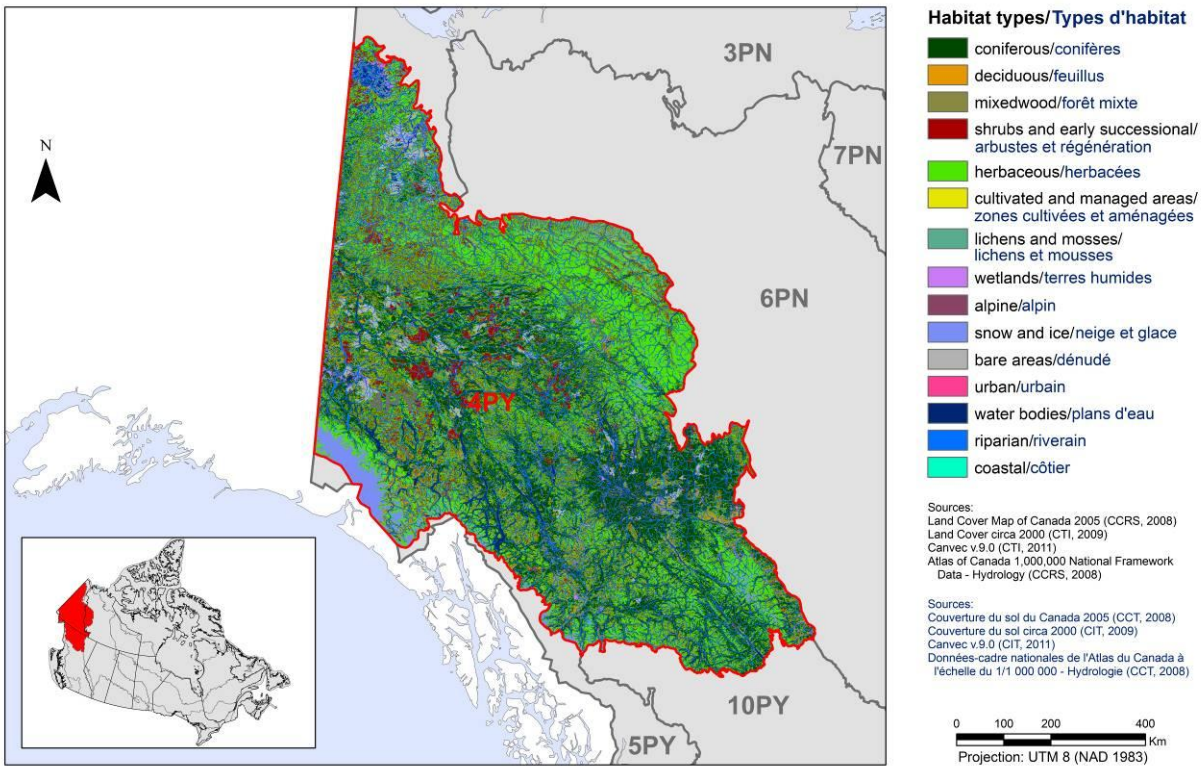

Figure 1. Land cover in BCR 4 in Canada: Northwestern Interior Forest.

The range of elevation and latitude in BCR 4 creates a diversity of habitat types, from dense lowland white spruce forest in the larger river valleys, to drier fire-driven coniferous forests and sparsely treed taiga, to open shrub flats and alpine tundra; the relatively limited wetland and riparian areas form rich pockets of biological diversity and productivity.

Winters in BCR 4 are long, dark and cold. In the Taiga Cordillera, January mean temperatures range between -25^{o} and -30^{o} C. Snow cover lasts a minimum of six months per year, and may persist up to eight months. In the Boreal Cordillera, January mean temperatures range between -15^{o} C and -27^{o} C. Throughout the BCR summers are short and cool, with July mean temperatures between 12^{o} C and 15^{o} C (Wahl 2004).

The Taiga Cordillera is the most sparsely populated ecozone in Canada, with only a few hundred human inhabitants. The largest community in the Boreal Cordillera ecozone, which forms the southern part of the BCR, is Whitehorse, Yukon. Within the entire Canadian portion of BCR 4, the human population is approximately 36,500. This includes all nine Yukon communities, plus seven small northern British Columbia communities. There are no settlements in the Northwest Territories portion of BCR 4.

The region encompasses all or part of the traditional territories of 23 First Nations, including Acho Dene Koe First Nation, Carcross/Tagish First Nation, Champagne and Aishihik First Nation, Daylu Dena Council, Dease River First Nation, Dehcho First Nations, Gwich'in Tribal Council, Iskut First Nation, Kluane First Nation, Kwanlin Dün First Nation, Liard First Nation, Little Salmon/Carmacks First Nation, Na-Cho Nyak Dun First Nation, Ross River Dena Council, Sahtu Dene Council, Selkirk First Nation, Ta'an Kwäch'än Council, Tahltan Band, Taku River Tlingit, Teslin Tlingit Council, Tr'ondëk Hwëch'in, Vuntut Gwitchin First Nation, and White River First Nation.

BCR 4 has relatively low levels of human development. There are large areas within this BCR subregion that remain free of roads, making many areas difficult to access. Agricultural activities are limited and clustered around communities, mostly around Whitehorse and Dawson. Forest harvest, placer and hard-rock mining, and oil and gas exploration and development are currently limited but expanding in the region.

BCR 4 includes within its boundaries four national parks (Ivvavik National Park, Vuntut National Park, Kluane National Park, and part of Nahanni National Park Reserve), one National Wildlife Area (Nisutlin River Delta NWA), and a number of Provincial and Territorial parks. Overall, 13% of BCR 4 is in protected areas (Fig. 2); however, this varies by jurisdiction (12% in Yukon, 22% in British Columbia) and land cover (from 42% of snow and ice to 7.4% of forest in protected areas within BCR 4, using Earth Observation for Sustainable Development (EOSD) land cover data). Additional protected areas are planned in British Columbia under the Taku Atlin Land Use Plan, and proposed in Northwest Territories.

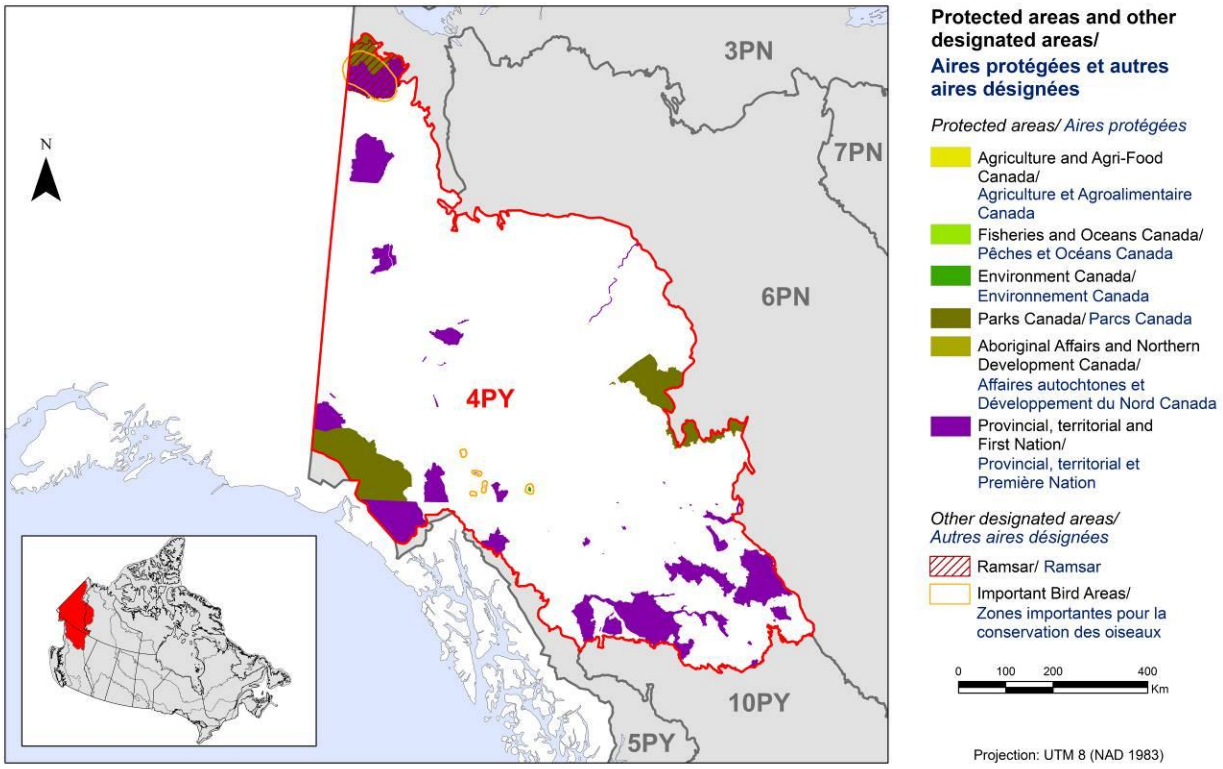

Figure 2. Protected and other designated areas in BCR 4 in Canada: Northwestern Interior Forest.

BCR 4 Birds

The Canadian portion of BCR 4 is home to 211 regularly-occurring bird species including 31 species of waterfowl, 19 species of waterbirds, 23 species of shorebirds, and 138 species of landbirds. Of these, 201 species breed in BCR 4 and 10 species occur as migrants only; 37 species are present year-round, while 174 species depart for the winter.

Five bird species which occur regularly in BCR 4 are listed under Canada's *Species at Risk Act* (SARA): Common Nighthawk and Olive-sided Flycatcher are listed as Threatened, and Peregrine Falcon (anatum/tundrius), Short-eared Owl and Rusty Blackbird are listed as Special Concern (Species at Risk Public Registry 2012). In addition, Barn Swallow has been recommended as Threatened, and Horned Grebe (western population) has been recommended as Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2012), but they have not yet been listed under SARA.

Of the 211 regularly occurring bird species in the Canadian portion of BCR 4, 170 are protected under Canada's *Migratory Birds Convention Act, 1994*. Three are introduced non-native species that occur regularly in small numbers in BCR 4: Rock Pigeon,

European Starling and House Sparrow. The remaining 38 species are under territorial/provincial jurisdiction (see Appendix 1).

BCR 4 birds include a mixture of species typical of the Boreal and Arctic regions, as well as eastern and western Canada. Many BCR 4 birds are widespread species such as Gray Jay and Rusty Blackbird that nest across the boreal region in North America, while others such as Long-tailed Jaeger and Lapland Longspur are typically Arctic species that reach their southern limits in alpine tundra habitats within this subregion. Still others are "west coast" species such as Varied Thrush and Townsend's Warbler that reach the eastern limit of their distribution in the subregion, sharing habitat with "eastern" birds such as "Myrtle" Yellow-rumped Warbler and White-throated Sparrow that reach their western limits here.

BCR 4 features significant numbers of nesting Trumpeter Swans, Golden Eagles, Gyrfalcons, and Peregrine Falcons; large concentrations of staging waterbirds at very limited open water areas in spring; high proportions of the world breeding populations of species such as Barrow's Goldeneye, Surfbird and Wandering Tattler; almost the entire breeding population of Harlan's Hawk; large concentrations of waterfowl moulting at Old Crow Flats, and also moving across the region from the Pacific coast to moulting areas in Northwest Territories; and high numbers of Sandhill Cranes and many other species migrating through the Tintina Trench between Alaskan breeding grounds and southern wintering areas

The small human population and inaccessibility of much of the region has ensured that large areas of bird habitat are still relatively undisturbed, but also means that available information on birds and habitats in BCR 4 is very limited.

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 (i.e. BCR 4 in Canada); 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 4 in Canada by bird group and by the reason for priority status.

For the Canadian portion of BCR 4, of the 211 species that occur regularly, 77 priority species were identified, including 74 breeding species and 3 species that are priorities as migrants (listed in Table 1, summarized in Table 2). Many species (43) are of conservation concern on a continental or national scale, and have sufficient numbers within BCR 4 to warrant being conservation needs within the region (Table 3). Many species (48) are regional stewardship priorities due to the large proportion of their continental and/or world population that occurs in BCR 4; in fact, 33 species are priorities for stewardship reasons alone (i.e., no strong conservation concern). Only six species are of regional conservation concern in BCR 4, mostly due to evidence of population declines within the region; these are American Wigeon, Lesser Scaup, American Kestrel, Lesser Yellowlegs, Olive-sided Flycatcher and Rusty Blackbird. With improved monitoring of birds within BCR 4, we may see further species of regional concern added to this list.

Table 1. Priority species in BCR 4 in Canada: Northwestern Interior Forest, population objective, and reasons for priority status.

Priority species	Bird group	Population trend	Population objective	COSEWIC[6]	SARA[7]	Regional concern	National/continental concern	Regional stewardship	Continental stewardship (waterbirds, landbirds only)	Other reason[8]
Alder Flycatcher	Landbird	3	Assess/Maintain						Yes	
American Kestrel	Landbird	3	Assess/Maintain			Yes				expert opinion
American Three-toed Woodpecker	Landbird	2*	Maintain Current					Yes		score change
Barn Swallow	Landbird	3	Assess/Maintain	T			Yes			
Blackpoll Warbler	Landbird	4*	Increase 50%					Yes		
Bohemian Waxwing	Landbird	3	Assess/Maintain					Yes	Yes	
Boreal Chickadee	Landbird	3	Assess/Maintain					Yes	Yes	
Boreal Owl	Landbird	3	Assess/Maintain					Yes		
Brewer's Sparrow	Landbird	3	Assess/Maintain				Yes			
Common Nighthawk	Landbird	3	Assess/Maintain	T	T		Yes			
Dusky Grouse	Landbird	3	Assess/Maintain				Yes			
Golden Eagle	Landbird	3	Assess/Maintain					Yes		score change
Golden-crowned Sparrow	Landbird	3	Assess/Maintain					Yes		score change
Gray Jay	Landbird	2	Maintain Current						Yes	
Gray-crowned Rosy-Finch	Landbird	3	Assess/Maintain					Yes		
Gray-headed Chickadee	Landbird	3	Assess/Maintain					Yes		expert opinion
Great Gray Owl	Landbird	3	Assess/Maintain					Yes		

[6] Assessed by COSEWIC (Committee on the Status of Endangered Wildlife in Canada) as: E, Endangered; T, Threatened; SC, Special Concern

[7] Species listed on Schedule 1 of the *Species at Risk Act* as E, Endangered; T, Threatened; SC, Special Concern (Species at Risk Public Registry).

[8] "expert opinion" indicates that a species was added or removed from the priority list as a result of expert opinion; "score change" and "score correction" indicate the Partners in Flight species assessment scores were modified or corrected by regional experts; "applied PIF methods" indicates species assessment designed for landbirds was applied to other groups

* Regional population trend scores that have been modified from the PIF 2007 database, based on current regional data, are marked with an asterisk (see Appendix 6)

Table 1 continued

Priority species	Bird group	Population trend	Population objective	COSEWIC[6]	SARA[7]	Regional concern	National/continental concern	Regional stewardship	Continental stewardship (waterbirds, landbirds only)	Other reason[8]
Northern Goshawk	Landbird	3	Assess/Maintain					Yes		
Northern Hawk Owl	Landbird	3	Assess/Maintain					Yes		
Northern Shrike	Landbird	3	Assess/Maintain					Yes		score correction
Olive-sided Flycatcher	Landbird	4	Increase 50%	T	T	Yes	Yes	Yes		
Peregrine Falcon (*anatum/tundrius)*	Landbird	3	Assess/Maintain	SC	SC		Yes	Yes		
Pine Grosbeak	Landbird	3*	Assess/Maintain					Yes	Yes	
Rufous Hummingbird	Landbird	3	Assess/Maintain				Yes			score change
Rusty Blackbird	Landbird	4	Increase 50%	SC	SC	Yes	Yes	Yes		
Short-eared Owl	Landbird	3	Assess/Maintain	SC	SC		Yes			
Smith's Longspur	Landbird	3	Assess/Maintain				Yes			
Swainson's Hawk	Landbird	3	Assess/Maintain				Yes			expert opinion
Townsend's Warbler	Landbird	3	Assess/Maintain					Yes		expert opinion
Varied Thrush	Landbird	3	Assess/Maintain					Yes		
White-crowned Sparrow	Landbird	4*	Increase 50%					Yes		
White-tailed Ptarmigan	Landbird	3	Assess/Maintain					Yes		
White-winged Crossbill	Landbird	3	Assess/Maintain						Yes	
Wilson's Warbler	Landbird	3*	Assess/Maintain					Yes		
American Golden-Plover	Shorebird	3	Assess/Maintain				Yes			
Killdeer	Shorebird	3	Assess/Maintain				Yes			
Lesser Yellowlegs	Shorebird	4*	Increase 50%			Yes	Yes	Yes		
Red-necked Phalarope	Shorebird	3	Assess/Maintain				Yes			
Semipalmated Sandpiper	Shorebird		Migrant (no pop. obj.)				Yes			
Short-billed Dowitcher	Shorebird	3	Assess/Maintain				Yes			
Solitary Sandpiper	Shorebird	3	Assess/Maintain				Yes	Yes		
Spotted Sandpiper	Shorebird	3	Assess/Maintain					Yes		applied PIF methods

Table 1 continued

Priority species	Bird group	Population trend	Population objective	COSEWIC[6]	SARA[7]	Regional concern	National/continental concern	Regional stewardship	Continental stewardship (waterbirds, landbirds only)	Other reason[8]
Surfbird	Shorebird	3	Assess/Maintain				Yes	Yes		
Upland Sandpiper	Shorebird	3	Assess/Maintain				Yes			
Wandering Tattler	Shorebird	3	Assess/Maintain					Yes		
Whimbrel	Shorebird	3	Assess/Maintain				Yes			
Wilson's Snipe	Shorebird	2	Maintain Current				Yes			
Arctic Tern	Waterbird	3	Assess/Maintain				Yes			
Black Tern	Waterbird	3	Assess/Maintain				Yes			
Bonaparte's Gull	Waterbird	3	Assess/Maintain				Yes	Yes	Yes	
Common Loon	Waterbird	3	Assess/Maintain				Yes		Yes	
Herring Gull	Waterbird	3	Assess/Maintain				Yes			
Horned Grebe (western population)	Waterbird	3	Assess/Maintain	SC			Yes	Yes		
Mew Gull	Waterbird	3	Assess/Maintain					Yes		score change, applied PIF methods
Pacific Loon	Waterbird	3	Assess/Maintain				Yes	Yes		
Red-necked Grebe	Waterbird	3	Assess/Maintain					Yes		applied PIF methods
Sora	Waterbird	2	Maintain Current				Yes		Yes	
Thayer's Gull	Waterbird		Migrant (no pop. obj.)				Yes		Yes	
American Wigeon	Waterfowl	4*	Increase 50%			Yes	Yes	Yes		
Barrow's Goldeneye	Waterfowl	3	Assess/Maintain					Yes		
Blue-winged Teal	Waterfowl	3	Assess/Maintain				Yes			
Bufflehead	Waterfowl	3	Assess/Maintain					Yes		
Canada Goose, Lesser	Waterfowl	3	Assess/Maintain				Yes	Yes		
Canvasback	Waterfowl	3	Assess/Maintain				Yes	Yes		
Common Goldeneye	Waterfowl	3	Assess/Maintain				Yes			
Greater White-fronted Goose,	Waterfowl	3	Assess/Maintain					Yes		

Table 1 continued

Priority species	Bird group	Population trend	Population objective	COSEWIC[6]	SARA[7]	Regional concern	National/continental concern	Regional stewardship	Continental stewardship (waterbirds, landbirds only)	Other reason[8]
Mid-continent										
Green-winged Teal	Waterfowl	2	Maintain Current					Yes		
Harlequin Duck	Waterfowl	3	Assess/Maintain					Yes		
Lesser Scaup	Waterfowl	4*	Increase 50%			Yes	Yes	Yes		
Long-tailed Duck	Waterfowl	3	Assess/Maintain				Yes			
Mallard	Waterfowl	2	Maintain Current				Yes	Yes		
Northern Pintail	Waterfowl	3	Assess/Maintain				Yes	Yes		
Northern Shoveler	Waterfowl	3	Assess/Maintain					Yes		
Surf Scoter	Waterfowl	3	Assess/Maintain				Yes	Yes		
Trumpeter Swan, Pacific Coast[9]	Waterfowl	2*	Maintain Current					Yes		
Trumpeter Swan, Rocky Mountain[9]	Waterfowl	2*	Maintain Current				Yes			
Tundra Swan, Western	Waterfowl		Migrant (no pop. obj.)					Yes		
White-winged Scoter	Waterfowl	3	Assess/Maintain				Yes	Yes		

[9] The Pacific Coast and Rocky Mountain populations of Trumpeter Swan are counted as one species in the total number of priority species.

Table 2. Summary of priority species, by bird group, in BCR 4 in Canada: Northwestern Interior Forest.

Bird Group	Total Species	Total Priority Species	Percent Listed as Priority	Percent of Priority List
Landbird	138	34	25%	44%
Shorebird	23	13	56%	17%
Waterbird	19	11	58%	14%
Waterfowl	31	19	61%	25%
Total/Overall	**211**[1]	**77**	**36%**	**100%**

[1] Table A1 includes 219 species, but 8 occur regularly only in the U.S. portion of the BCR and so are excluded in the total here.

Table 3. Number of priority species in BCR 4 in Canada: Northwestern Interior Forest, by reason for priority status.

Reason for Priority Listing[1]	Landbirds	Shorebirds	Waterbirds	Waterfowl
COSEWIC[2]	6	0	1	0
Federal SARA listed[3]	5	0	0	0
National/Continental Concern	11	11	9	12
Regional Concern	3	1	0	2
National/Continental Stewardship	6	-	4	-
Regional Stewardship	22	5	5	16

[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 Endangered, Threatened or Special Concern.
[3] Species listed on Schedule 1 of the *Species at Risk Act* as Endangered, Threatened or Special Concern.

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 Element 2: Habitats Important to Priority Species 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 4, as in other BCRs, land cover classes from the Land Cover Classification System (LCCS) developed by the United Nations (Food and Agriculture Organization 2000) were used as broad habitat categories to assign species to primary (most used) and secondary (also used) habitat types. However, in order to describe the relative abundance of broad habitat categories in BCR 4 in Section 2 below, percent cover of Earth Observation for Sustainable Development (EOSD) land cover classes were used (Wulder and Nelson 2003). Finally, the Land Cover Map of Canada was used to illustrate the distribution of each broad habitat category in maps. As a result of using these three different land cover systems (each of which defines the habitats

somewhat differently), the maps, text, and species habitat assignments do not always concur in their definition of each habitat class; discrepancies are explained in the text. Future versions of this BCR strategy will resolve these discrepancies.

In BCR 4, the LCCS classes used as primary habitat by the most priority species were wetland, shrub/early successional, coniferous and waterbodies (Fig. 3). Primary and secondary habitat associations for each priority species are presented in Appendix 3.

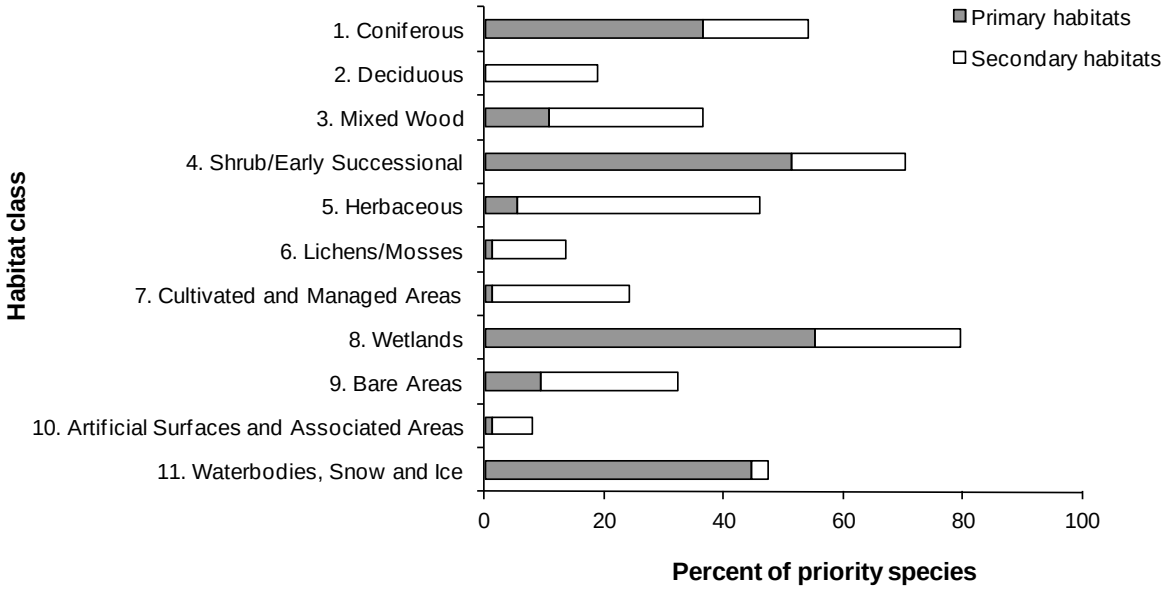

Figure 3. Percent of priority species that are associated with each habitat type in BCR 4 in Canada: Northwestern Interior Forest.
Note: The total exceeds 100% because each species was assigned to more than one habitat class (up to three primary habitat classes, and up to eight habitat classes overall, per species).

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 Element 3: Population Objectives for Priority Species). 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.

In BCR 4, 60 of the 74 priority breeding species have unknown regional population trends; as a result, for these species the population objective is to "assess and maintain" the regional population. Seven species are considered to have stable populations in the region, and have been assigned an objective of "maintain current" population. Within BCR 4, 7 species have documented regional population declines: American Wigeon, Lesser Scaup, Lesser Yellowlegs, Olive-sided Flycatcher, Blackpoll Warbler, White-crowned Sparrow and Rusty Blackbird. Regional declines were detected by the Yukon Cooperative Roadside Waterbird Survey for the 2 waterfowl, and by the North American Breeding Bird Survey for the other 5 species. All 7 of these species have a "possible or moderate population decrease," with "increase 50%" as population objectives (Fig. 4).

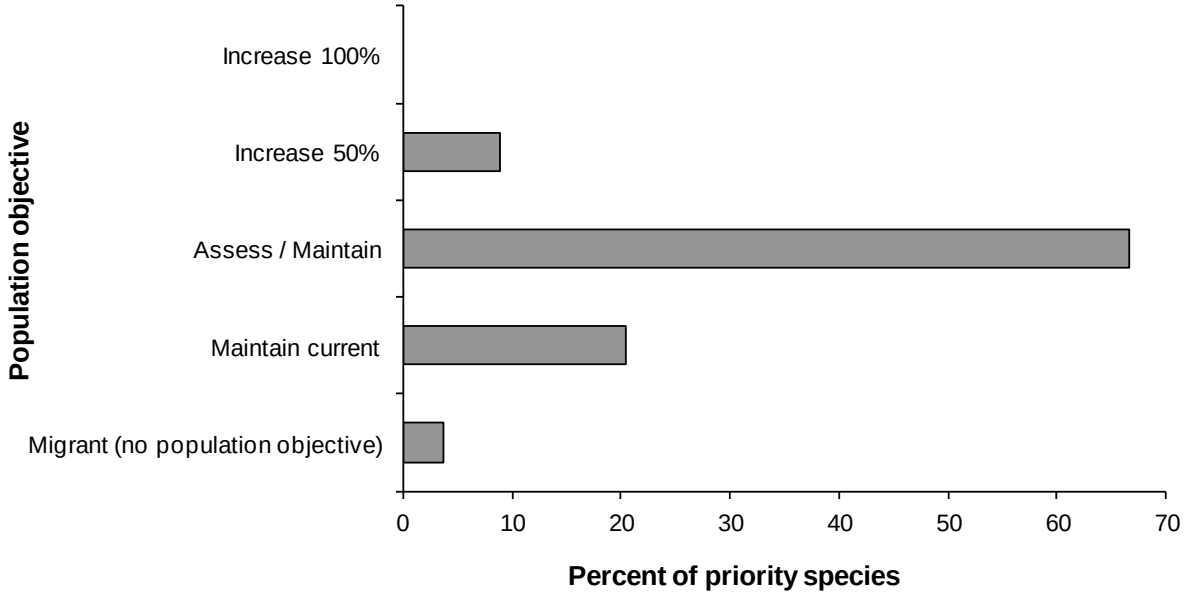

Figure 4. Percent of priority species that are associated with each population objective category in BCR 4 in Canada: Northwestern Interior Forest.

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.

We identified a total of 831 specific threats to bird species while they are in BCR 4; these included threats to 72 of the 77 priority species (Fig. 5, Table 4). To clarify, each "specific threat" is one specific threat affecting one priority species (so, for example, if the same threat affects 3 species, or affects one species in 3 habitats, then that is considered to be 3 "specific threats").

In BCR 4, no specific threats were assessed as having "very high" magnitude; but 30 threats to 8 priority species in 6 broad habitat types were assessed as having "high" magnitude. Each of these had a large scope ("throughout"; >50% of the species' range within BCR 4 affected), and medium severity (where the threat exists, 25% of the population is affected). Species with high magnitude threats include 7 alpine species highly threatened by reduction of alpine tundra habitats due to climate change, including White-tailed Ptarmigan, American Golden-Plover, Wandering Tattler, Whimbrel, Surfbird, Smith's Longspur and Gray-crowned Rosy-Finch. The eighth species is Black Tern, which uses the "wetland/lake" regional habitat subclass and breeds at only one site in BCR 4; it has high magnitude threats from habitat change and disturbance from aquaculture operations at its single breeding lake.

A further 23 priority species had threats of medium magnitude, and 41 priority species had low magnitude threats only. Five priority species had no known threats in BCR 4 (Swainson's Hawk, Rufous Hummingbird, Alder Flycatcher, Gray-headed Chickadee, Wilson's Warbler).

Two threat categories rolled up to High magnitude in BCR 4 (Table 4). The Climate Change and Severe Weather threat category included threats such as reduction in alpine tundra due to encroachment of trees and shrubs, loss of wetlands due to melting permafrost, loss of spruce forest (all included in sub-category 11.1 in Fig. 5), and increasing frequency of storms and cold temperatures (sub-categories 11.3 and 11.4). Human Intrusions and Disturbance included disturbance of nesting and staging birds by people, pets, boats, all-terrain vehicles, and aircraft (sub-categories 6.1 and 6.3).

Four threat categories rolled up to Medium magnitude. Residential and Commercial Development included encroachment of residential development on waterbodies and wetlands, particularly at spring staging areas, as well as collisions with windows. Agriculture and Aquaculture included encroachment of rangeland and cropland on wetlands and riparian habitats, and degradation of habitat from aquaculture. Biological Resource Use included loss of old growth riparian white spruce forest, and loss of standing dead trees, through harvest and firewood cutting. Natural System Modifications included water level changes from hydroelectric development, and forest fire suppression.

Four threat categories rolled up to Low magnitude. Energy Production and Mining included habitat loss and degradation from mining and oil and gas exploration and development,

including leaking of toxins from tailing ponds. Transportation and Service Corridors included habitat fragmentation and degradation from roads, as well as collisions with vehicles. Pollution included ingestion of garbage from landfills, ingestion of lead sinkers, and reduction of insect prey from pesticides. Invasive and Other Problematic Species and Genes included increased populations of competing species or predators, and increased frequency/intensity of forest pest outbreaks and diseases. Energy Production and Mining is currently expanding rapidly in the region, and threats in this category may already be significantly greater than is documented here. The same may be true for Transportation and Service Corridors, Pollution, and Invasive and Other Problematic Species and Genes; threats in these categories will likely increase as part of the same expanding development.

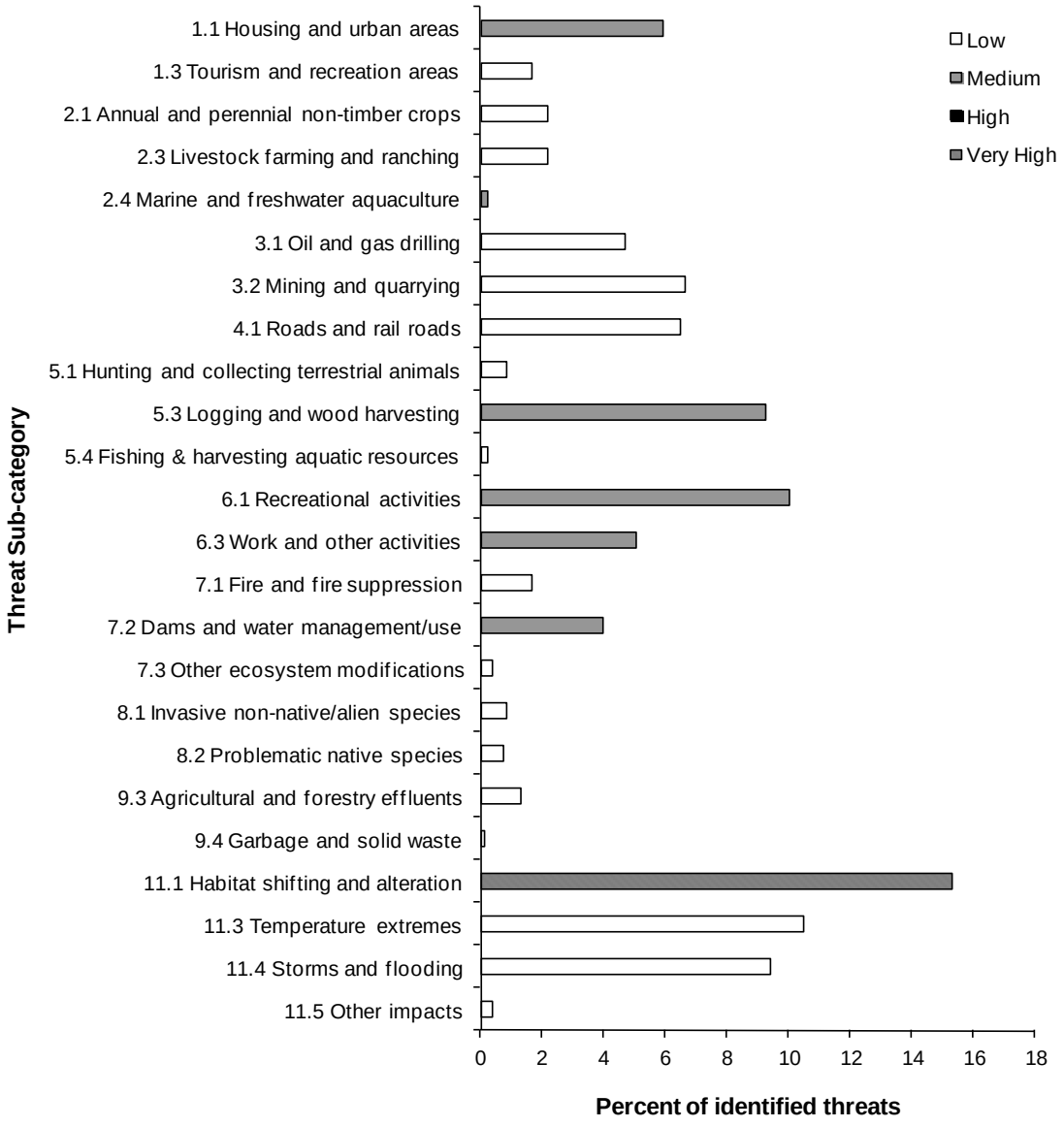

Figure 5. Percent and magnitude of identified threats to priority species in BCR 4 in Canada: Northwestern Interior Forest, by threat sub-category.

Overall, 831 threats to species were identified (each threat is to one species in one habitat; there were 319 species-habitat combinations). Class 10, Geological events, was omitted because there were no threats identified in that category.

Each bar represents the percent of the total number of threats identified in each threat sub-category in BCR X (for example, if 100 threats were identified in total for all priority species in BCR 4 in Canada: Northwestern Interior Forest, 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 (VH = very high, H = high, M = medium and L = low) represents the rolled up magnitude of all threats in each threat subcategory in the BCR. (See Element 4: Threat Assessment for Priority Species for details on how magnitude was assessed.)

Much remains to be learned about conservation issues and threats to birds in boreal regions, including BCR 4. For example, a threat which has been identified for one species may also affect other species which use the same habitats, but in many cases there is no documentation to support this, and so those threats to other species are not included. Further, much remains to be learned about the magnitude of threats to birds in boreal regions. If a particular threat is not listed for a particular species in this strategy, this may be due to a lack of information rather than the absence of the threat. Also, the magnitude of any threat may be underestimated in this first version of the strategy, due to limited knowledge. Future versions of this strategy will incorporate new information on threats to birds, and the magnitude of threats within BCR 4.

Table 4. Relative magnitude of identified threats to priority species within BCR 4 in Canada: Northwestern Interior Forest, 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. Threat categories and habitat classes which rolled up to medium or high threat levels overall are in bold. Threats to species in both their primary and secondary habitat classes were included.

Threat Category	**Habitat Class**											
	Coniferous	Deciduous	Mixed Wood	**Shrub/Early Successional**	**Herbaceous**	Cultivated and Managed Areas	**Lichens/Mosses**	**Bare Areas**	Artificial Surfaces and Associated Areas	**Wetlands**	**Waterbodies, Snow and Ice**	**Overall**
Overall	**M**	**L**	**L**	**M**	**M**	**L**	**M**	**M**	**L**	**H**	**M**	
1. Residential & commercial development	L	L		L	M	L	L	M		M	M	**M**
2. Agriculture & aquaculture	L			L	L					M	M	**M**
3. Energy production & mining	L	L	L	L	L	L	L	L		L	L	**L**
4. Transportation & service corridors	L	L	L	L	L	L	L	L		L	L	**L**
5. Biological resource use	M	L	M	L	L	L	L	L		M	L	**M**
6. Human intrusions & disturbance	L	L	L	M	L	L	L	L	L	H	H	**H**
7. Natural system modifications	L		L	L	L	L	L	L	L	M	M	**M**
8. Invasive & other problematic species & genes	M	L	L	L	L	L				L		**L**
9. Pollution	L		L	L		L		L		L	L	**L**
11. Climate change & severe weather	L	L	L	H	H	L	H	H	L	H	L	**H**

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

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 Element 5: Conservation Objectives).

In BCR 4, most conservation actions fell under the related objectives of ensuring adequate habitat and managing for climate change (Fig. 6). In addition, many actions were recommended under the objective of reducing disturbance. For BCR 4, we did not include research and monitoring ("7 Improve Understanding") as a conservation objective, because the need for improved knowledge encompasses virtually all species in all habitats in this remote region. Knowledge gaps are discussed separately under "Research and Population Monitoring Needs".

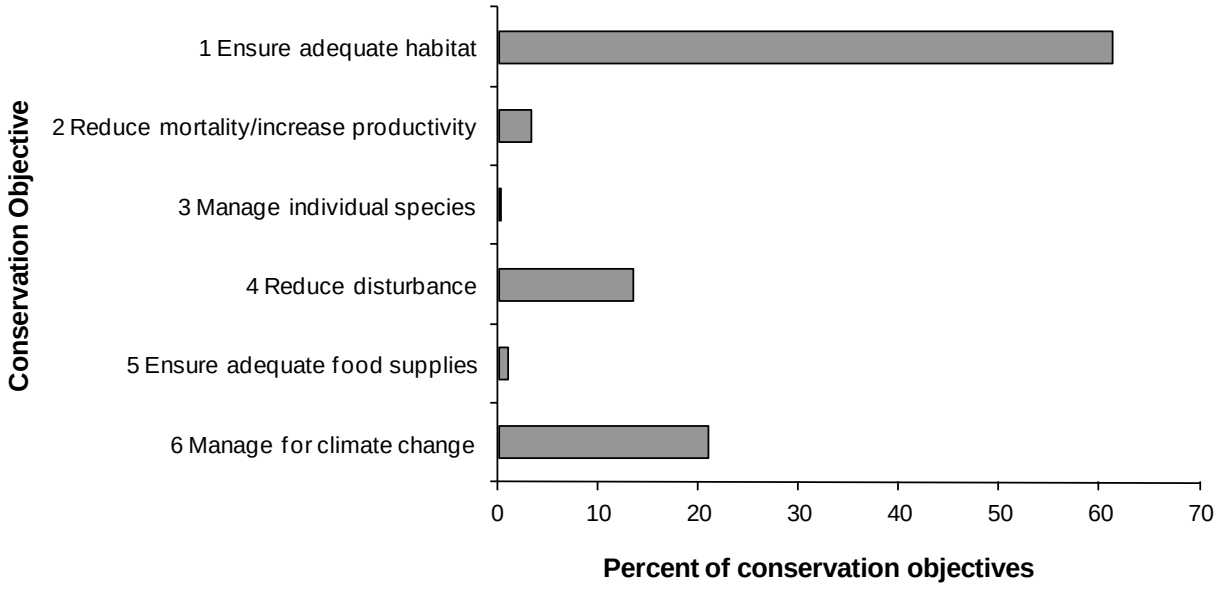

Figure 6. Percent of conservation objectives assigned to each conservation objective category in BCR 4 in Canada: Northwestern Interior Forest.

There were 1575 actions recommended to address the 836 threats to species in their habitats in BCR 4. Each action falls under one of the Conservation Objective categories.

Note: "7 Improve Understanding" is not included here for BCR 4 because virtually all species require research and monitoring for management, and this is discussed separately under "Research and Population Monitoring Needs."

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 Element 6: Recommended Actions). 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.

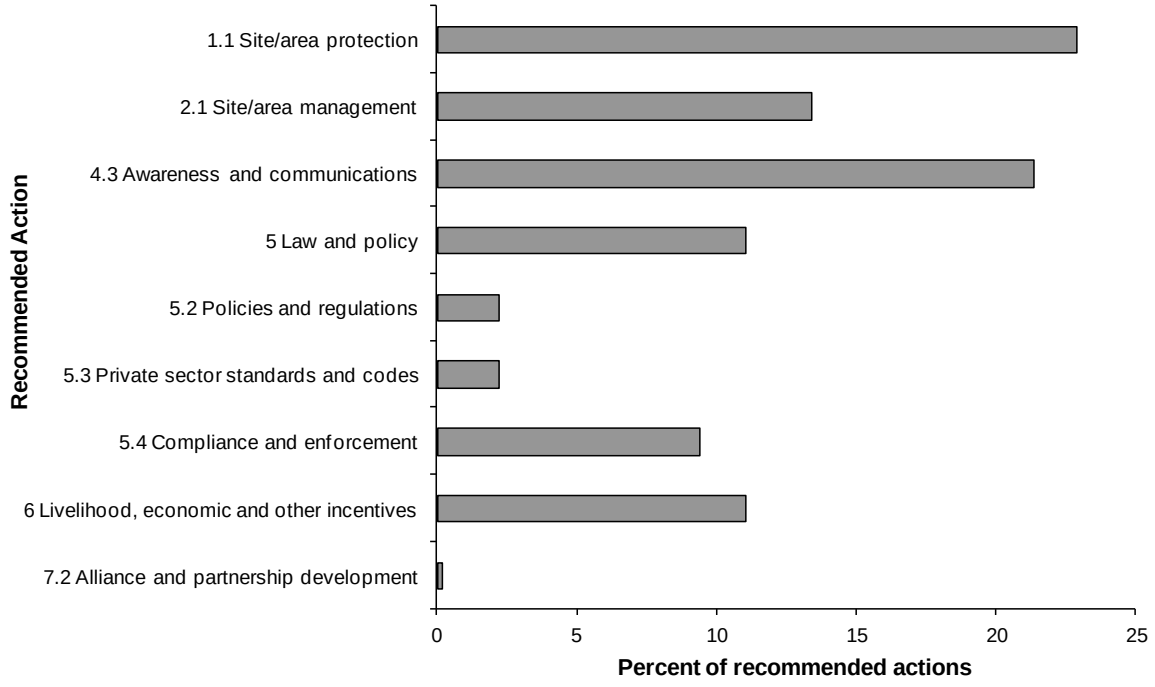

Figure 7. Percent of recommended actions assigned to each sub-category in BCR 4 in Canada: Northwestern Interior Forest.

There were 1575 actions recommended to address the 836 threats to species in their habitats in BCR 4.
Note: "8. Knowledge acquisition" is not included here for BCR 4 because virtually all species require research and monitoring for management, and this is discussed separately under Research and Population Monitoring Needs.

In BCR 4, the most important sub-category of actions recommended is "Site/area protection," to ensure that the system of protected areas is sufficient to maintain species in the face of climate change, including large protected areas adequately representing all habitats and connected by movement corridors, to buffer against habitat loss, increased mortality, and to allow movement of habitats and species. Recommendations in "Site/area protection" category refer to protected areas that correspond roughly to IUCN categories I–VI (Salafsky et al. 2008).

Many recommended actions fell under the “Awareness and communications” sub-category, reflecting the need to inform land managers and the public of the status and conservation needs of birds in the region. Many actions under “Law and Policy” and “Livelihood, economic and other incentives” involve supporting efforts to reduce greenhouse gas emissions.

Section 2: Conservation Needs by Habitat

The following sections provide more detailed information on priority species, their threats and objectives within each of the broad habitat classes that occur in BCR 4 in Canada. Where appropriate, habitat information is provided at a finer scale than the broad Land Cover Classification System (LCCS) habitat categories. Prevalence of each broad habitat type within BCR 4 is summarized based on Earth Observation for Sustainability (EOSD) data, while maps are based on the Land Cover Map of Canada. Significant differences among these three land cover systems are described in the text.

Some priority species do not appear in the threats tables because they have no threats within BCR 4, or within a particular habitat type in BCR 4.

Coniferous

Coniferous habitats are defined as treed areas where over 75% of the trees are coniferous species (Food and Agriculture Organization 2000). Coniferous habitats cover 37% of BCR 4 in Canada (EOSD; Wulder and Nelson 2003; Fig. 8). These habitats range from dense, tall, productive riparian white spruce forests in the broader river valleys of the south (most extensive in the Liard River watershed), to the vast, sparsely treed spruce taiga of higher elevations and latitudes. Mixed open white spruce/black spruce forest is widespread, and lodgepole pine forests are common in southern and eastern parts of the region. Subalpine fir is common at higher elevations; and western larch is found in some areas.

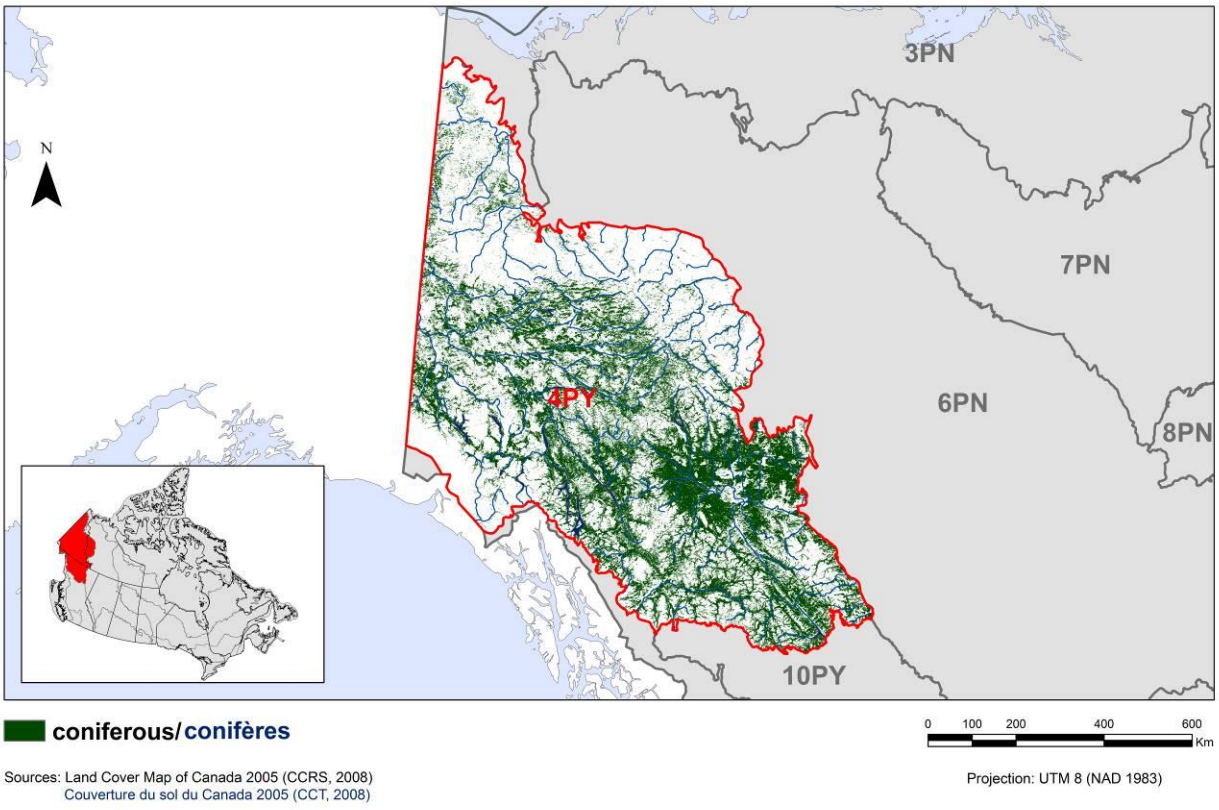

Figure 8. Map of coniferous habitat in BCR 4 in Canada: Northwestern Interior Forest.

Most of the coniferous habitats in BCR 4 have been relatively unaffected by human disturbance, and regenerate within natural disturbance regimes involving periodic forest fire and/or insect outbreaks. Second-growth forest, however, is common along the Yukon River system where forests within reach of the rivers were heavily logged to provide fuel for steam-powered paddle-wheel boats used for transportation in the early part of the 20th century. More recently, since the 1980s, significant areas of the most productive white spruce forests have been harvested in southeast Yukon, and since the 1990s, limited salvage logging has taken place in spruce bark beetle areas in southwest Yukon. Near communities, firewood harvest continues to increase with population growth, as does “FireSmart,” a program to remove dead wood

(including snags suitable for cavity nesting birds) and understory shrubs from forested areas in and around residential developments.

According to EOSD data, 36.6% of the Canadian portion of BCR 4 is in coniferous land cover, but only 5.2% is dense coniferous, with 20.0% open coniferous and 11.4% sparse coniferous cover.

There are 27 priority species which use coniferous forests as primary habitat in BCR 4 (Table 5). These include 3 waterfowl, 2 shorebird, 1 waterbird, and 21 landbird species. Of these, 3 are species at risk. A further 13 priority species use coniferous forests as secondary habitat. Within the broad coniferous habitat category, regional habitat sub-classes include white spruce, white spruce/aspen, mixed black/white spruce, lodgepole pine, mixed pine/spruce, riparian spruce, scattered spruce taiga, subalpine fir, and stunted subalpine fir. These are all mature to old-growth habitats.

For priority species that use coniferous habitats, 80 threats of medium and low magnitude were identified (Fig. 9). The number of medium threats (11) was sufficient to "roll up" threats to coniferous habitats in BCR 4 as medium overall (Table 4).

Medium-magnitude threats included loss and degradation of old-growth riparian white spruce forest; the richest pockets of this relatively rare habitat represent the most economically valuable timber in the region, and are often targeted for harvest (Fig. 9, sub-category 5.3). This threat was assessed as medium magnitude for Northern Goshawk, Boreal and Great Gray owls, Boreal Chickadee, Townsend's Warbler, and White-winged Crossbill. Degradation of coniferous forest habitat through salvage logging and firewood harvest of standing dead trees was assessed as a medium threat to American Three-toed Woodpecker. In addition, reduction of white spruce cone crops due to spruce bark beetle infestations and subsequent salvage harvest was assessed as a medium threat to White-winged Crossbill. Other medium-magnitude threats included encroachment of residential and agricultural developments on Short-billed Dowitcher habitat (sub-categories 1.1 & 2.1), and competition from expanding Red-winged Blackbirds for Rusty Blackbird (sub-category 8.2). Climate Change is a threat to birds in coniferous habitat in BCR4 through loss of spruce forest; however, due to a lack of information on effects on individual bird species, this threat is addressed under Widespread Issues.

Actions recommended to conserve priority species that use coniferous habitats involve protection and management of land, especially lowland and riparian white spruce forest, and retention of standing dead and decaying trees; increased public awareness of the value of standing dead trees and other issues; policies and enforcement, including riparian guidelines for agricultural leases; and research and monitoring (Table 6).

Table 5. Priority species that use coniferous habitats in BCR 4 in Canada: Northwestern Interior Forest, with regional habitat class, reason for priority and habitat use rank.

Species for which this is a primary habitat are indicated by Habitat use = P, and are in bold. Species for which this is a secondary habitat are indicated by Habitat use = S.

Priority species	Habitat use	Regional habitat sub-class	Population objective	Reason for priority status				
				At Risk	RC	CC	RS	CS
American Kestrel	S	mixed black/white spruce	Assess/Maintain		Yes			
American Three-toed Woodpecker	**P**	**white spruce**	**Maintain Current**				**Yes**	
American Wigeon	S	riparian spruce	Increase 50%		Yes	Yes	Yes	
Barrow's Goldeneye	**P**	**riparian spruce**	**Assess/Maintain**				**Yes**	
Blackpoll Warbler	**P**	**riparian spruce**	**Increase 50%**				**Yes**	
Bohemian Waxwing	**P**	**mixed black/white spruce**	**Assess/Maintain**				**Yes**	**Yes**
Bonaparte's Gull	**P**	**riparian spruce**	**Assess/Maintain**			**Yes**	**Yes**	**Yes**
Boreal Chickadee	**P**	**mixed black/white spruce**	**Assess/Maintain**				**Yes**	**Yes**
Boreal Owl	**P**	**white spruce**	**Assess/Maintain**				**Yes**	
Bufflehead	**P**	**riparian spruce**	**Assess/Maintain**				**Yes**	
Canada Goose	S	riparian spruce	Assess/Maintain			Yes	Yes	
Common Goldeneye	**P**	**riparian spruce**	**Assess/Maintain**			**Yes**		
Common Nighthawk	**P**	**lodgepole pine**	**Assess/Maintain**	**T**		**Yes**		
Dusky Grouse	**P**	**subalpine fir**	**Assess/Maintain**			**Yes**		
Golden-crowned Sparrow	**P**	**stunted subalpine fir**	**Assess/Maintain**				**Yes**	
Gray Jay	**P**	**lodgepole pine, mixed pine/spruce**	**Maintain Current**					**Yes**
Gray-headed Chickadee	**P**	**scattered spruce taiga**	**Assess/Maintain**				**Yes**	
Great Gray Owl	**P**	**white spruce**	**Assess/Maintain**				**Yes**	
Green-winged Teal	S	riparian spruce	Maintain Current				Yes	
Lesser Scaup	S	riparian spruce	Increase 50%		Yes	Yes	Yes	
Lesser Yellowlegs	**P**	**scattered spruce taiga**	**Increase 50%**		**Yes**	**Yes**	**Yes**	
Mallard	S	riparian spruce	Maintain Current			Yes	Yes	
Mew Gull	S	riparian spruce	Assess/Maintain				Yes	
Northern Goshawk	**P**	**white spruce/aspen**	**Assess/Maintain**				**Yes**	
Northern Hawk Owl	**P**	**mixed black/white spruce**	**Assess/Maintain**				**Yes**	
Olive-sided Flycatcher	**P**	**mixed black/white spruce**	**Increase 50%**	**T**	**Yes**	**Yes**	**Yes**	
Pine Grosbeak	**P**	**lodgepole pine**	**Assess/Maintain**				**Yes**	**Yes**
Rufous Hummingbird	S	mixed black/white spruce	Assess/Maintain			Yes		
Rusty Blackbird	**P**	**riparian spruce**	**Increase 50%**	**SC**	**Yes**	**Yes**	**Yes**	
Short-billed Dowitcher	S	riparian spruce	Assess/Maintain			Yes		
Solitary Sandpiper	**P**	**riparian spruce**	**Assess/Maintain**			**Yes**	**Yes**	

Table 5 continued

Priority species	Habitat use	Regional habitat sub-class	Population objective	Reason for priority status				
				At Risk	RC	CC	RS	CS
Surf Scoter	S	riparian spruce	Assess/Maintain			Yes	Yes	
Swainson's Hawk	**P**	**scattered spruce taiga**	**Assess/Maintain**			**Yes**		
Townsend's Warbler	**P**	**white spruce**	**Assess/Maintain**				**Yes**	
Upland Sandpiper	S	scattered spruce taiga	Assess/Maintain			Yes		
Varied Thrush	**P**	**white spruce/aspen**	**Assess/Maintain**				**Yes**	
White-crowned Sparrow	**P**	**scattered spruce taiga**	**Increase 50%**				**Yes**	
White-winged Scoter	S	riparian spruce	Assess/Maintain			Yes	Yes	
Wilson's Snipe	S	riparian spruce	Maintain Current			Yes		
White-winged Crossbill	**P**	**white spruce**	**Assess/Maintain**					**Yes**

Note: Reasons for inclusion in the priority species list are as follows. At Risk: the species was assessed by COSEWIC as Endangered (E), Threatened (T) or Special Concern (SC); RC (regional concern): the species meets PIF regional concern criteria; CC (continental concern): the species meets conservation concern or continental priority criteria for its bird group, and/or is At Risk nationally; RS (regional stewardship): waterfowl with highest, high or moderate high breeding importance in BCR 4, or the species meets PIF criteria for regional stewardship; CS (continental stewardship): landbirds identified as PIF continental stewardship species, or waterbirds listed in WOW as having at least 50% of global population in Canada. All priority species have PIF Relative Density>1.

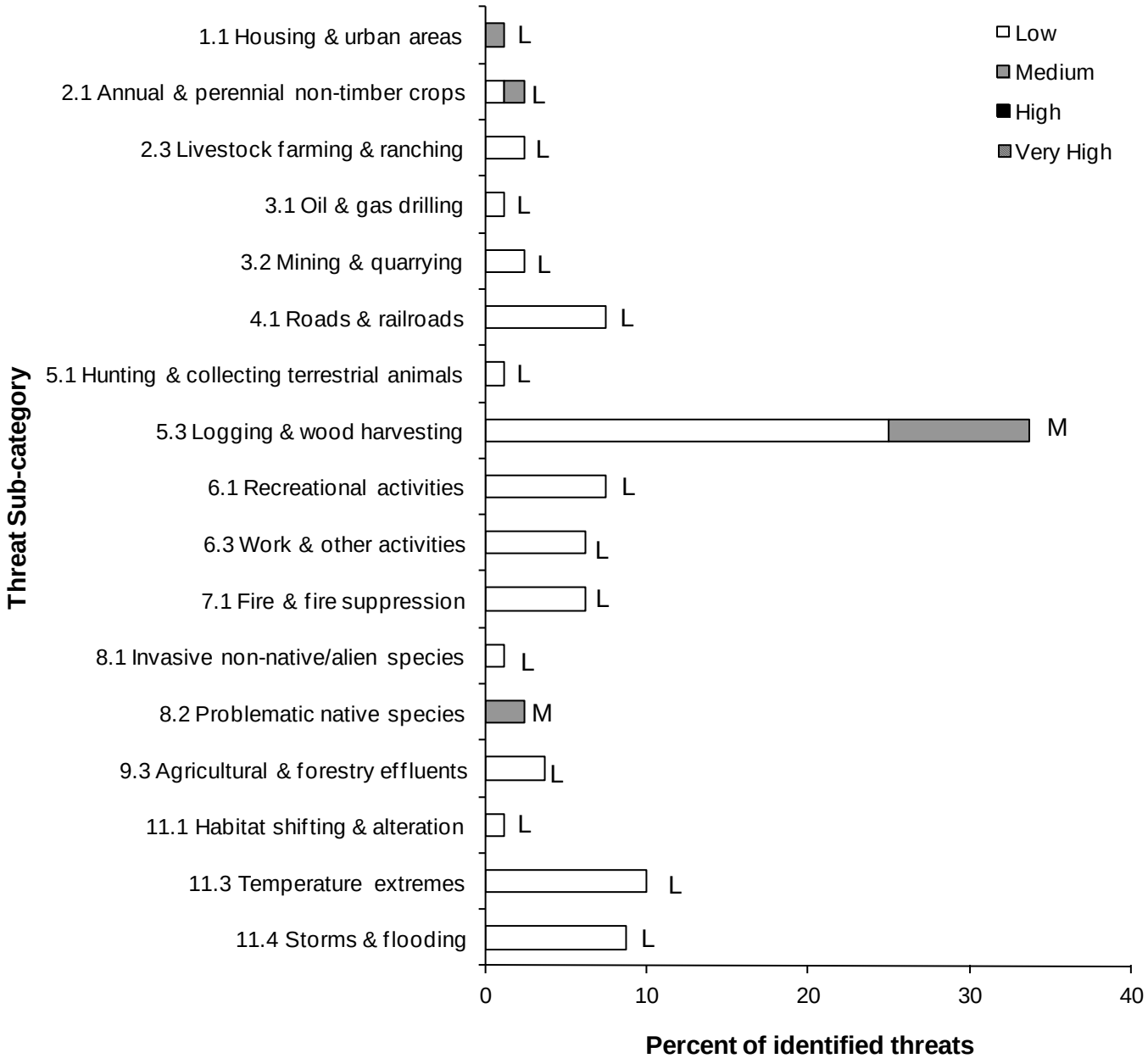

Figure 9. Percent of identified threats to priority species in coniferous habitat in each threat sub-category in BCR 4 in Canada: Northwestern Interior Forest.

Priority species may use coniferous forest as their primary or secondary habitat. A total of 80 threats were identified. Each bar represents the percent of the total number of threats identified in each threat sub-category in coniferous habitat (for example, if 100 threats were identified in total for all priority species in coniferous habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category). The overall magnitude of the sub-threat in coniferous habitat is shown at the end of each bar (also presented in Table 4, Relative magnitude of identified threats to priority species within BCR 4 in Canada by threat category and broad habitat class).

Table 6. Threats addressed, conservation objectives, recommended actions and priority species affected for coniferous habitats in BCR 4 in Canada: Northwestern Interior Forest.

Species for which a threat is of medium or high magnitude are in bold. Threats, objectives and actions are presented only for species that use coniferous forest as a primary habitat. "Priority species affected" are species for which the threat has been documented; additional species that are not listed may also be affected.

Threat category	Threats addressed	Objective category	Objectives	Action category	Recommended actions	Priority species affected†
2. Agriculture and Aquaculture						
2.1 Annual & perennial non-timber crops 2.3 Livestock farming & ranching	Encroachment on/loss of breeding habitat from cropland or livestock farming/ranching.	1.4 Maintain important habitat features on the landscape	Maintain the quantity and quality of forested wetland habitat within BCR 4 for nesting birds.	5.2 Policies and regulations 5.4 Compliance and enforcement	In areas with agricultural operations, establish and enforce habitat protection of wetlands and adjacent areas, including riparian guidelines for agricultural leases.	Rusty Blackbird
3. Energy Production and Mining						
3.2 Mining & quarrying	Habitat degradation from placer mining.	1.4 Maintain important habitat features on the landscape	Maintain the quantity and quality of forested wetland habitat within BCR 4 for nesting birds.	5.4 Compliance and enforcement 8.2 Monitoring	Incorporate exclusion zones into mining plans to protect habitat. Incorporate habitat recovery into post-mining site clean-up. Monitor Rusty Blackbirds at susceptible sites.	Rusty Blackbird
4. Transportation and Service Corridors						
4.1 Roads & railroads	Degradation of habitat from road construction.	1.4 Maintain important habitat features on the landscape	Maintain the quantity and quality of forested wetland habitat within BCR 4 for nesting birds.	2.1 Site/area management	Limit construction of roads in and near wetland areas.	Lesser Yellowlegs
	Mortality from collisions with vehicles.	2.7 Reduce incidental mortality from collisions	Reduce vehicle collision mortality of coniferous forest birds.	4.3 Awareness and communications	Increase public awareness of coniferous forest birds and vulnerability to high-speed traffic.	Bohemian Waxwing, Common Nighthawk, Northern Hawk Owl, Pine Grosbeak, White-winged Crossbill
5. Biological Resource Use						
5.1 Hunting & collecting terrestrial animals	Vulnerable to traps set for furbearers.	2.4 Reduce incidental mortality	Reduce mortality from trapping bycatch.	7.2 Alliance and partnership development	Work with trappers to develop sets that will not capture jays and other non-target bird species, and to assess whether this is a significant issue	Gray Jay

Table 6 continued

Threat category	Threats addressed	Objective category	Objectives	Action category	Recommended actions	Priority species affected†
5.3 Logging & wood harvesting	Loss/degradation of riparian breeding habitat from logging.	1.4 Maintain important habitat features on the landscape	Maintain the quantity and quality of forested lake/pond habitat within BCR 4 for nesting birds.	4.3 Awareness and communications	Increase public awareness of the value of standing dead trees, provide guidelines for retention of existing and potential cavity trees.	American Three-toed Woodpecker, Barrow's Goldeneye, Boreal Owl, Bufflehead, Common Goldeneye, Northern Hawk Owl
				2.1 Site/area management	Leave large no-harvest buffers around all forested lakes and wetlands.	
					Leave large no-harvest buffers around all forested lakes and wetlands.	Lesser Yellowlegs, Rusty Blackbird, Solitary Sandpiper
5.3 Logging & wood harvesting	Loss/degradation of habitat from logging of boreal forest.	1.4 Maintain important habitat features on the landscape	Maintain the quantity and quality of coniferous forest habitat within BCR 4 for nesting birds.	1.1 Site/area protection	Create protected areas that include large, productive areas of forest, particularly riparian white spruce.	Blackpoll Warbler, **Boreal Chickadee**, **Boreal Owl**, **Northern Goshawk**, Northern Hawk Owl, **Great Gray Owl**, Olive-sided Flycatcher, Pine Grosbeak, **Townsend's Warbler**, Varied Thrush, **White-winged Crossbill**
				2.1 Site/area management 5.3 Private sector standards and codes	Maintain current extent of old-growth coniferous forest, especially riparian white spruce forest.	
					Maintain perch and nest sites across harvested landscapes, by planning for large tree recruitment, and by ensuring large trees and attributes (e.g. mistletoe, large raptor/corvid nests) that provide raptor nesting requirements are retained.	
				2.1 Site/area management	Ensure harvesting practices retain dead and decaying trees for cavities, perches, and foraging, and plan for cavity and perch recruitment in harvested stands.	**American Three-toed Woodpecker**, Boreal Chickadee, Boreal Owl, Northern Hawk Owl
				4.3 Awareness and communications	Increase public awareness of the value of standing dead trees, provide guidelines for retention of existing and potential cavity trees.	
6. Human Intrusions and Disturbance						
6.1 Recreational activities 6.3 Work &	Disturbance at nest sites from recreation or other activities.	4.2 Reduce disturbance from industrial or work activity	Minimize human disturbance of priority species	5.2 Policies and regulations 5.4 Compliance and enforcement	Restrict use of motorized crafts in known nesting areas during breeding season.	Bonaparte's Gull

Table 6 continued

Threat category	Threats addressed	Objective category	Objectives	Action category	Recommended actions	Priority species affected†
other activities				4.3 Awareness and communications	Reduce disturbance of nest sites and breeding areas by watercraft, by increasing public awareness of waterbirds, their vulnerability to disturbance, and guidelines around nesting areas.	Barrow's Goldeneye, Bonaparte's Gull, Bufflehead, Common Goldeneye
				1.1 Site/area protection	Ensure adequate protection of forested boreal lakes suitable for cavity-nesting ducks.	Barrow's Goldeneye, Bufflehead, Common Goldeneye,
				2.1 Site/area management	When goshawk nests are located, follow "Identified Wildlife Management Strategy" guidance standards to ensure the birds are not disturbed, and the nest area is not abandoned or logged.	Northern Goshawk
7. Natural System Modifications						
7.1 Fire & fire suppression	Degradation of habitat from fire suppression.	1.3 Ensure the continuation of natural processes that maintain bird habitat	Maintain the quantity and quality of coniferous forest habitat within BCR 4 for nesting birds.	2.1 Site/area management	Maintain natural fire disturbance regimes and ensure forest harvest patterns mimic natural disturbance patterns, specifically ensuring mature-old growth patches do not become isolated, and that >60% of the forested landscape remains in mature-old growth.	American Three-toed Woodpecker, Common Nighthawk, Northern Hawk Owl, Olive-sided Flycatcher
				5.3 Private sector standards and codes	Limit salvage logging of snags. Retain snags with cavities that may provide suitable nesting and foraging opportunities.	
8. Invasive and Other Problematic Species and Genes						
8.2 Problematic native species	Loss of cone crop due to trees dying from spruce bark beetle.	5.1 Maintain natural food webs and prey sources	Ensure that issues related to spruce beetle are not limiting priority species' populations.	2.1 Site/area management	Maintain current extent of old-growth white spruce forest, by creating protected areas that include large areas of white spruce forest.	**White-winged Crossbill**
					Limit harvest of live trees in beetle killed areas.	
	Increased abundance of competitors, e.g. Red-winged Blackbird.	3.2 Reduce competition with problematic native species	Ensure that issues related to other native species are not limiting priority species' populations.	8.1 Research	Research effects of Red-winged Blackbird on Rusty Blackbird populations.	**Rusty Blackbird**

Table 6 continued

Threat category	Threats addressed	Objective category	Objectives	Action category	Recommended actions	Priority species affected†
9. Pollution						
9.3 Agricultural & forestry effluents	Forest pesticides and herbicides may reduce prey abundance	5.2 Manage decreases in prey due to contaminants	Ensure that issues related to pesticides are not limiting priority species' populations	2.1 Site/area management	Restrict use of forest and other pesticides in areas where priority species nest and forage.	Common Nighthawk, Olive-sided Flycatcher, Townsend's Warbler
11. Climate Change and Severe Weather						
11.1 Habitat shifting & alteration	Loss of spruce forest due to climate change.	6.2 Manage for habitat resilience as climate changes	Maintain and restore white spruce forest including bog and riparian habitat.	1.1 Site/area protection	Identify and protect areas of white spruce forest most resilient to climate change.	White-winged Crossbill
				2.1 Site/area management	Retain riparian strips adjacent to intact forest.	
				4.3 Awareness and communications 5. Law and policy 6. Livelihood, economic and other incentives	Support efforts to reduce greenhouse gas emissions.	
11.3 Temperature extremes 11.4 Storms & flooding	Vulnerable to increasing severity of temperature extremes (adults, young).	6.3 Manage populations for resilience to increased mortality from climate change	Ensure that population size is large enough to buffer against years of high mortality due to severe weather.	1.1 Site/area protection	Create a system of protected areas sufficient to support populations that are robust enough to recover from years of high mortality.	Barrow's Goldeneye, Bufflehead, Common Goldeneye, Common Nighthawk, Dusky Grouse, Golden-crowned Sparrow, White-crowned Sparrow
				4.3 Awareness and communications 5. Law and policy 6. Livelihood, economic and other incentives	Support efforts to reduce greenhouse gas emissions.	
				8.1 Research	Measure the impact of such weather events on populations.	

† Priority species not mentioned in this table have no identified threats in this habitat.

Deciduous

Deciduous habitats are defined as treed habitats where at least 75% of the trees are deciduous species (Food and Agriculture Organization 2000). Deciduous habitats cover only 2.4% of BCR 4 (Fig. 10); most of this is open or dense forest (EOSD; Wulder and Nelson 2003). Deciduous habitats include trembling aspen forests in upland areas, and balsam poplar forest in narrow riparian bands along rivers and lake edges, while patches of white birch are found in some areas. Deciduous trees are important habitat components for many species, and are used, for example, as nest cavity trees. However, most deciduous trees in BCR 4 occur as a component of coniferous or mixed wood forest types, or as small forest patches, or narrow bands of riparian forest.

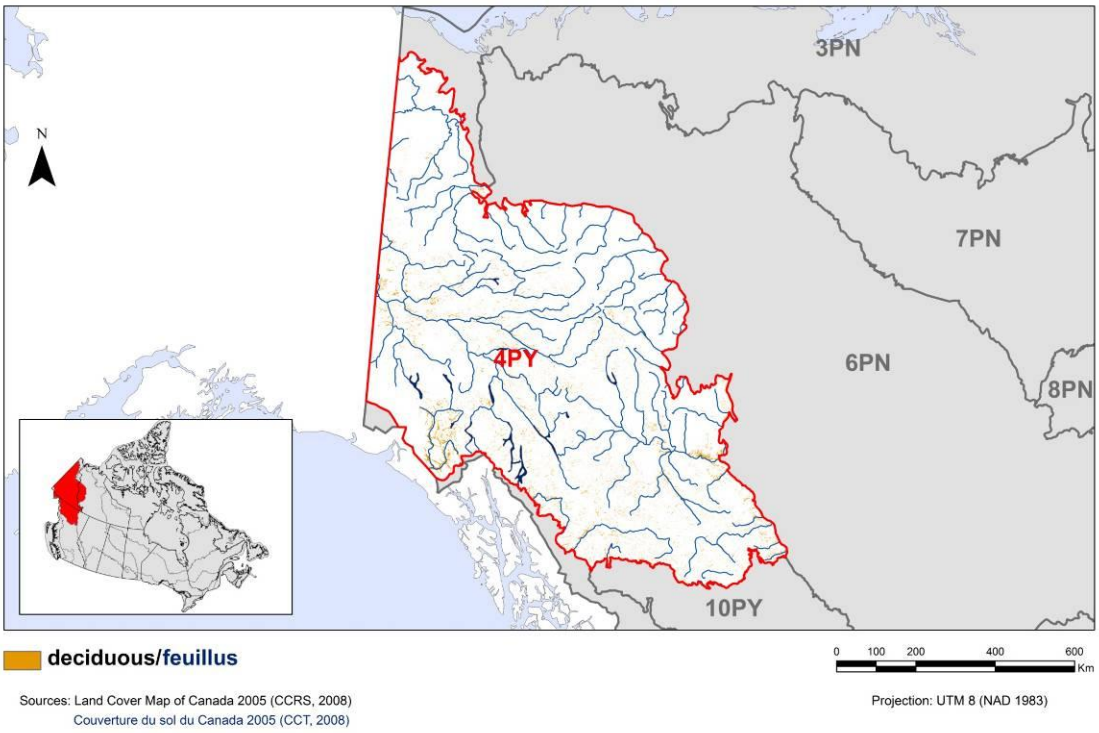

Figure 10. Map of deciduous habitat in BCR 4 in Canada: Northwestern Interior Forest.

Although no priority species in BCR 4 use deciduous forest as their primary habitat, 15 priority species, which primarily use other forest types or wetlands, use deciduous forest as secondary habitat (Table 7). These include 7 waterfowl and 8 landbird species. Of these, none is a species at risk, but one (American Wigeon) is declining within the region. Within the deciduous habitat category, regional habitat sub-classes include trembling aspen forest and riparian balsam poplar forest.

For priority species that use deciduous habitats, 13 threats of medium and low magnitude were identified (Fig. 11). Threats to priority species in deciduous habitats rolled up to low magnitude overall (Table 4). As no priority species use deciduous as a primary habitat type, no Conservation Objectives or Recommended Actions are presented here.

Table 7. Priority species that use deciduous treed habitats in BCR 4 in Canada: Northwestern Interior Forest, with reason for priority and habitat use rank.

Species for which this is a primary habitat are indicated by Habitat use = P, and are in bold. Species for which this is a secondary habitat are indicated by Habitat use = S.

Priority species	Habitat use	Regional habitat sub-class	Population objective	Reason for priority status				
				At Risk	RC	CC	RS	CS
Alder Flycatcher	S	riparian balsam poplar	Assess/Maintain					Yes
American Kestrel	S	riparian balsam poplar	Assess/Maintain		Yes			
American Wigeon	S	riparian balsam poplar	Increase 50%		Yes	Yes	Yes	
Barrow's Goldeneye	S	riparian balsam poplar	Assess/Maintain				Yes	
Bohemian Waxwing	S	trembling aspen	Assess/Maintain				Yes	Yes
Boreal Chickadee	S	trembling aspen	Assess/Maintain				Yes	Yes
Bufflehead	S	riparian balsam poplar	Assess/Maintain				Yes	
Canada Goose, Lesser	S	riparian balsam poplar	Assess/Maintain			Yes	Yes	
Common Goldeneye	S	riparian balsam poplar	Assess/Maintain			Yes		
Gray Jay	S	trembling aspen	Maintain Current					Yes
Green-winged Teal	S	riparian balsam poplar	Maintain Current				Yes	
Mallard	S	riparian balsam poplar	Maintain Current			Yes	Yes	
Pine Grosbeak	S	trembling aspen	Assess/Maintain				Yes	Yes
Varied Thrush	S	trembling aspen	Assess/Maintain				Yes	
Wilson's Warbler	S	riparian balsam poplar	Assess/Maintain				Yes	

Note: Reasons for inclusion in the priority species list are as follows. At Risk: the species was assessed by COSEWIC as Endangered (E), Threatened (T) or Special Concern (SC); RC (regional concern): the species meets PIF regional concern criteria; CC (continental concern): the species meets conservation concern or continental priority criteria for its bird group, and/or is At Risk nationally; RS (regional stewardship): waterfowl with highest, high or moderate high breeding importance in BCR 4, or the species meets PIF criteria for regional stewardship; CS (continental stewardship): landbirds identified as PIF continental stewardship species, or waterbirds listed in WOW as having at least 50% of global population in Canada. All priority species have PIF Relative Density>1.

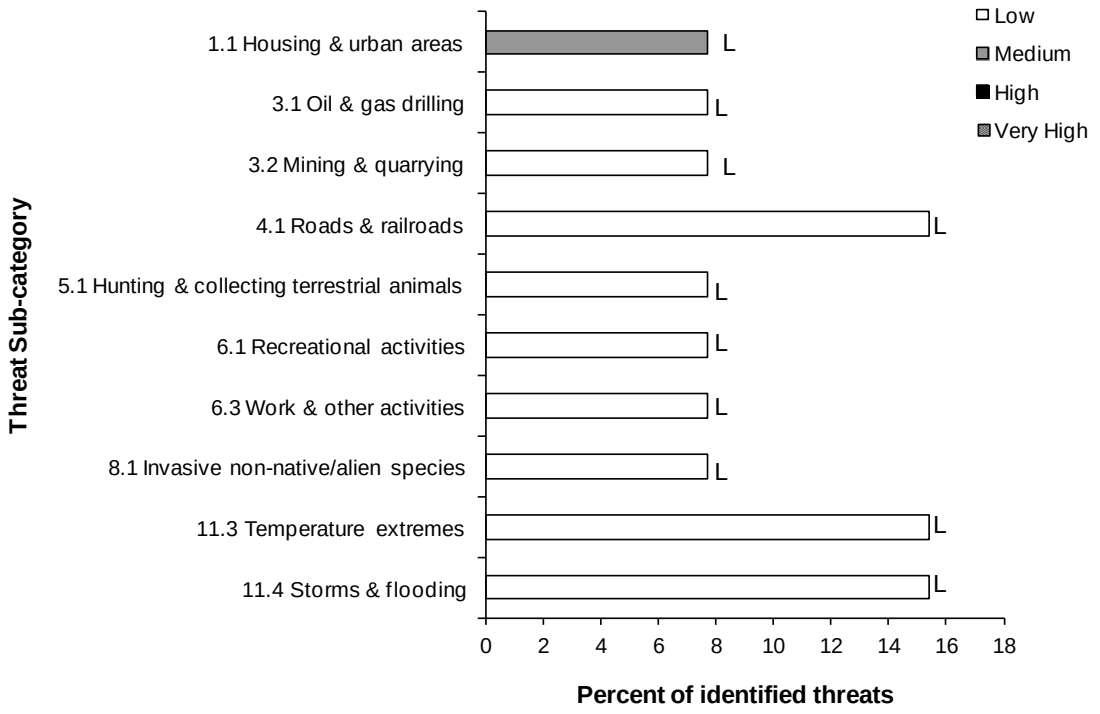

Figure 11. Percent of identified threats to priority species in deciduous habitat in each threat sub-category in BCR 4 in Canada: Northwestern Interior Forest.

Priority species may use deciduous forest as their primary or secondary habitat. A total of 13 threats were identified.

Each bar represents the percent of the total number of threats identified in each threat sub-category in deciduous habitat (for example, if 100 threats were identified in total for all priority species in deciduous habitat, and 10 of those threats were in the category *1.1 Housing & urban areas*, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category). The overall magnitude of the sub-threat in deciduous habitat is shown at the end of each bar (also presented in Table 4, Relative magnitude of identified threats to priority species within BCR 4 in Canada by threat category and broad habitat class).

Mixed Wood

Mixed wood habitats are defined as treed areas with a mix of coniferous and deciduous tree species, with both types making up more than 25% each (Food and Agriculture Organization 2000). Mixed wood forests are not widespread in Canada's portion of BCR 4 (Fig. 12), accounting for only 3.7% of land cover (EOSD; Wulder and Nelson 2003). Almost all of this is open mixed forest, mostly consisting of upland spruce and/or pine mixed with trembling aspen, although mixtures of balsam poplar and white spruce, and white birch mixed with spruce, do occur. Many forests with a deciduous component are dominated by conifers and classified under the coniferous habitat class, e.g. "white spruce/aspen."

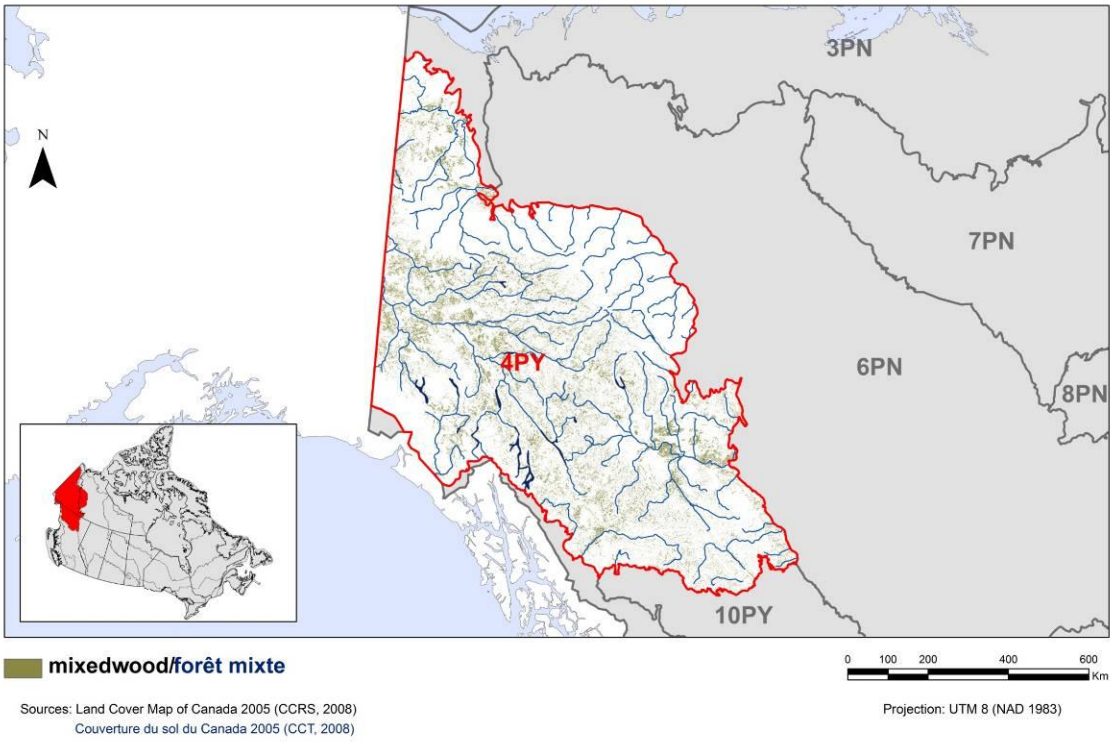

Figure 12. Map of mixed wood habitat in BCR 4 in Canada: Northwestern Interior Forest.

Eight priority species use mixed wood forests as primary habitat in BCR 4; all are landbirds, and none are species at risk (Table 8). A further 19 species use mixed wood areas as a secondary habitat, including 1 species at risk and 4 species that are declining within the region. Within the broad mixed wood category, regional habitat sub-classes include mixed pine/aspen, mixed spruce/aspen, riparian poplar/spruce, and montane spruce/aspen. All are mature to old-growth habitats.

For priority species that use mixed wood habitats, 55 threats of medium and low magnitude were identified (Fig. 13). The 7 medium-magnitude threats included loss and degradation of habitat from forest harvest, for Northern Goshawk, Boreal and Great Gray owls, American Three-toed Woodpecker, Boreal Chickadee and White-winged Crossbill; and reduction of spruce cone crops due to spruce bark beetle and subsequent salvage harvest. Although threats under the Biological Resource Use category rolled up to medium magnitude within this habitat, the overall threat magnitude in mixed wood habitats was low (Table 4).

Actions recommended to conserve priority species that use mixed wood habitats involve protection and management of land, including maintaining the extent of old-growth forest, maintaining natural disturbance regimes, retention of standing dead and decaying trees, and beneficial management practices around raptor nests; increased public awareness of the value of standing dead trees and other issues; and research and monitoring (Table 9).

Table 8. Priority species that use mixed wood habitats in BCR 4 in Canada: Northwestern Interior Forest, with reason for priority and habitat use rank.
Species for which this is a primary habitat are indicated by Habitat use = P, and are in bold. Species for which this is a secondary habitat are indicated by Habitat use =S.

Priority species	Habitat use	Regional habitat sub-class	Population objective	Reason for priority status				
				At Risk	RC	CC	RS	CS
Alder Flycatcher	S	riparian poplar/spruce	Assess/Maintain					Yes
American Kestrel	**P**	**riparian poplar/spruce**	**Assess/Maintain**		**Yes**			
American Three-toed Woodpecker	S	mixed spruce/aspen	Maintain Current				Yes	
American Wigeon	S	riparian poplar/spruce	Increase 50%		Yes	Yes	Yes	
Barrow's Goldeneye	S	riparian poplar/spruce	Assess/Maintain				Yes	
Blackpoll Warbler	S	mixed spruce/aspen	Increase 50%				Yes	
Bohemian Waxwing	**P**	**mixed spruce/aspen**	**Assess/Maintain**				**Yes**	**Yes**
Boreal Chickadee	**P**	**mixed spruce/aspen**	**Assess/Maintain**				**Yes**	**Yes**
Boreal Owl	S	mixed spruce/aspen	Assess/Maintain				Yes	
Bufflehead	S	riparian poplar/spruce	Assess/Maintain				Yes	
Canada Goose, Lesser	S	riparian poplar/spruce	Assess/Maintain			Yes	Yes	
Common Goldeneye	S	riparian poplar/spruce	Assess/Maintain			Yes		
Common Nighthawk	S	mixed pine/aspen	Assess/Maintain	T		Yes		
Dusky Grouse	S	montane spruce/aspen	Assess/Maintain			Yes		
Gray Jay	**P**	**mixed spruce/aspen**	**Maintain Current**					**Yes**
Great Gray Owl	S	mixed spruce/aspen	Assess/Maintain				Yes	
Green-winged Teal	S	riparian poplar/spruce	Maintain Current					
Lesser Yellowlegs	S	riparian poplar/spruce	Increase 50%		Yes	Yes	Yes	
Mallard	S	riparian poplar/spruce	Maintain Current			Yes	Yes	
Northern Goshawk	**P**	**mixed spruce/aspen**	**Assess/Maintain**				**Yes**	
Northern Hawk Owl	**P**	**mixed spruce/aspen**	**Assess/Maintain**				**Yes**	
Pine Grosbeak	S	mixed pine/aspen	Assess/Maintain				Yes	Yes
Rufous Hummingbird	**P**	**riparian poplar/spruce**	**Assess/Maintain**			**Yes**		
Solitary Sandpiper	S	riparian poplar/spruce	Assess/Maintain			Yes	Yes	
Varied Thrush	**P**	**mixed spruce/aspen**	**Assess/Maintain**				**Yes**	
White-crowned Sparrow	S	riparian poplar/spruce	Increase 50%				Yes	
White-winged Crossbill	S	mixed spruce/aspen	Assess/Maintain					Yes

Note: Reasons for inclusion in the priority species list are as follows. At Risk: the species was assessed by COSEWIC as Endangered (E), Threatened (T) or Special Concern (SC); RC (regional concern): the species meets PIF regional concern criteria; CC (continental concern): the species meets conservation concern or continental priority criteria for its bird group, and/or is At Risk nationally; RS (regional stewardship): waterfowl with highest, high or moderate high breeding importance in BCR 4, or the species meets PIF criteria for regional stewardship; CS (continental stewardship): landbirds identified as PIF continental stewardship species, or waterbirds listed in WOW as having at least 50% of global population in Canada. All priority species have PIF Relative Density>1.

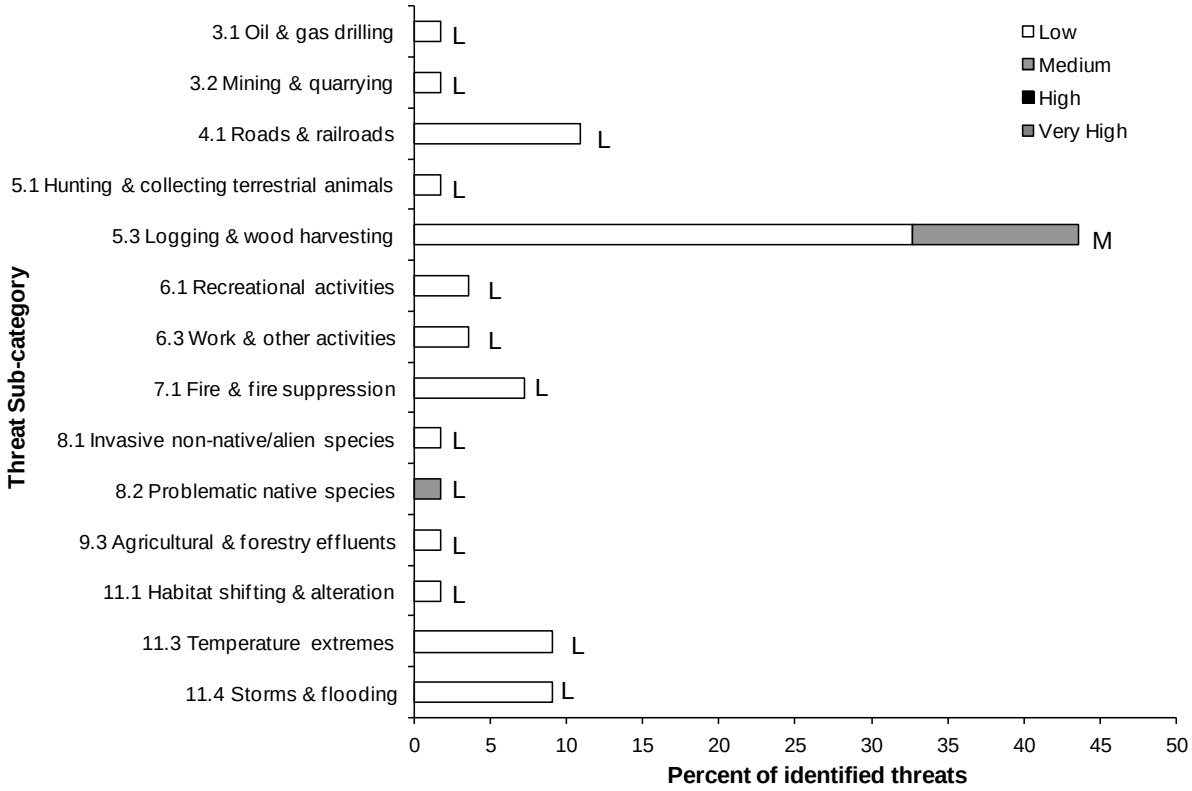

Figure 13. Percent of identified threats to priority species in mixed wood habitat in each threat sub-category in BCR 4 in Canada: Northwestern Interior Forest.

Priority species may use mixed wood forest as their primary or secondary habitat. A total of 55 threats were identified.

Each bar represents the percent of the total number of threats identified in each threat sub-category in mixed wood habitat (for example, if 100 threats were identified in total for all priority species in mixed wood habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category). The overall magnitude of the sub-threat in mixed wood habitat is shown at the end of each bar (also presented in Table 4, Relative magnitude of identified threats to priority species within BCR 4 in Canada by threat category and broad habitat class).

Table 9. Threats addressed, conservation objectives, recommended actions and priority species affected for mixed wood habitats in BCR 4 in Canada: Northwestern Interior Forest.

Species for which a threat is of medium or high magnitude are in bold. Objectives and actions are presented only for species that use mixed wood forest as a primary habitat. "Priority species affected" are species for which the threat has been documented; additional species that are not listed may also be affected.

Threat category	Threats addressed	Objective Subcategory	Objectives	Action category	Recommended actions	Priority species affected†
4. Transportation and Service Corridors						
4.1 Roads & railroads	Mortality from collisions with vehicles.	2.7 Reduce incidental mortality from collisions	Reduce vehicle collision mortality of forest birds.	4.3 Awareness and communications	Increase public awareness of forest birds and vulnerability to high-speed traffic.	Bohemian Waxwing, Northern Hawk Owl
5. Biological Resource Use						
5.1 Hunting & collecting terrestrial animals	Vulnerable to traps set for furbearers.	2.4 Reduce incidental mortality	Reduce mortality from trapping by-catch.	7.2 Alliance and partnership development	Work with trappers to develop sets that will not capture jays and other non-target bird species, and to assess whether this is a significant issue.	Gray Jay
5.3 Logging & wood harvesting	Loss/degradation of breeding habitat from logging and other timber harvest (e.g. firewood collection).	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain the quantity and quality of forest habitat within BCR 4 for nesting birds.	1.1 Site/area protection	Create protected areas that include large, productive areas of riparian white spruce.	**Boreal Chickadee**, **Northern Goshawk**, Northern Hawk Owl, Varied Thrush
				2.1 Site/area management	Maintain current extent of old-growth coniferous forest, especially riparian white spruce forest.	
				5.3 Private sector standards and codes	Maintain perch and nest sites across harvested landscapes, by planning for large tree recruitment, and by ensuring large trees and attributes (e.g. mistletoe, large raptor/corvid nests) that provide raptor nesting requirements are retained.	
				2.1 Site/area management	Ensure harvesting practices retain dead and decaying trees for cavities, perches, and foraging, and plan for cavity and perch recruitment in harvested stands.	American Kestrel, **Boreal Chickadee,** Northern Hawk Owl
				4.3 Awareness and communications	Increase public awareness of the value of standing dead trees, provide guidelines for retention of existing and potential cavity trees.	

Table 9 continued

Threat category	Threats addressed	Objective Subcategory	Objectives	Action category	Recommended actions	Priority species affected†
6. Human Intrusions and Disturbance						
6.1 Recreational activities 6.3 Work & other activities	Disturbance at nest sites from recreation and other activities.	4.1 Reduce disturbance from human recreation	Minimize human disturbance of priority forest species.	2.1 Site/area management	When goshawk nests are located, follow "Identified Wildlife Management Strategy" guidance standards to ensure the birds are not disturbed, and the nest area is not abandoned or logged.	Northern Goshawk
7. Natural System Modifications						
7.1 Fire & fire suppression	Fire suppression degrades habitat.	1.3 Ensure the continuation of natural processes that maintain bird habitat	Maintain the quantity and quality of forest habitat within BCR 4 for nesting birds.	2.1 Site/area management	Maintain natural fire disturbance regimes and ensure forest harvest patterns mimic natural disturbance patterns, specifically ensuring mature-old growth patches do not become isolated, and that >60% of the forested landscape remains in mature-old growth.	American Kestrel, Northern Hawk Owl
				5.3 Private sector standards and codes	Limit salvage logging of snags. Retain snags with cavities that may provide suitable nesting and foraging opportunities.	
8. Invasive and Other Problematic Species and Genes						
8.1 Invasive non-native/alien species	West Nile Virus.	2.6 Reduce the spread of disease	Ensure that issues related to diseases are not limiting priority species' populations.	8.1 Research	Research effects of West Nile Virus on American Kestrel to determine if it is a factor in population decline.	American Kestrel

† Priority species not mentioned in this table have no identified threats in this habitat.

Shrub/Early Successional

Shrub/early successional habitats are defined as areas with vegetation less than 5m tall, mostly dominated by shrubs (Food and Agriculture Organization 2000). Shrub-dominated habitats are widespread in the Canadian portion of BCR 4 (Fig. 14), covering 25% of the landscape, including 22% low (<2 m tall) shrub and 3% tall (>2 m tall) shrub habitats (EOSD; Wulder and Nelson 2003). In BCR 4, habitats in this category include extensive shrubby subalpine habitats, and also lower elevation shrub habitats associated with wetlands or burned forest. In addition, tundra areas with abundant dwarf shrubs were included in this habitat class for the purposes of this strategy, but may be classed as "herb" in the EOSD data. Early successional habitats in BCR 4 are mostly restricted to regenerating forest fire areas, as shown in the Land Cover Map of Canada, below.

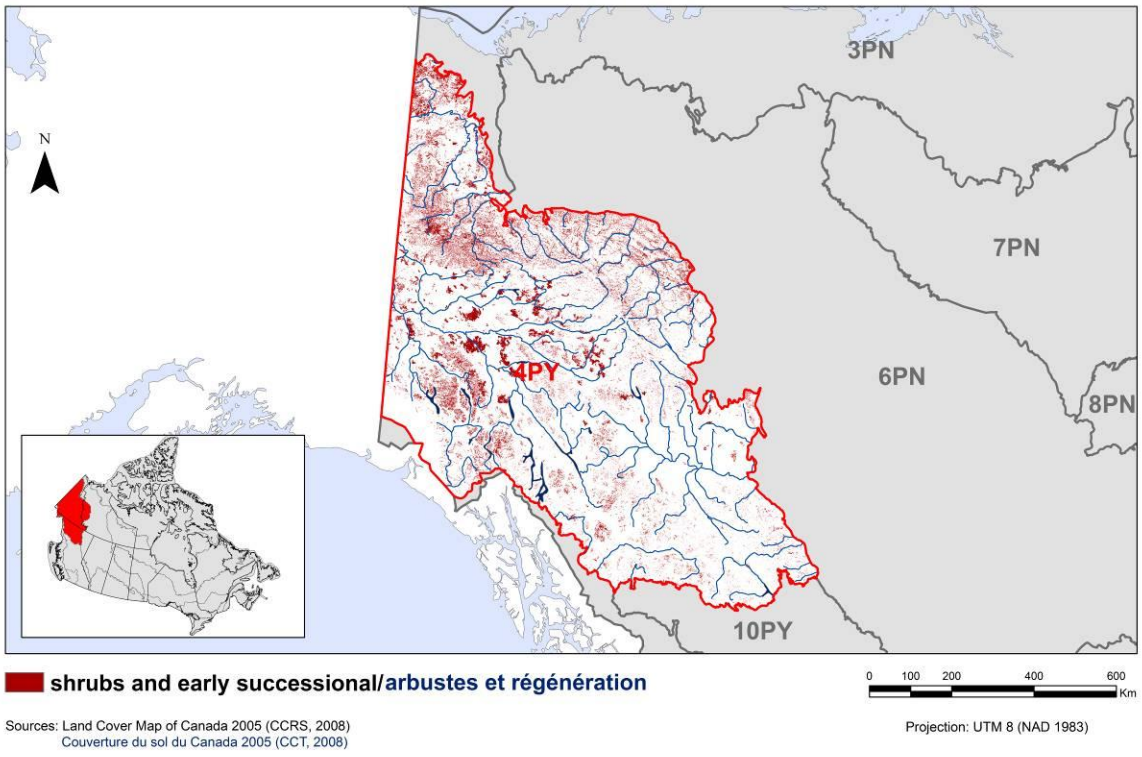

Figure 14. Map of shrub/early successional habitat in BCR 4 in Canada: Northwestern Interior Forest.

There are 37 priority species which use shrub/early successional as primary habitat in BCR 4 (Table 10). These include 12 waterfowl, 9 shorebird, and 16 landbird species. Of these, one is a species at risk. A further 15 priority species, including 5 species at risk, use shrub/early successional areas as secondary habitat. Within the shrub/early

successional category, regional habitat sub-classes include riparian shrub, post-fire early successional, shrubby taiga, subalpine shrub, and dwarf shrub tundra.

For priority species that use shrub/early successional habitats, 137 threats of high, medium- and low-magnitude were identified (Fig. 15). Overall, the threat level rolled up to medium-magnitude for this habitat, due to high-magnitude threats in the Climate change and severe weather category (Table 4).

High-magnitude threats were all related to habitat shifting and alteration due to climate change, specifically the loss of alpine tundra breeding habitat due to encroachment of shrubs and trees (Fig. 15). This threat affected seven species, including White-tailed Ptarmigan, American Golden-Plover, Wandering Tattler, Whimbrel, Surfbird, Smith's Longspur and Gray-crowned Rosy-Finch.

Recommended actions included protecting areas of tundra habitats large enough to buffer against habitat loss due to climate change; identifying areas of importance to alpine tundra species; supporting efforts to reduce climate change; and managing energy and mining development to minimize impacts on tundra birds (Table 11).

Table 10. Priority species that use shrub/early successional habitats in BCR 4 in Canada: Northwestern Interior Forest, with reason for priority and habitat use rank.

Species for which this is a primary habitat are indicated by Habitat use = P, and are in bold. Species for which this is a secondary habitat are indicated by Habitat use = S.

Priority species	Habitat use	Regional habitat sub-class	Population objective	Reason for priority status				
				At Risk	RC	CC	RS	CS
Alder Flycatcher	**P**	**riparian shrub, post fire early successional**	**Assess/Maintain**					**Yes**
American Golden-Plover	**P**	**dwarf shrub tundra**	**Assess/Maintain**			**Yes**		
American Kestrel	**P**	**subalpine shrub, post fire early successional, riparian shrub**	**Assess/Maintain**		**Yes**			
American Three-toed Woodpecker	S	post fire early successional	Maintain Current				Yes	
American Wigeon	**P**	**riparian shrub**	**Increase 50%**		**Yes**	**Yes**	**Yes**	
Arctic Tern	S	dwarf shrub tundra	Assess/Maintain			Yes		
Barn Swallow	S	riparian shrub, subalpine shrub	Assess/Maintain	T		Yes		
Blackpoll Warbler	**P**	**subalpine shrub**	**Increase 50%**				**Yes**	
Blue-winged Teal	**P**	**riparian shrub**	**Assess/Maintain**			**Yes**		
Brewer's Sparrow	**P**	**subalpine shrub**	**Assess/Maintain**			**Yes**		
Canada Goose, Lesser	**P**	**riparian shrub**	**Assess/Maintain**			**Yes**	**Yes**	
Common Nighthawk	S	post fire early successional	Assess/Maintain	T		Yes		
Dusky Grouse	**P**	**subalpine shrub**	**Assess/Maintain**			**Yes**		
Golden Eagle	**P**	**dwarf shrub tundra**	**Assess/Maintain**				**Yes**	
Golden-crowned Sparrow	**P**	**subalpine shrub**	**Assess/Maintain**				**Yes**	
Gray Jay	S	post fire early successional	Maintain Current					Yes
Gray-crowned Rosy-Finch	**P**	**dwarf shrub tundra**	**Assess/Maintain**				**Yes**	
Gray-headed Chickadee	**P**	**shrubby taiga**	**Assess/Maintain**				**Yes**	
Greater White-fronted Goose	**P**	**shrubby taiga**	**Assess/Maintain**				**Yes**	
Green-winged Teal	**P**	**riparian shrub**	**Maintain Current**				**Yes**	
Harlequin Duck	**P**	**riparian shrub**	**Assess/Maintain**				**Yes**	
Lesser Scaup	**P**	**riparian shrub**	**Increase 50%**		**Yes**	**Yes**	**Yes**	
Lesser Yellowlegs	**P**	**riparian shrub**	**Increase 50%**		**Yes**	**Yes**	**Yes**	
Long-tailed Duck	S	dwarf shrub tundra	Assess/Maintain			Yes		
Mallard	**P**	**riparian shrub**	**Maintain Current**			**Yes**	**Yes**	
Mew Gull	S	riparian shrub	Assess/Maintain				Yes	
Northern Goshawk	S	subalpine shrub, post fire early successional, riparian shrub	Assess/Maintain				Yes	
Northern Hawk Owl	S	subalpine shrub	Assess/Maintain				Yes	
Northern Pintail	**P**	**riparian shrub**	**Assess/Maintain**			**Yes**	**Yes**	
Northern Shoveler	**P**	**riparian shrub**	**Assess/Maintain**				**Yes**	
Northern Shrike	**P**	**subalpine shrub**	**Assess/Maintain**				**Yes**	

Table 10 continued

Priority species	Habitat use	Regional habitat sub-class	Population objective	Reason for priority status				
				At Risk	RC	CC	RS	CS
Olive-sided Flycatcher	S	post fire early successional	Increase 50%	T	Yes	Yes	Yes	
Peregrine Falcon	S	dwarf shrub tundra	Assess/Maintain	SC		Yes	Yes	
Pine Grosbeak	S	riparian shrub	Assess/Maintain				Yes	Yes
Rufous Hummingbird	S	riparian shrub	Assess/Maintain			Yes		
Rusty Blackbird	**P**	**riparian shrub**	**Increase 50%**	**SC**	**Yes**	**Yes**	**Yes**	
Short-billed Dowitcher	**P**	**riparian shrub**	**Assess/Maintain**			**Yes**		
Short-eared Owl	**P**	**dwarf shrub tundra**	**Assess/Maintain**	**SC**		**Yes**		
Smith's Longspur	**P**	**dwarf shrub tundra**	**Assess/Maintain**			**Yes**		
Solitary Sandpiper	**P**	**riparian shrub**	**Assess/Maintain**			**Yes**	**Yes**	
Spotted Sandpiper	S	riparian shrub	Assess/Maintain				Yes	
Surf Scoter	**P**	**riparian shrub**	**Assess/Maintain**			**Yes**	**Yes**	
Surfbird	**P**	**dwarf shrub tundra**	**Assess/Maintain**			**Yes**	**Yes**	
Swainson's Hawk	**P**	**shrubby taiga**	**Assess/Maintain**			**Yes**		
Upland Sandpiper	**P**	**shrubby taiga**	**Assess/Maintain**			**Yes**		
Wandering Tattler	**P**	**dwarf shrub tundra**	**Assess/Maintain**			**Yes**	**Yes**	
Whimbrel	**P**	**dwarf shrub tundra**	**Assess/Maintain**			**Yes**		
White-crowned Sparrow	**P**	**subalpine shrub, post fire early successional, riparian shrub**	**Increase 50%**				**Yes**	
White-tailed Ptarmigan	**P**	**dwarf shrub tundra**	**Assess/Maintain**				**Yes**	
White-winged Scoter	**P**	**riparian shrub**	**Assess/Maintain**			**Yes**	**Yes**	
Wilson's Snipe	**P**	**riparian shrub**	**Maintain Current**			**Yes**		
Wilson's Warbler	**P**	**riparian shrub, subalpine shrub**	**Assess/Maintain**				**Yes**	

Note: Reasons for inclusion in the priority species list are as follows. RC (regional concern): the species meets PIF regional concern criteria; CC (continental concern): the species meets conservation concern or continental priority criteria for its bird group, and/or is At Risk nationally; RS (regional stewardship): waterfowl with highest, high or moderate high breeding importance in BCR 4, or the species meets PIF criteria for regional stewardship; CS (continental stewardship): landbirds identified as PIF continental stewardship species, or waterbirds listed in WOW as having at least 50% of global population in Canada. All priority species have PIF Relative Density>1.

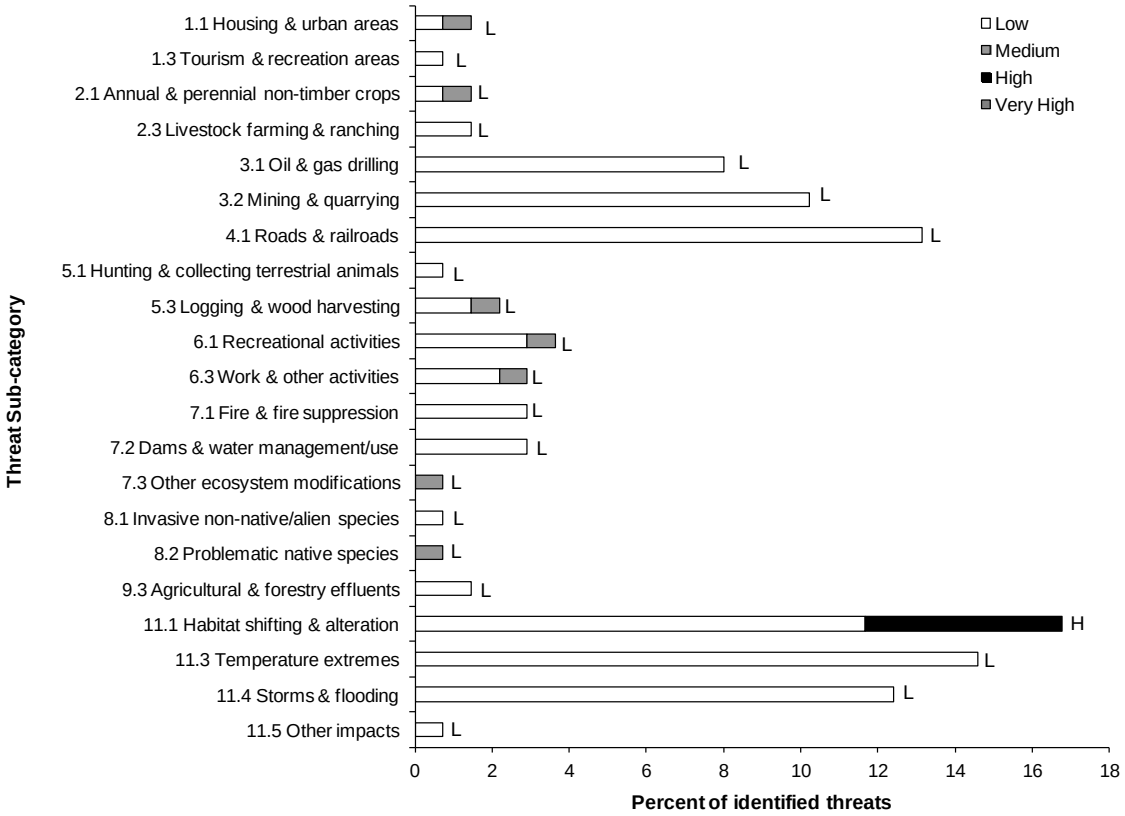

Figure 15. Percent of identified threats to priority species in shrub/early successional habitat in each threat sub-category in BCR 4 in Canada: Northwestern Interior Forest. Priority species may use shrub/early successional areas as their primary or secondary habitat. A total of 137 threats were identified.

Each bar represents the percent of the total number of threats identified in each threat sub-category in shrub/early successional habitat (for example, if 100 threats were identified in total for all priority species in shrub/early successional habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category). The overall magnitude of the sub-threat in shrub/early successional habitat is shown at the end of each bar (also presented in Table 4, Relative magnitude of identified threats to priority species within BCR 4 in Canada by threat category and broad habitat class).

Table 11. Threats addressed, conservation objectives, recommended actions and priority species affected for shrub/early successional habitats in BCR 4 in Canada: Northwestern Interior Forest.

Species for which a threat is of medium or high magnitude are in bold. Objectives and actions are presented only for species that use shrub/early successional habitats as a primary habitat. "Priority species affected" are species for which the threat has been documented; additional species that are not listed may also be affected.

Threat category	Threats addressed	Objective category	Objectives	Action category	Recommended actions	Priority species affected[†]
1. Residential and Commercial Development						
1.1 Housing & urban areas	Encroachment of housing developments at nesting areas.	1.2 Maintain the size, shape and configuration of habitat within the natural range of variation	Maintain the quantity and quality of riparian shrub habitat within BCR 4 for nesting waterbirds.	1.1 Site/area protection	Establish protection of important nesting areas.	**Short-billed Dowitcher**
2. Agriculture and Aquaculture						
2.1 Annual & perennial non-timber crops 2.3 Livestock farming & ranching	Encroachment on/loss of breeding habitat to cropland and rangeland.	1.2 Maintain the size, shape and configuration of habitat within the natural range of variation	Maintain the quantity and quality of riparian shrub habitat within BCR 4 for nesting waterbirds.	5.2 Policies and regulations 5.4 Compliance and enforcement	In areas with agricultural operations, establish and enforce habitat protection of wetlands and adjacent areas, including riparian guidelines for agricultural leases.	Rusty Blackbird, **Short-billed Dowitcher**
3. Energy Production and Mining						
3.1 Oil & gas drilling	Habitat degradation from oil and gas development.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain the quantity and quality of dwarf shrub tundra and riparian shrub habitat within BCR 4 for nesting birds.	5.4 Compliance and enforcement	Incorporate exclusion zones into oil and gas development and exploration plans to protect habitat.	American Golden-Plover, American Wigeon, Blue-winged Teal, Green-winged Teal, Lesser Scaup, Mallard, Northern Pintail, Northern Shoveler, Smith's Longspur, Surf Scoter, White-winged Scoter

Table 11 continued

Threat category	Threats addressed	Objective category	Objectives	Action category	Recommended actions	Priority species affected†
3.2 Mining & quarrying	Habitat degradation from mining.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain the quantity and quality of dwarf shrub tundra and riparian shrub habitat within BCR 4 for nesting birds.	5.4 Compliance and enforcement	Incorporate exclusion zones into mining plans to protect habitat.	American Golden-Plover, American Wigeon, Blue-winged Teal, Green-winged Teal, Harlequin Duck, Lesser Scaup, Mallard, Northern Pintail, Northern Shoveler, Surf Scoter, Wandering Tattler, White-tailed Ptarmigan, White-winged Scoter
					Incorporate habitat recovery into post-mining site clean-up.	
	Habitat degradation from placer mining.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain the quantity and quality of riparian shrub habitat within BCR 4 for nesting birds.	5.4 Compliance and enforcement	Incorporate exclusion zones into mining plans to protect habitat.	Rusty Blackbird
					Incorporate habitat recovery into post-mining site clean-up.	
				8.2 Monitoring	Monitor Rusty Blackbirds at susceptible sites.	
4. Transportation and Service Corridors						
4.1 Roads & railroads	Degradation of habitat from road construction.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain the quantity and quality of dwarf shrub tundra and riparian shrub habitat within BCR 4 for nesting birds.	2.1 Site/area management	Limit construction of roads in alpine areas.	White-tailed Ptarmigan
					Reclaim old unused roads.	
					Limit construction of roads in and near wetland areas.	American Wigeon, Blue-winged Teal, Canada Goose, Greater White-fronted Goose, Green-winged Teal, Lesser Scaup, Lesser Yellowlegs

Table 11 continued

Threat category	Threats addressed	Objective category	Objectives	Action category	Recommended actions	Priority species affected†
						Mallard, Northern Pintail, Northern Shoveler, Surf Scoter, White-winged Scoter
	Collisions with vehicles.	2.7 Reduce incidental mortality from collisions	Reduce vehicle collision mortality of birds.	4.3 Awareness and communications	Increase public awareness of birds and vulnerability to high-speed traffic.	Northern Shrike, Short-eared Owl
5. Biological Resource Use						
5.1 Hunting & collecting terrestrial animals	May be vulnerable to local overharvest due to flocking behaviour etc., where access to alpine areas is opened up by new mines etc.	7.7. Ensure sustainable harvest	Ensure that hunting pressure is not limiting priority species' populations.	5.4 Compliance and enforcement	Enforce bag and possession limits.	White-tailed Ptarmigan
				8.2 Monitoring	Monitor harvest/populations in affected areas, review bag and possession limits.	
6. Human Intrusions and Disturbance						
6.1 Recreational activities 6.3 Work & other activities	Disturbance from recreational off-road vehicles.	4.1 Reduce disturbance from human recreation	Minimize human disturbance of priority species.	4.3 Awareness and communications	Increase public awareness of vulnerability of nesting birds to disturbance from watercraft, recreational hikers, mining activities, off-road vehicles, etc.; provide guidelines.	White-tailed Ptarmigan
	Disturbance at nesting areas from recreation.					Harlequin Duck, Short-billed Dowitcher
	Disturbance at nesting areas from mining					Harlequin Duck
7. Natural System Modifications						
7.2 Dams &	Flow changes	1.1 Ensure land and	Maintain the quantity	2.1 Site/area	Work with hydroelectric	Harlequin Duck

Table 11 continued

Threat category	Threats addressed	Objective category	Objectives	Action category	Recommended actions	Priority species affected†
water manage-ment/use	from hydroelectric development.	resource-use policies and practices maintain or improve bird habitat	and quality of riparian shrub habitat within BCR 4 for nesting birds.	management	companies to establish in-stream flow agreements that would manipulate water to provide appropriate water levels at critical times.	
8. Invasive and Other Problematic Species and Genes						
8.1 Invasive non-native/alien species	West Nile Virus.	2.6 Reduce the spread of disease	Ensure that issues related to diseases are not limiting priority species' populations	8.1 Research	Research effects of West Nile Virus on American Kestrel to determine if it is a factor in population decline.	American Kestrel
8.2 Problematic native species	Increased abundance of competitors, e.g. Red-winged Blackbird.	3.2 Reduce competition with problematic native species	Ensure that issues related to other native species are not limiting priority species' populations	8.1 Research	Research effects of Red-winged Blackbird on Rusty Blackbird populations.	**Rusty Blackbird**
11. Climate Change and Severe Weather						
11.1 Habitat shifting & alteration	Incremental wetland loss due to melting permafrost and evapotranspira-tion.	1.2 Maintain the size, shape and configuration of habitat within the natural range of variation	Maintain the quantity and quality of riparian shrub habitat within BCR 4 for nesting waterbirds.	1.1 Site/area protection	Create a system of large protected areas to maintain breeding populations, and to buffer against habitat loss.	American Wigeon, Canada Goose, Green-winged Teal, Harlequin Duck, Lesser Scaup, Lesser Yellowlegs, Mallard, Northern Pintail, Northern Shoveler, Solitary Sandpiper, White-winged Scoter, Wilson's Snipe
				4.3 Awareness and communications 5. Law and policy 6. Livelihood, economic and other incentives	Support efforts to reduce greenhouse gas emissions.	
11.1 Habitat shifting & alteration	Reduction in alpine tundra habitat.	1.2 Maintain the size, shape and configuration of	Maintain the quantity and quality of dwarf shrub tundra within	1.1 Site/area protection	Create a system of protected areas sufficient to buffer against habitat loss.	**American Golden-Plover**, Golden Eagle, **Gray-crowned Rosy-**

Table 11 continued

Threat category	Threats addressed	Objective category	Objectives	Action category	Recommended actions	Priority species affected†
		habitat within the natural range of variation	BCR 4 for nesting birds.	8.1 Research	Identify areas of high breeding importance.	**Finch**, Short-eared Owl, **Smith's Longspur**, **Surfbird**, **Wandering Tattler**, **Whimbrel**, **White-tailed Ptarmigan**
				4.3 Awareness and communications 5. Law and policy 6. Livelihood, economic and other incentives	Support efforts to reduce greenhouse gas emissions.	
11.3 Temperature extremes 11.4 Storms & flooding	Vulnerable to increasing severity of temperature extremes and severe weather events.	6.3 Manage populations for resilience to increased mortality from climate change	Ensure that population size is large enough to buffer against years of high mortality due to severe weather.	1.1 Site/area protection	Create a system of protected areas sufficient to support populations that are robust enough to recover from years of high mortality.	American Golden-Plover, Brewer's Sparrow, Dusky Grouse, Golden-crowned Sparrow, Gray-crowned Rosy-Finch, Lesser Scaup, Mallard, Northern Pintail, Northern Shoveler, Short-eared Owl, Smith's Longspur, Surfbird, Upland Sandpiper, Wandering Tattler, White-tailed Ptarmigan, Whimbrel, White-crowned Sparrow, White-winged Scoter
				8.1 Research	Measure the impact of such weather events on populations.	
				4.3 Awareness and communications 5. Law and policy 6. Livelihood, economic and other incentives	Support efforts to reduce greenhouse gas emissions.	

† Priority species not mentioned in this table have no identified threats in this habitat or BCR subregion.

Herbaceous

Herbaceous habitats are defined as areas dominated by non-woody vegetation such as forbs and graminoids (Food and Agriculture Organization 2000), and are not particularly widespread in BCR 4; mostly they are found in alpine areas, or on dry south-facing hillsides. Some habitats with abundant herbs are included under other broad habitat types for the purposes of this strategy; e.g., herbaceous wetland meadows are classified under the Wetland habitat class, and most tundra habitats, although they may have abundant herbaceous plants, are classified as "dwarf shrub tundra" under the shrubs/early successional habitat class. Thus although herbaceous habitat as defined by the LCCS is uncommon in BCR 4, it is classified differently by the EOSD (Wulder and Nelson 2003), which shows 10% of the Canadian portion of BCR 4 as Herb cover, and by the Land Cover Map of Canada (Fig. 16), which shows even greater coverage of this type. Again, much of this is likely dwarf shrub tundra that we have classified as part of the LCCS "shrubs/early successional" habitat class due to the abundance of dwarf shrubs.

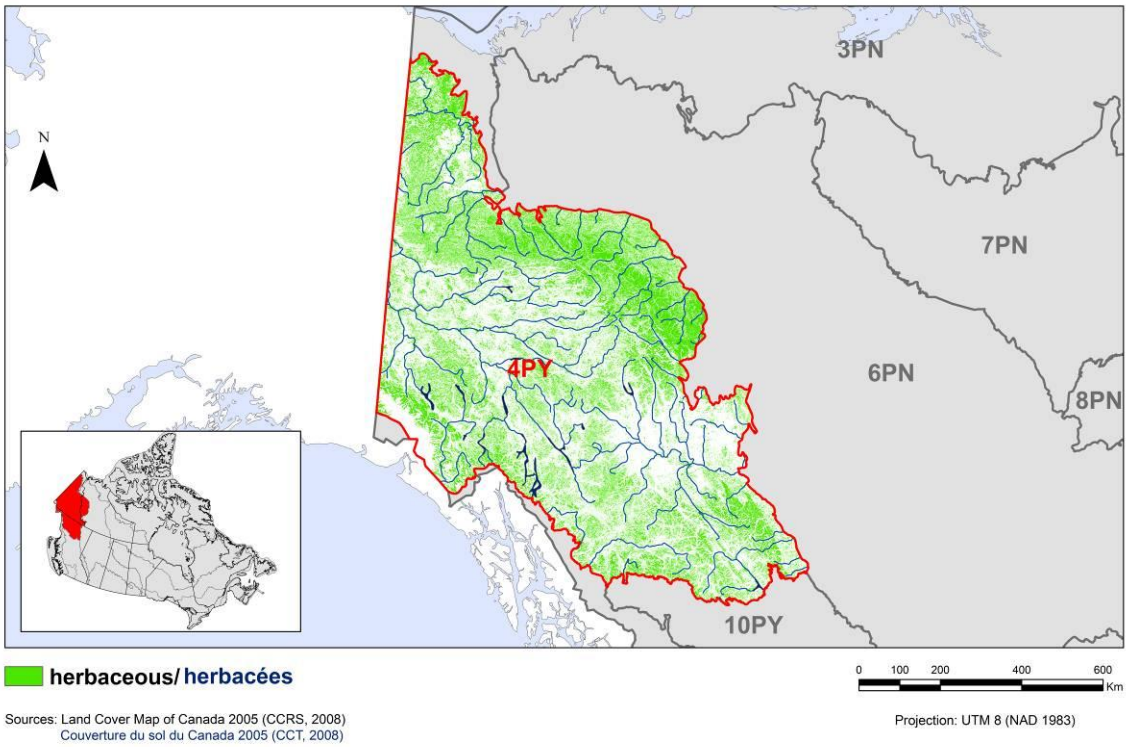

Figure 16. Map of Herbaceous habitat in BCR 4 in Canada: Northwestern Interior Forest.

There are 4 priority species which use herbaceous areas as primary habitat in BCR 4 (Table 12). These include 2 shorebird and 2 landbird species. Of these, one is a species at risk. A further 30 priority species, including 2 species at risk, use herbaceous areas as

a secondary habitat, mostly in association with wetlands. Within the broad herbaceous habitat category, regional habitat sub-classes include riparian herbaceous, and tundra meadow.

For priority species that use herbaceous habitats, 95 threats of high, medium and low magnitude were identified (Fig. 17). Overall, the threat level rolled up to medium magnitude for this habitat (Table 4), due to high-magnitude threats in the Climate change and severe weather category. Most priority species that use tundra meadow within the herbaceous habitat category also use dwarf shrub tundra under the shrub/early successional habitat category, and they share the same threats in both tundra habitats.

High-magnitude threats were all related to habitat shifting and alteration due to climate change, specifically the loss of alpine tundra breeding habitat due to encroachment of shrubs and trees. This threat affected seven species, including White-tailed Ptarmigan, American Golden-Plover, Wandering Tattler, Whimbrel, Surfbird, Smith's Longspur, Gray-crowned Rosy-Finch. Medium-magnitude threats were mostly related to encroachment of development on riparian herbaceous habitats. Recommended actions include protecting large enough areas of these habitats to buffer against habitat loss, and supporting efforts to reduce climate change (Table 13).

Table 12. Priority species that use herbaceous habitats in BCR 4 in Canada: Northwestern Interior Forest, with reason for priority, and habitat use rank.

Species for which this is a primary habitat are indicated by Habitat use = P, and are in bold. Species for which this is a secondary habitat are indicated by Habitat use = S.

Priority species	Habitat use	Regional habitat sub-class	Population objective	Reason for priority status				
				At Risk	RC	CC	RS	CS
American Golden-Plover	S	tundra meadow	Assess/Maintain			Yes		
American Kestrel	S	riparian herbaceous	Assess/Maintain		Yes			
American Wigeon	S	riparian herbaceous	Increase 50%		Yes	Yes	Yes	
Arctic Tern	S	riparian herbaceous	Assess/Maintain			Yes		
Blue-winged Teal	S	riparian herbaceous	Assess/Maintain			Yes		
Canada Goose	S	riparian herbaceous	Assess/Maintain			Yes	Yes	
Golden Eagle	**P**	**tundra meadow**	**Assess/Maintain**				**Yes**	
Golden-crowned Sparrow	S	tundra meadow	Assess/Maintain				Yes	
Gray-crowned Rosy-Finch	S	tundra meadow	Assess/Maintain				Yes	
Greater White-fronted Goose	S	riparian herbaceous	Assess/Maintain				Yes	
Green-winged Teal	S	riparian herbaceous	Maintain Current				Yes	
Herring Gull	S	riparian herbaceous	Assess/Maintain			Yes		
Killdeer	S	riparian herbaceous	Assess/Maintain			Yes		
Lesser Scaup	S	riparian herbaceous	Increase 50%		Yes	Yes	Yes	
Lesser Yellowlegs	S	riparian herbaceous	Increase 50%		Yes	Yes	Yes	
Mallard	S	riparian herbaceous	Maintain Current			Yes	Yes	
Mew Gull	S	riparian herbaceous	Assess/Maintain				Yes	
Northern Pintail	S	riparian herbaceous	Assess/Maintain			Yes	Yes	
Northern Shoveler	S	riparian herbaceous	Assess/Maintain				Yes	
Northern Shrike	S	tundra meadow	Assess/Maintain				Yes	
Peregrine Falcon	S	riparian herbaceous	Assess/Maintain	SC		Yes	Yes	
Rusty Blackbird	S	riparian herbaceous	Increase 50%	SC	Yes	Yes	Yes	
Short-billed Dowitcher	S	riparian herbaceous	Assess/Maintain			Yes		
Short-eared Owl	**P**	**tundra meadow, riparian herbaceous**	**Assess/Maintain**	**SC**		**Yes**		
Smith's Longspur	S	tundra meadow	Assess/Maintain			Yes		
Solitary Sandpiper	S	riparian herbaceous	Assess/Maintain			Yes	Yes	
Spotted Sandpiper	**P**	**riparian herbaceous**	**Assess/Maintain**				**Yes**	

Table 12 continued

Priority species	Habitat use	Regional habitat sub-class	Population objective	Reason for priority status				
				At Risk	RC	CC	RS	CS
Surfbird	S	tundra meadow	Assess/Maintain			Yes	Yes	
Swainson's Hawk	S	tundra meadow	Assess/Maintain			Yes		
Upland Sandpiper	**P**	**tundra meadow**	**Assess/Maintain**			**Yes**		
Wandering Tattler	S	tundra meadow	Assess/Maintain			Yes	Yes	
Whimbrel	S	tundra meadow	Assess/Maintain			Yes		
White-tailed Ptarmigan	S	tundra meadow	Assess/Maintain				Yes	
Wilson's Snipe	S	riparian herbaceous	Maintain Current			Yes		

Note: Reasons for inclusion in the priority species list are as follows. At Risk: the species was assessed by COSEWIC as Endangered (E), Threatened (T) or Special Concern (SC); RC (regional concern): the species meets PIF regional concern criteria; CC (continental concern): the species meets conservation concern or continental priority criteria for its bird group, and/or is At Risk nationally; RS (regional stewardship): waterfowl with highest, high or moderate high breeding importance in BCR 4, or the species meets PIF criteria for regional stewardship; CS (continental stewardship): landbirds identified as PIF continental stewardship species, or waterbirds listed in WOW as having at least 50% of global population in Canada. All priority species have PIF Relative Density>1.

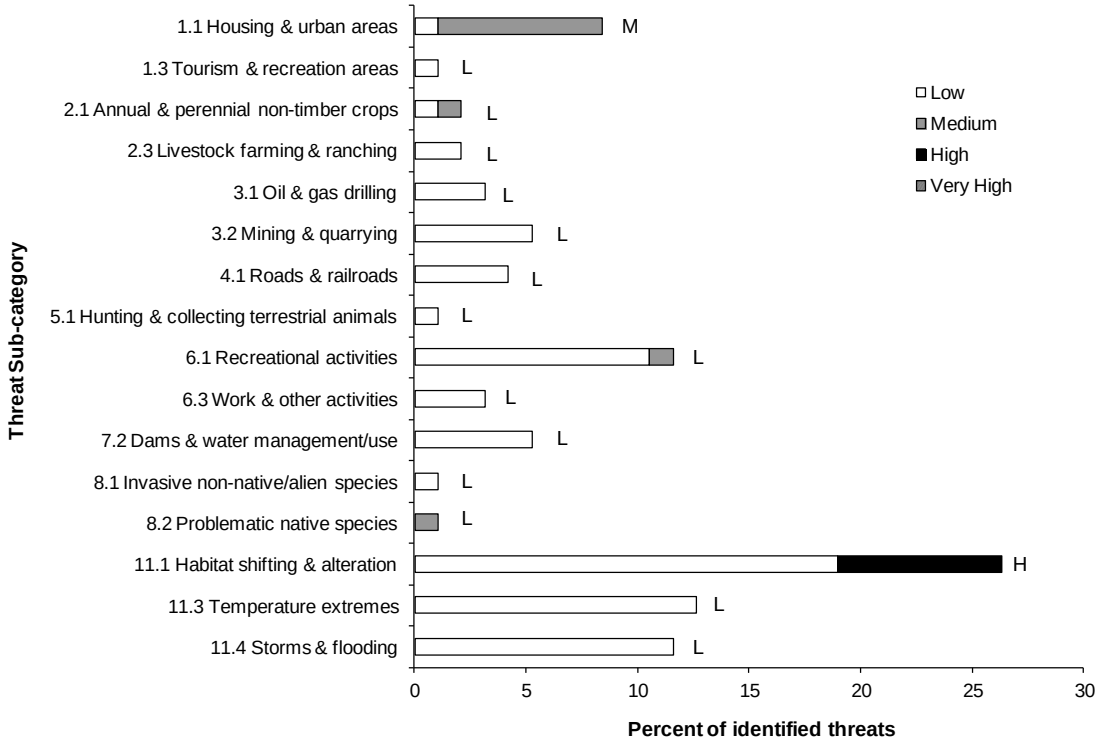

Figure 17. Percent of identified threats to priority species in herbaceous habitat in each threat sub-category in BCR 4 in Canada: Northwestern Interior Forest.

Priority species may use herbaceous habitat as their primary or secondary habitat. A total of 95 threats were identified.

Each bar represents the percent of the total number of threats identified in each threat sub-category in herbaceous habitat (for example, if 100 threats were identified in total for all priority species in herbaceous habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category). The overall magnitude of the sub-threat in herbaceous habitat is shown at the end of each bar (also presented in Table 4, Relative magnitude of identified threats to priority species within BCR 4 in Canada by threat category and broad habitat class).

Table 13. Threats addressed, conservation objectives, recommended actions and priority species affected for herbaceous habitats in BCR 4 in Canada: Northwestern Interior Forest.

Species for which a threat is of medium or high magnitude are in bold. Objectives and actions are presented only for species that use herbaceous habitats as a primary habitat. "Priority species affected" are species for which the threat has been documented; additional species that are not listed may also be affected.

Threat category	Threats addressed	Objective category	Objectives	Action category	Recommended actions	Priority species affected
4. Transportation and Service Corridors						
4.1 Roads & railroads	Mortality from collisions with vehicles.	2.7 Reduce incidental mortality from collisions	Reduce vehicle collision mortality of birds.	4.3 Awareness and communications	Increase public awareness of birds and vulnerability to high-speed traffic.	Short-eared Owl
7. Natural System Modifications						
7.2 Dams & water management/use	Habitat degradation from flow changes due to hydroelectric development.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain the quantity and quality of herbaceous riparian habitats within BCR 4 for nesting birds.	2.1 Site/area management	Work with hydroelectric companies to establish flow agreements that would manipulate water to provide appropriate water levels at critical times.	Spotted Sandpiper
11. Climate Change and Severe Weather						
11.1 Habitat shifting & alteration	Loss of alpine tundra due to climate change.	1.2 Maintain the size, shape and configuration of habitat within the natural range of variation	Maintain the quantity and quality of tundra meadow habitat within BCR 4 for nesting birds.	1.1 Site/area protection	Create a system of protected areas sufficient to buffer against loss of alpine tundra habitat.	Golden Eagle, Short-eared Owl, Upland Sandpiper
				4.3 Awareness and communications 5. Law and policy 6. Livelihood, economic and other incentives	Support efforts to reduce greenhouse gas emissions.	
		6.2 Manage for habitat resilience as climate changes		8.1 Research	Identify areas of high breeding importance to priority alpine species.	
11.3 Temperature extremes 11.4 Storms & flooding	Vulnerable to increasing severity of storms and temperature extremes.	6.3 Manage populations for resilience to increased mortality from climate change	Ensure that population size is large enough to buffer against years of high mortality due to severe weather.	1.1 Site/area protection	Create a system of protected areas sufficient to support populations that are robust enough to recover from years of high mortality.	Upland Sandpiper
				8.1 Research	Measure the impact of such weather events on populations.	

Lichens/Mosses

Lichens/Mosses habitats are areas of non-woody vegetation dominated by lichens and mosses (Food and Agriculture Organization 2000). This habitat class is not extensive in BCR 4 (Fig. 18), occupying some high elevation areas and wind-swept ridges and hills, and covering less than 1% of the region (EOSD; Wulder and Nelson 2003), although the Land Cover Map of Canada (below) assigns more alpine areas to this type. Most tundra areas are classified as "dwarf shrub tundra" under the shrubs/early successional habitat class.

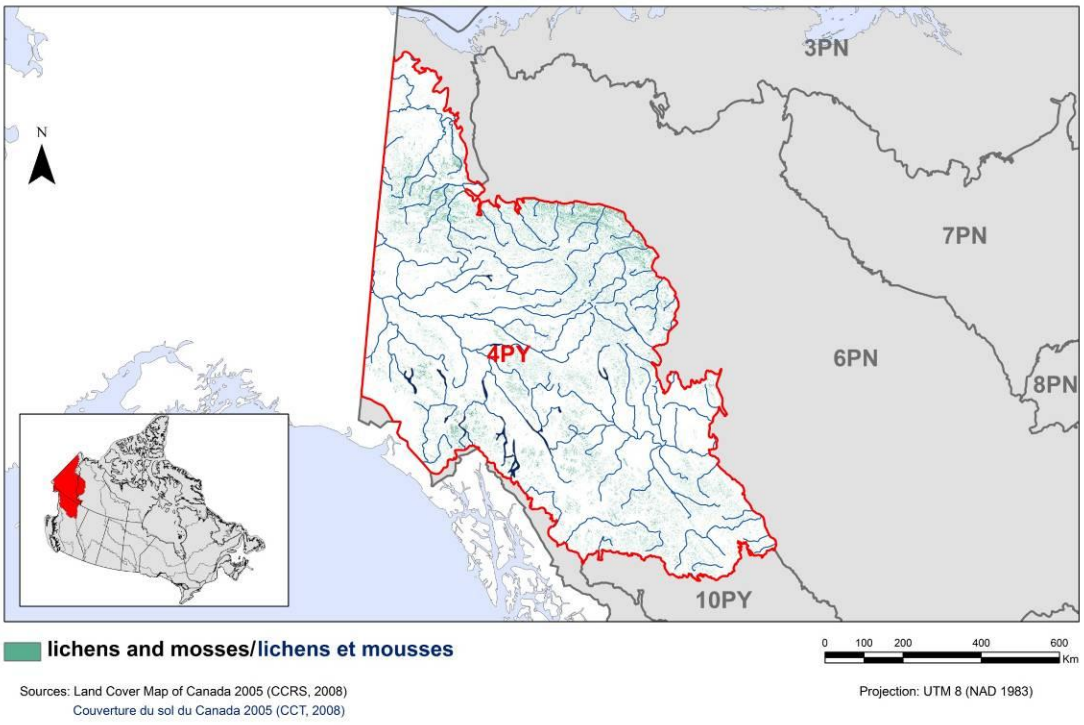

Figure 18. Map of lichens/mosses habitat in BCR 4 in Canada: Northwestern Interior Forest.

One priority species uses lichens/mosses areas as primary habitat in BCR 4 (Table 14). This landbird, the White-tailed Ptarmigan, uses rock/lichen habitats in high alpine areas throughout most of the region. A further 9 priority species, including 2 species at risk, use lichens/mosses areas as a secondary habitat. Within the lichens/mosses habitat category, regional habitat sub-classes include moss/lichen tundra, and high alpine rock/lichen.

For priority species that use lichens/mosses habitats, 38 threats of high, medium and low magnitude were identified (Fig. 19). Overall, the threat level rolled up to medium-magnitude for this habitat (Table 4), due to high-magnitude threats in the Climate change and severe weather category.

High-magnitude threats were all related to habitat shifting and alteration due to climate change, specifically the loss of alpine tundra breeding habitat due to encroachment of shrubs and trees. This threat affected six species, including White-tailed Ptarmigan, American Golden-Plover, Wandering Tattler, Whimbrel, Surfbird and Gray-crowned Rosy-Finch.

Recommended actions include limiting access and activities in alpine tundra, protecting large enough areas of these tundra habitats to buffer against habitat loss, and supporting efforts to reduce climate change (Table 15).

Table 14. Priority species that use lichens/mosses habitats in BCR 4 in Canada: Northwestern Interior Forest, with reason for priority and habitat use rank.

Species for which this is a primary habitat are indicated by Habitat use = P, and are in bold. Species for which this is a secondary habitat are indicated by Habitat use = S.

Priority species	Habitat use	Regional habitat sub-class	Population objective	Reason for priority status				
				At Risk	RC	CC	RS	CS
American Golden-Plover	S	moss/lichen tundra	Assess/Maintain			Yes		
Arctic Tern	S	moss/lichen tundra	Assess/Maintain			Yes		
Golden Eagle	S	high alpine rock/lichen	Assess/Maintain				Yes	
Gray-crowned Rosy-Finch	S	high alpine rock/lichen	Assess/Maintain				Yes	
Peregrine Falcon	S	moss/lichen tundra	Assess/Maintain	SC		Yes	Yes	
Short-eared Owl	S	moss/lichen tundra	Assess/Maintain	SC		Yes		
Surfbird	S	high alpine rock/lichen	Assess/Maintain			Yes	Yes	
Wandering Tattler	S	moss/lichen tundra	Assess/Maintain			Yes	Yes	
Whimbrel	S	moss/lichen tundra	Assess/Maintain			Yes		
White-tailed Ptarmigan	**P**	**high alpine rock/lichen**	**Assess/Maintain**				**Yes**	

Note: Reasons for inclusion in the priority species list are as follows. At Risk: the species was assessed by COSEWIC as Endangered (E), Threatened (T) or Special Concern (SC); RC (regional concern): the species meets PIF regional concern criteria; CC (continental concern): the species meets conservation concern or continental priority criteria for its bird group, and/or is At Risk nationally; RS (regional stewardship): waterfowl with highest, high or moderate high breeding importance in BCR 4, or the species meets PIF criteria for regional stewardship; CS (continental stewardship): landbirds identified as PIF continental stewardship species, or waterbirds listed in WOW as having at least 50% of global population in Canada. All priority species have PIF Relative Density>1.

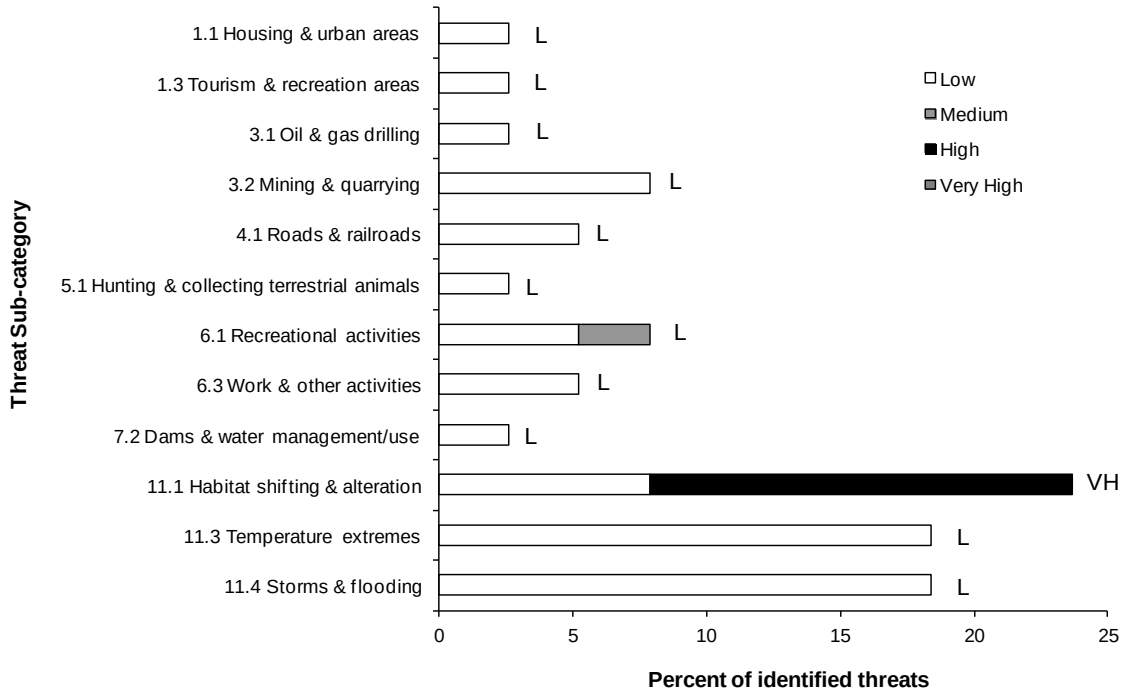

Figure 19. Percent of identified threats to priority species in lichens/mosses habitat in each threat sub-category in BCR 4 in Canada: Northwestern Interior Forest.

Priority species may use lichens/mosses habitat as their primary or secondary habitat. A total of 38 threats were identified.

Each bar represents the percent of the total number of threats identified in each threat sub-category in lichens/mosses habitat (for example, if 100 threats were identified in total for all priority species in lichens/mosses habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category). The overall magnitude of the sub-threat in lichens/mosses habitat is shown at the end of each bar (also presented in Table 4, Relative magnitude of identified threats to priority species within BCR 4 in Canada by threat category and broad habitat class).

Table 15. Threats addressed, conservation objectives, recommended actions and priority species affected for lichens/mosses habitats in BCR 4 in Canada: Northwestern Interior Forest.

Species for which a threat is of medium or high magnitude are in bold. Objectives and actions are presented only for species that use lichens/mosses habitats as a primary habitat. "Priority species affected" are species for which the threat has been documented; additional species that are not listed may also be affected.

Threat category	Threats addressed	Objective category	Objectives	Action category	Recommended actions	Priority species affected
3. Energy Production and Mining						
3.2 Mining & quarrying	Habitat degradation from mining.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain the quantity and quality of alpine tundra habitat within BCR 4 for nesting birds.	5.4 Compliance and enforcement	Incorporate exclusion zones into mining plans to protect habitat. Incorporate habitat recovery into post-mining site clean-up.	White-tailed Ptarmigan
4. Transportation and Service Corridors						
4.1 Roads & railroads	Habitat degradation from road construction.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain the quantity and quality of alpine tundra habitat within BCR 4 for nesting birds.	2.1 Site/area management	Limit construction of roads in alpine areas. Reclaim old unused roads.	White-tailed Ptarmigan
5. Biological Resource Use						
5.1 Hunting & collecting terrestrial animals	May be vulnerable to local overharvest due to flocking behaviour, etc., where access to alpine areas is opened up by new mines, etc.	7.2 Improve harvest monitoring	Ensure that hunting pressure is not limiting priority species' populations.	5.4 Compliance and enforcement 8.2 Monitoring	Enforce upland game bird bag and possession limits in areas with new access. Monitor harvest/populations in affected areas, review bag and possession limits.	White-tailed Ptarmigan
6. Human Intrusions and Disturbance						
6.1 Recreational activities	Disturbance from recreational activity.	4.1 Reduce disturbance from human recreation	Minimize human disturbance of alpine bird species.	4.3 Awareness and communications	Increase public awareness of vulnerability of ptarmigan to disturbance.	White-tailed Ptarmigan
11. Climate Change and Severe Weather						
11.1 Habitat shifting & alteration	Reduction in alpine tundra habitat.	1.2 Maintain the size, shape and configuration of habitat within the natural range of variation	Maintain the quantity and quality of alpine tundra habitat within BCR 4 for nesting birds.	1.1 Site/area protection	Create a system of protected areas sufficient to buffer against habitat loss.	**White-tailed Ptarmigan**

Table 15 continued

Threat category	Threats addressed	Objective category	Objectives	Action category	Recommended actions	Priority species affected
		6.2 Manage for habitat resilience as climate changes		4.3 Awareness and communications 5. Law and policy 6. Livelihood, economic and other incentives	Support efforts to reduce greenhouse gas emissions.	
				8.1 Research	Identify areas of high breeding importance.	
11.3 Temperature extremes 11.4 Storms & flooding	Vulnerable to increasing severity of temperature extremes and storms.	6.3 Manage populations for resilience to increased mortality from climate change	Ensure that population size is large enough to buffer against years of high mortality due to severe weather.	1.1 Site/area protection	Create a system of protected areas sufficient to support populations that are robust enough to recover from years of high mortality.	White-tailed Ptarmigan
				8.1 Research	Measure the impact of such weather events on populations.	

Cultivated and Managed Areas

Cultivated and Managed Areas are defined in the as areas where the natural vegetation has been removed, modified, or replaced (Food and Agriculture Organization 2000); these habitats include agricultural areas, urban lawns and gardens, and some urban parks. In BCR 4 these habitats are restricted to small areas in and around communities; agricultural habitats are limited, but are most extensive around Whitehorse and Dawson (Fig. 20).

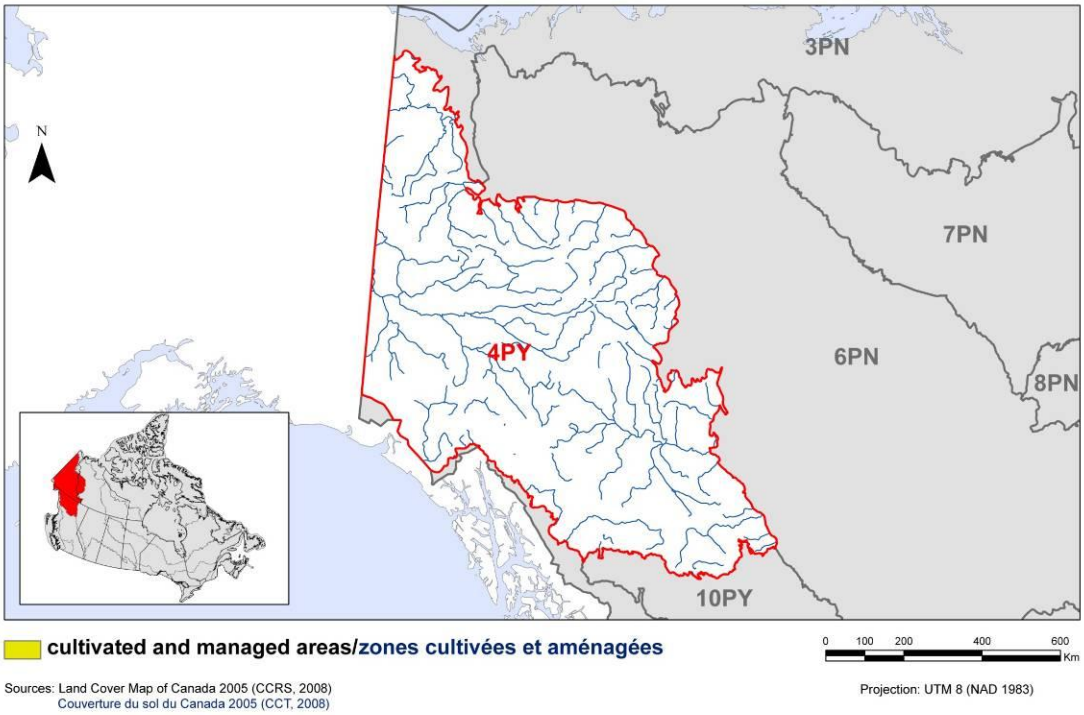

Figure 20. Map of cultivated and managed areas habitat in BCR 4 in Canada: Northwestern Interior Forest.

One priority species uses cultivated and managed areas as primary habitat in BCR 4 (Table 16). This landbird, the Rufous Hummingbird, occurs mostly in southern parts of the region and is most often seen in gardens around houses, especially in Atlin and Whitehorse. A further 16 priority species use cultivated and managed areas as secondary habitat. These are species that feed on spilled or leftover grain in fall; species that nest or forage in open fields where livestock is grazed; and species that use planted berry trees and bushes, and bird feeders, in urban yards and gardens. Within the broad cultivated and managed areas category, regional habitat sub-classes include grain fields, rangeland, gardens, and bird feeders.

For priority species that use cultivated and managed areas, 13 threats of medium and low magnitude were identified (Fig. 21). Overall, the threat level rolled up to low magnitude for this habitat (Table 4). Threats included loss of nests and nesting sites due to human activity, degradation of habitat from further development, disturbance, and collisions with windows and vehicles. However, as only one priority species—Rufous Hummingbird—uses cultivated and managed areas as a primary habitat type, and no threats to Rufous Hummingbird were identified, no Conservation Objectives or Recommended Actions are presented here. The two medium-magnitude threats, both to Barn Swallow, are addressed under “artificial surfaces and associated areas.”

Table 16. Priority species that use cultivated and managed areas in BCR 4 in Canada: Northwestern Interior Forest, with reason for priority and habitat use rank.

Species for which this is a primary habitat are indicated by Habitat use = P, and are in bold. Species for which this is a secondary habitat are indicated by Habitat use = S.

Priority species	Habitat use	Regional habitat sub-class	Population objective	Reason for priority status				
				At Risk	RC	CC	RS	CS
American Kestrel	S	rangeland	Assess/Maintain		Yes			
Barn Swallow	S	rangeland	Assess/Maintain	T		Yes		
Bohemian Waxwing	S	gardens	Assess/Maintain				Yes	Yes
Boreal Chickadee	S	bird feeders	Assess/Maintain				Yes	Yes
Canada Goose	S	grain fields	Assess/Maintain			Yes	Yes	
Gray Jay	S	bird feeders	Maintain Current					Yes
Greater White-fronted Goose	S	grain fields	Assess/Maintain				Yes	
Killdeer	S	rangeland	Assess/Maintain			Yes		
Northern Shrike	S	rangeland, bird feeders	Assess/Maintain				Yes	
Pine Grosbeak	S	bird feeders	Assess/Maintain				Yes	Yes
Rufous Hummingbird	**P**	**gardens**	**Assess/Maintain**			**Yes**		
Rusty Blackbird	S	grain fields	Increase 50%	SC	Yes	Yes	Yes	
Short-eared Owl	S	rangeland	Assess/Maintain	SC		Yes		
Trumpeter Swan	S	grain fields	Maintain Current			Yes	Yes	
Tundra Swan	S	grain fields	Migrant (no obj.)				Yes	
Upland Sandpiper	S	rangeland	Assess/Maintain			Yes		
White-crowned Sparrow	S	bird feeders	Increase 50%				Yes	

Note: Reasons for inclusion in the priority species list are as follows. At Risk: the species is assessed by COSEWIC as Endangered (E), Threatened (T) or Special Concern (SC); RC (regional concern): the species meets PIF regional concern criteria; CC (continental concern): the species meets conservation concern or continental priority criteria for its bird group, and/or is At Risk nationally; RS (regional stewardship): waterfowl with highest, high or moderate high breeding importance in BCR 4, or the species meets PIF criteria for regional stewardship; CS (continental stewardship): landbirds identified as PIF continental stewardship species, or waterbirds listed in WOW as having at least 50% of global population in Canada. All priority species have PIF Relative Density>1.

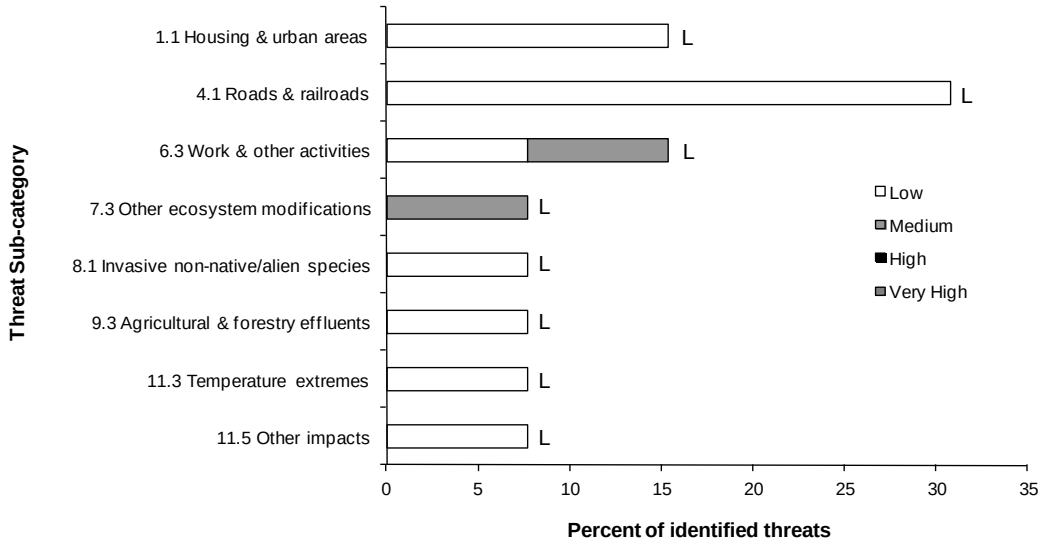

Figure 21. Percent of identified threats to priority species in cultivated and managed areas in each threat sub-category in BCR 4 in Canada: Northwestern Interior Forest.

Priority species may use cultivated and managed areas as their primary or secondary habitat. A total of 13 threats were identified.

Each bar represents the percent of the total number of threats identified in each threat sub-category in cultivated and managed areas (for example, if 100 threats were identified in total for all priority species in cultivated and managed areas, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category). The overall magnitude of the sub-threat in cultivated and managed areas is shown at the end of each bar (also presented in Table 4, Relative magnitude of identified threats to priority species within BCR 4 in Canada by threat category and broad habitat class).

Wetlands

Wetland habitats are defined as natural and semi-natural aquatic or regularly flooded habitats which are at least 4% vegetated for at least two months of the year (Food and Agriculture Organization 2000). Wetland habitats are relatively uncommon in BCR 4 compared to other boreal BCRs, but these productive habitats are very important to many bird species. According to EOSD data (Wulder and Nelson 2003), wetlands cover just 1.1% of BCR 4 within Canada, although this estimate is thought to be low, as some regularly-flooded herbaceous, shrubby, and treed habitats may be classed as non-wetland habitats by the EOSD. The largest concentration of wetlands in Canada's portion of BCR 4 is in the Old Crow Flats area in northern Yukon, with lesser concentrations in various lowland areas of the region (Fig. 22).

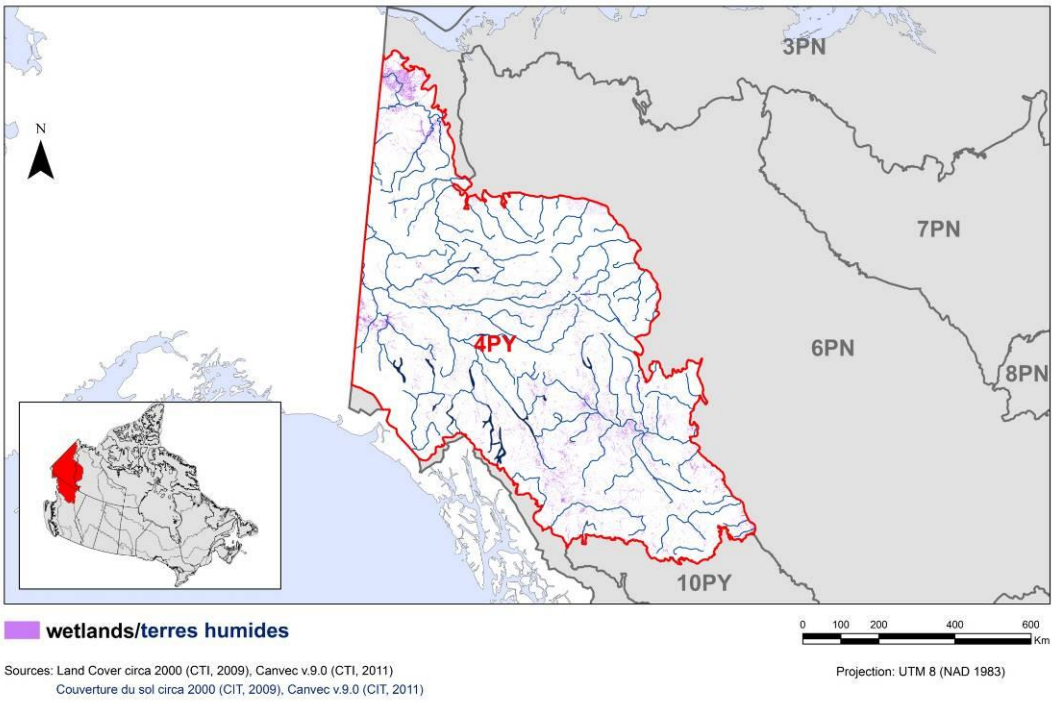

Figure 22. Map of wetland habitat in BCR 4 in Canada: Northwestern Interior Forest.

There are 40 priority species that use wetlands as primary habitat in BCR 4 (Table 17). These include 17 waterfowl, 6 shorebird, 7 waterbird, and 10 landbird species, and all 7 species at risk in BCR 4. A further 18 priority species use wetlands as a secondary habitat. Within the broad wetland category, regional habitat sub-classes include marsh, shallow water/forest, tundra wetland, wetland/lake, wetland/riparian meadow and wetland/riparian shrub/forest.

For priority species that use wetland habitats, 212 threats of high, medium and low magnitude were identified (Fig. 23). Overall, the threat level rolled up to high magnitude for this habitat (Table 4), due to high- and medium-magnitude threats in the Climate change and severe weather category, and several other categories.

High-magnitude threats include habitat degradation and disturbance from freshwater aquaculture to Black Tern, which nests on only one lake in BCR 4; and the threat of loss of tundra wetland habitat for Whimbrel and Gray-crowned Rosy Finch. Medium threats include encroachment of residential development, agriculture, and recreation, and associated disturbance, on staging areas and breeding wetlands; flow changes from hydroelectric dams; and harvest of trees in wetland areas. One medium-magnitude threat was identified for Rusty Blackbird: competition from Red-winged Blackbirds, which are expanding their range.

Recommended actions include protection and management of important sites, development and enforcement of guidelines for development around wetlands, and increasing public awareness of important wetland sites (Table 18).

Table 17. Priority species that use wetland habitats in BCR 4 in Canada: Northwestern Interior Forest, with reason for priority and habitat use rank.
Species for which this is a primary habitat are indicated by Habitat use = P, and are in bold. Species for which this is a secondary habitat are indicated by Habitat use = S.

Priority species	Habitat use	Regional habitat sub-class	Population objective	Reason for priority status				
				At Risk	RC	CC	RS	CS
Alder Flycatcher	**P**	**wetland/riparian shrub/forest**	**Assess/Maintain**					**Yes**
American Golden-Plover	S	wetland/riparian meadow	Assess/Maintain			Yes		
American Kestrel	S	wetland/riparian shrub/forest	Assess/Maintain		Yes			
American Three-toed Woodpecker	S	wetland/riparian shrub/forest	Maintain Current				Yes	
American Wigeon	**P**	**wetland/lake**	**Increase 50%**		**Yes**	**Yes**	**Yes**	
Barn Swallow	**P**	**wetland/lake**	**Assess/Maintain**	**T**		**Yes**		
Barrow's Goldeneye	**P**	**shallow water/forest**	**Assess/Maintain**				**Yes**	
Black Tern	**P**	**wetland/lake**	**Assess/Maintain**			**Yes**		
Blackpoll Warbler	**P**	**wetland/riparian shrub/forest**	**Increase 50%**				**Yes**	
Blue-winged Teal	**P**	**wetland/lake**	**Assess/Maintain**			**Yes**		
Bohemian Waxwing	S	wetland/riparian shrub/forest	Assess/Maintain				Yes	Yes
Bonaparte's Gull	**P**	**wetland/riparian shrub/forest**	**Assess/Maintain**			**Yes**	**Yes**	**Yes**
Boreal Chickadee	S	wetland/riparian shrub/forest	Assess/Maintain				Yes	Yes
Bufflehead	**P**	**shallow water/forest**	**Assess/Maintain**				**Yes**	
Canada Goose	**P**	**wetland/riparian shrub/forest**	**Assess/Maintain**			**Yes**	**Yes**	
Canvasback	**P**	**wetland/lake**	**Assess/Maintain**			**Yes**	**Yes**	
Common Goldeneye	**P**	**shallow water/forest**	**Assess/Maintain**			**Yes**		
Common Loon	S	wetland/lake	Assess/Maintain			Yes		Yes
Common Nighthawk	**P**	**wetland/lake**	**Assess/Maintain**	**T**		**Yes**		
Gray-crowned Rosy-Finch	S	tundra wetland	Assess/Maintain				Yes	
Great Gray Owl	**P**	**wetland/riparian shrub/forest**	**Assess/Maintain**				**Yes**	
Greater White-fronted Goose	**P**	**tundra wetland**	**Assess/Maintain**				**Yes**	
Green-winged Teal	**P**	**wetland/lake**	**Maintain Current**				**Yes**	
Harlequin Duck	S	wetland/lake	Assess/Maintain				Yes	
Horned Grebe	**P**	**wetland/lake**	**Assess/Maintain**	**SC**		**Yes**	**Yes**	
Killdeer	S	wetland/riparian meadow	Assess/Maintain			Yes		
Lesser Scaup	**P**	**wetland/lake**	**Increase 50%**		**Yes**	**Yes**	**Yes**	
Lesser Yellowlegs	**P**	**wetland/riparian shrub/forest**	**Increase 50%**		**Yes**	**Yes**	**Yes**	
Long-tailed Duck	**P**	**tundra wetland**	**Assess/Maintain**			**Yes**		
Mallard	**P**	**wetland/lake**	**Maintain Current**			**Yes**	**Yes**	
Mew Gull	**P**	**wetland/riparian shrub/forest**	**Assess/Maintain**				**Yes**	
Northern Goshawk	S	wetland/riparian shrub/forest	Assess/Maintain				Yes	
Northern Hawk Owl	S	wetland/riparian shrub/forest	Assess/Maintain				Yes	

Table 17 continued

Priority species	Habitat use	Regional habitat sub-class	Population objective	Reason for priority status				
				At Risk	RC	CC	RS	CS
Northern Pintail	**P**	**wetland/lake**	**Assess/Maintain**			**Yes**	**Yes**	
Northern Shoveler	**P**	**wetland/lake**	**Assess/Maintain**				**Yes**	
Northern Shrike	S	wetland/riparian shrub/forest	Assess/Maintain				Yes	
Olive-sided Flycatcher	**P**	**wetland/riparian shrub/forest**	**Increase 50%**	**T**	**Yes**	**Yes**	**Yes**	
Pacific Loon	**P**	**wetland/lake**	**Assess/Maintain**			**Yes**	**Yes**	
Peregrine Falcon	**P**	**wetland/lake**	**Assess/Maintain**	**SC**		**Yes**	**Yes**	
Pine Grosbeak	S	wetland/riparian shrub/forest	Assess/Maintain				Yes	Yes
Red-necked Grebe	**P**	**wetland/lake**	**Assess/Maintain**				**Yes**	
Red-necked Phalarope	**P**	**wetland/lake**	**Assess/Maintain**			**Yes**		
Rusty Blackbird	**P**	**wetland/riparian shrub/forest**	**Increase 50%**	**SC**	**Yes**	**Yes**	**Yes**	
Semipalmated Sandpiper	S	wetland/riparian meadow	Migrant (no obj.)			Yes		
Short-billed Dowitcher	**P**	**wetland/riparian shrub/forest**	**Assess/Maintain**			**Yes**		
Short-eared Owl	**P**	**wetland/riparian meadow**	**Assess/Maintain**	**SC**		**Yes**		
Solitary Sandpiper	**P**	**wetland/riparian shrub/forest**	**Assess/Maintain**			**Yes**	**Yes**	
Sora	**P**	**marsh**	**Maintain Current**			**Yes**		**Yes**
Spotted Sandpiper	S	wetland/lake	Assess/Maintain				Yes	
Surf Scoter	**P**	**wetland/lake**	**Assess/Maintain**			**Yes**	**Yes**	
Trumpeter Swan	**P**	**wetland/lake**	**Maintain Current**			**Yes**	**Yes**	
Tundra Swan	**P**	**wetland/lake**	**Migrant (no obj.)**				**Yes**	
Whimbrel	**P**	**tundra wetland**	**Assess/Maintain**			**Yes**		
White-crowned Sparrow	S	wetland/riparian shrub/forest	Increase 50%				Yes	
White-winged Crossbill	S	wetland/riparian shrub/forest	Assess/Maintain					Yes
White-winged Scoter	**P**	**wetland/lake**	**Assess/Maintain**			**Yes**	**Yes**	
Wilson's Snipe	**P**	**wetland/riparian shrub/forest**	**Maintain Current**			**Yes**		
Wilson's Warbler	**P**	**wetland/riparian shrub/forest**	**Assess/Maintain**				**Yes**	

Note: Reasons for inclusion in the priority species list are as follows. At Risk: the species was assessed by COSEWIC as Endangered (E), Threatened (T) or Special Concern (SC); RC (regional concern): the species meets PIF regional concern criteria; CC (continental concern): the species meets conservation concern or continental priority criteria for its bird group, and/or is At Risk nationally; RS (regional stewardship): waterfowl with highest, high or moderate high breeding importance in BCR 4, or the species meets PIF criteria for regional stewardship; CS (continental stewardship): landbirds identified as PIF continental stewardship species, or waterbirds listed in WOW as having at least 50% of global population in Canada. All priority species have PIF Relative Density>1.

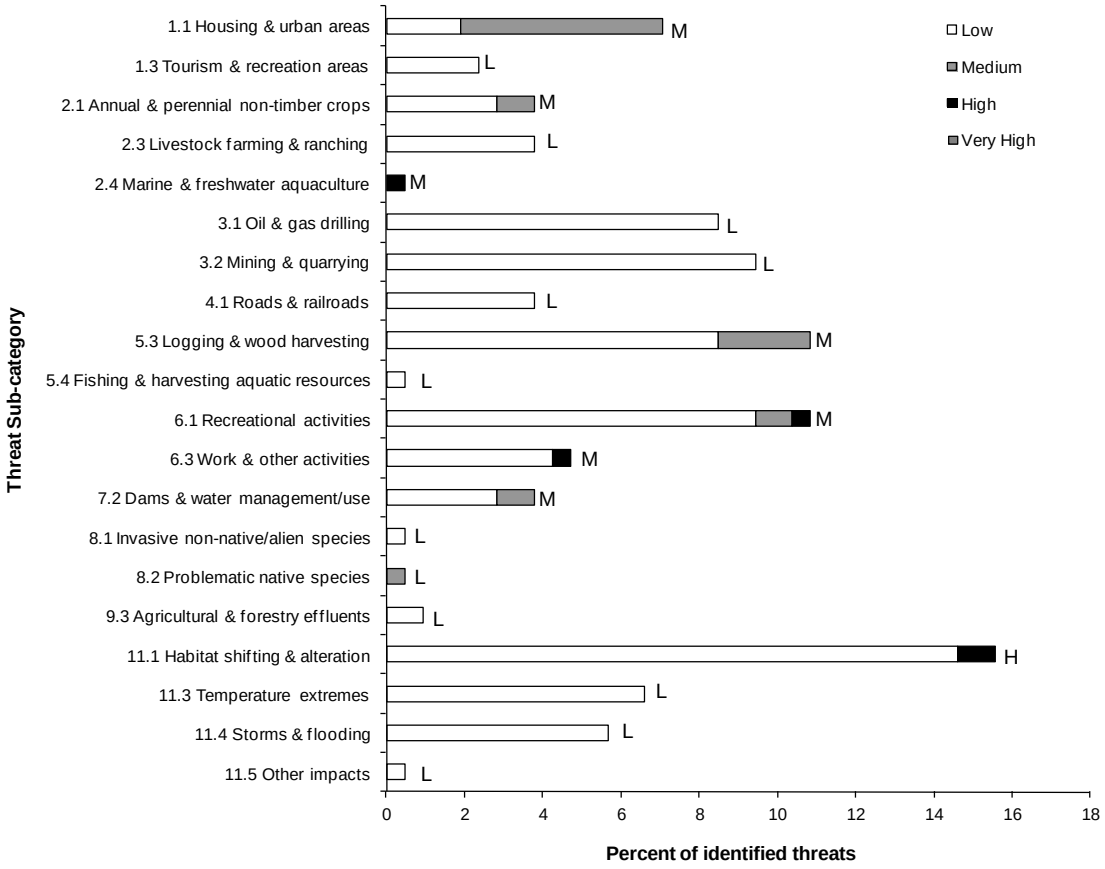

Figure 23. Percent of identified threats to priority species in wetland habitat in each threat sub-category in BCR 4 in Canada: Northwestern Interior Forest.

Priority species may use wetlands as their primary or secondary habitat. A total of 212 threats were identified.

Each bar represents the percent of the total number of threats identified in each threat sub-category in wetland habitat (for example, if 100 threats were identified in total for all priority species in wetland habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category). The overall magnitude of the sub-threat in wetland habitat is shown at the end of each bar (also presented in Table 4, Relative magnitude of identified threats to priority species within BCR 4 in Canada by threat category and broad habitat class).

Table 18. Threats addressed, conservation objectives, recommended actions and priority species affected for wetland habitats in BCR 4 in Canada: Northwestern Interior Forest.

Species for which a threat is of medium or high magnitude are in bold. Objectives and actions are presented only for species that use wetland habitats as a primary habitat. "Priority species affected" are species for which the threat has been documented; additional species that are not listed may also be affected.

Threat category	Threats addressed	Objective category	Objectives	Action category	Recommended actions	Priority species affected†
1. Residential and Commercial Development						
1.1 Housing & urban areas	Encroachment of housing developments at staging areas.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain value of important early-open-water spring staging areas for waterbirds.	1.1 Site/area protection	Establish and enforce habitat protection at important spring staging sites.	**American Wigeon, Canvasback, Green-winged Teal, Lesser Scaup, Mallard, Northern Pintail, Northern Shoveler, Trumpeter Swan (Pacific Coast), Tundra Swan**
1.1 Housing & urban areas 1.3 Tourism & recreation areas	Encroachment on/degradation and loss of wetlands to developments.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain the quantity and quality of wetland habitat within BCR 4 for nesting waterbirds.	1.1 Site/area protection	Establish protection of important nesting areas.	Horned Grebe, Red-necked Grebe, **Short-billed Dowitcher,** Sora, Trumpeter Swan (Pacific Coast), Trumpeter Swan (Rocky Mountain)
2. Agriculture and Aquaculture						
2.1 Annual & perennial non-timber crops 2.3 Livestock farming & ranching	Encroachment on/loss of breeding habitat from cropland or ranchland/live-stock farming.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain the quantity and quality of wetland habitat within BCR 4 for nesting birds.	5.2 Policies and regulations 5.4 Compliance and enforcement	In areas with agricultural operations, establish and enforce habitat protection of wetlands and adjacent areas, including riparian guidelines for agricultural leases.	Horned Grebe, Red-necked Grebe, Rusty Blackbird, **Short-billed Dowitcher, Short-eared Owl**, Sora, Trumpeter Swan (Pacific Coast), Trumpeter Swan (Rocky Mountain)
2.4 Marine & freshwater aquaculture	Degradation of habitat from freshwater	1.1 Ensure land and resource-use policies and	Maintain the quantity and quality of wetland	5.4 Compliance and enforcement	Establish and enforce freshwater aquaculture guidelines.	**Black Tern**

Table 18 continued

Threat category	Threats addressed	Objective category	Objectives	Action category	Recommended actions	Priority species affected†
	aquaculture.	practices maintain or improve bird habitat	habitat within BCR 4 for nesting waterbirds.			
3. Energy Production and Mining						
3.1 Oil & gas drilling	Encroachment on/degradation of breeding habitat from petroleum development.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain the quantity and quality of wetland habitat within BCR 4 for nesting waterbirds.	5.4 Compliance and enforcement	Incorporate exclusion zones into oil and gas development and exploration plans to protect habitat.	American Wigeon, Barrow's Goldeneye, Blue-winged Teal, Bufflehead, Canada Goose, Canvasback, Common Goldeneye, Greater White-fronted Goose, Green-winged Teal, Lesser Scaup, Long-tailed Duck, Mallard, Northern Pintail, Northern Shoveler, Surf Scoter, Trumpeter Swan (Pacific Coast), Trumpeter Swan (Rocky Mountain), White-winged Scoter
3.2 Mining & quarrying	Encroachment on/degradation of breeding habitat from mining.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain the quantity and quality of wetland habitat within BCR 4 for nesting waterbirds.	5.4 Compliance and enforcement	Incorporate exclusion zones into mining plans to protect habitat.	
					Incorporate habitat recovery into post-mining site clean-up.	
	Habitat degradation from placer mining.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain the quantity and quality of wetland habitat within BCR 4 for nesting birds.	5.4 Compliance and enforcement	Incorporate exclusion zones into mining plans to protect habitat.	Rusty Blackbird
					Incorporate habitat recovery into post-mining site clean-up.	
				8.2 Monitoring	Monitor Rusty Blackbirds at susceptible sites.	
4. Transportation and Service Corridors						
4.1 Roads & railroads	Degradation of habitat from road construction.	1.1 Ensure land and resource-use policies and	Maintain the quantity and quality of wetland	2.1 Site/area management	Limit construction of roads in and near wetland areas.	Lesser Yellowlegs

Table 18 continued

Threat category	Threats addressed	Objective category	Objectives	Action category	Recommended actions	Priority species affected†
		practices maintain or improve bird habitat	habitat within BCR 4 for nesting waterbirds.			
	Mortality from collisions with vehicles.	2.7 Reduce incidental mortality from collisions	Reduce vehicle collision mortality of wetland birds.	4.3 Awareness and communications	Increase public awareness of birds and vulnerability to high-speed traffic.	Common Nighthawk, Short-eared Owl
5. Biological Resource Use						
5.3 Logging & wood harvesting	Loss/degradation of habitat from logging of boreal forest.	1.2 Maintain the size, shape and configuration of habitat within the natural range of variation	Maintain the quantity and quality of wetland/riparian forest habitat within BCR 4 for nesting birds.	1.1 Site/area protection	Create protected areas that include large, productive areas of riparian white spruce.	Blackpoll Warbler, **Great Gray Owl**, Olive-sided Flycatcher
				2.1 Site/area management	Maintain current extent of old-growth coniferous forest, especially riparian white spruce forest.	
		1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat		5.3 Private sector standards and codes	Maintain perch and nest sites across harvested landscapes, by planning for large tree recruitment, and by ensuring large trees and attributes (e.g. mistletoe, large raptor/corvid nests) are retained.	
5.3 Logging & wood harvesting	Loss of breeding habitat to logging and other timber harvest (e.g., firewood collection).	1.4 Maintain important habitat features on the landscape	Maintain the quantity and quality of forested lake/pond/wetland habitat within BCR 4 for nesting birds.	1.1 Site/area protection	Create protected areas that include large, productive areas of riparian white spruce.	Barrow's Goldeneye, Bufflehead, Common Goldeneye
				4.3 Awareness and communications	Increase public awareness of the value of standing dead trees, and provide	

Table 18 continued

Threat category	Threats addressed	Objective category	Objectives	Action category	Recommended actions	Priority species affected†
					guidelines for retention of existing and potential cavity trees.	
				2.1 Site/area management	Leave large no-harvest buffers around all forested lakes and wetlands.	Barrow's Goldeneye, Bufflehead, Common Goldeneye, Lesser Yellowlegs, Rusty Blackbird, Solitary Sandpiper, Trumpeter Swan (Pacific Coast), Trumpeter Swan (Rocky Mountain)
6. Human Intrusions and Disturbance						
6.1 Recreational activities	Disturbance at staging areas from recreation.	4.1 Reduce disturbance from human recreation	Maintain value of important early-open-water spring staging areas for waterbirds.	1.1 Site/area protection	Establish protection at important spring staging sites.	American Wigeon, Canvasback, Green-winged Teal, Lesser Scaup Mallard, Northern Pintail, Northern Shoveler, **Trumpeter Swan (Pacific Coast), Tundra Swan**
				2.1 Site/area management	Restrict access to stopover areas during migration (e.g. prohibit boats, off-road vehicles, pets; recommend unobtrusive distances for observing waterbirds).	
				4.3 Awareness and communications	Increase public awareness of the crucial role of stopover sites, and detrimental effects of disturbance on staging birds, establish guidelines/rules for visitors.	
6.1 Recreational activities 6.3 Work &	Disturbance at nest sites from recreation and other activities.	4.1 Reduce disturbance from human recreation	Minimize human disturbance of priority wetland species	4.3 Awareness and communications	Reduce disturbance of nest sites and breeding areas by watercraft, by increasing public awareness of	**Black Tern,** Bonaparte's Gull, Bufflehead, Pacific Loon, Peregrine Falcon, Red-necked Grebe, Short-billed

Table 18 continued

Threat category	Threats addressed	Objective category	Objectives	Action category	Recommended actions	Priority species affected†
other activities		4.2 Reduce disturbance from industrial or work activity			waterbirds, their vulnerability to disturbance, and guidelines around nesting areas.	Dowitcher, Trumpeter Swan (Pacific Coast), Trumpeter Swan (Rocky Mountain)
				5.2 Policies and regulations 5.4 Compliance and enforcement	Restrict use of motorized crafts in known nesting areas during breeding season.	Bonaparte's Gull, Trumpeter Swan (Pacific Coast), Trumpeter Swan (Rocky Mountain)
7. Natural System Modifications						
7.2 Dams & water management /use	Water level/flow changes from hydroelectric development.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain the quantity and quality of riparian nesting habitats within BCR 4 for nesting birds.	2.1 Site/area management	Work with hydroelectric companies to establish in-stream flow agreements that would manipulate water to provide appropriate water levels at critical times, and maintain aquatic plant production.	Mew Gull, Red-necked Grebe
			Maintain value of important early-open-water spring staging areas for waterbirds.			**Trumpeter Swan (Pacific Coast), Tundra Swan**
8. Invasive and Other Problematic Species and Genes						
8.2 Problematic native species	Increased abundance of competitors, e.g. Red-winged Blackbird.	3.2 Reduce competition with problematic native species	Ensure that issues related to other native species are not limiting priority species' populations.	8.1 Research	Research effects of Red-winged Blackbird on Rusty Blackbird populations.	Rusty Blackbird
9. Pollution						
9.3 Agricultural	Pesticides and herbicides may	5.2 Manage decreases in prey	Ensure that issues related to	2.1 Site/area management	Restrict use of forest and other pesticides in areas	Common Nighthawk, Olive-sided Flycatcher

Table 18 continued

Threat category	Threats addressed	Objective category	Objectives	Action category	Recommended actions	Priority species affected†
& forestry effluents	reduce prey abundance.	due to contaminants	pesticides are not limiting priority species' populations.		where priority species nest and forage.	
11. Climate Change and Severe Weather						
11.1 Habitat shifting & alteration	Incremental wetland/pond loss due to melting permafrost and evapo-transpiration.	1.2 Maintain the size, shape and configuration of habitat within the natural range of variation	Maintain the quantity and quality of wetland habitat within BCR 4 for nesting waterbirds.	1.1 Site/area protection	Create a system of large protected areas which include high quality wetlands, to maintain breeding populations and to buffer against habitat loss.	American Wigeon, Barrow's Goldeneye, Blackpoll Warbler, Bonaparte's Gull, Bufflehead, Canada Goose, Canvasback, Common Goldeneye, Greater White-fronted Goose, Green-winged Teal, Horned Grebe, Lesser Scaup, Lesser Yellowlegs, Long-tailed Duck, Mallard, Mew Gull, Northern Pintail, Northern Shoveler, Pacific Loon, Peregrine Falcon, Red-necked Grebe, Red-necked Phalarope, Rusty Blackbird, Solitary Sandpiper, Sora, Surf Scoter, Trumpeter Swan (Pacific Coast), Trumpeter Swan (Rocky Mountain), **Whimbrel**, White-winged Scoter, Wilson's Snipe
				4.3 Awareness and communications 5. Law and policy 6. Livelihood, economic and other incentives	Support efforts to reduce greenhouse gas emissions.	
11.3 Temperature extremes 11.4 Storms & flooding	Vulnerable to increasing severity of temperature extremes and storms.	6.3 Manage populations for resilience to increased mortality from	Ensure that population size is large enough to buffer against years of high	1.1 Site/area protection	Create a system of protected areas sufficient to support populations that are robust enough to recover from years of high	Barn Swallow, Barrow's Goldeneye, Common Goldeneye, Common Nighthawk, Lesser Scaup, Mallard, Northern Pintail,

Table 18 continued

Threat category	Threats addressed	Objective category	Objectives	Action category	Recommended actions	Priority species affected†
		climate change	mortality due to severe weather.		mortality.	Northern Shoveler, Peregrine Falcon, Red-necked Grebe, Whimbrel, White-winged Scoter
				4.3 Awareness and communications 5. Law and policy 6. Livelihood, economic and other incentives	Support efforts to reduce greenhouse gas emissions.	
				8.1 Research	Measure the impact of such weather events on populations.	
11.5 Other impacts	Reduction in insect abundance and changes in timing of emergence resulting from climate change.	6.1 Support efforts to reduce greenhouse gas emissions	Ensure that population size is large enough to buffer against years of high mortality/low productivity due to low food availability.	4.3 Awareness and communications 5. Law and policy 6. Livelihood, economic and other incentives	Support efforts to reduce greenhouse gas emissions.	Barn Swallow

† Priority species not mentioned in this table have no identified threats in this habitat.

Bare Areas

Bare areas are defined as natural areas with less than 4% vegetation (Food and Agriculture Organization 2000). Bare areas in BCR 4 are a diverse group of habitat types including riverbanks, lakeside and riverside beaches, sandbars, and gravel bars, as well as bare areas in the high alpine (Fig. 24). These cover types make up 14% of the region, mostly as high-alpine bare ground, which is particularly well represented in the mountainous Northwest Territories portion of BCR 4 (EOSD; Wulder and Nelson 2003).

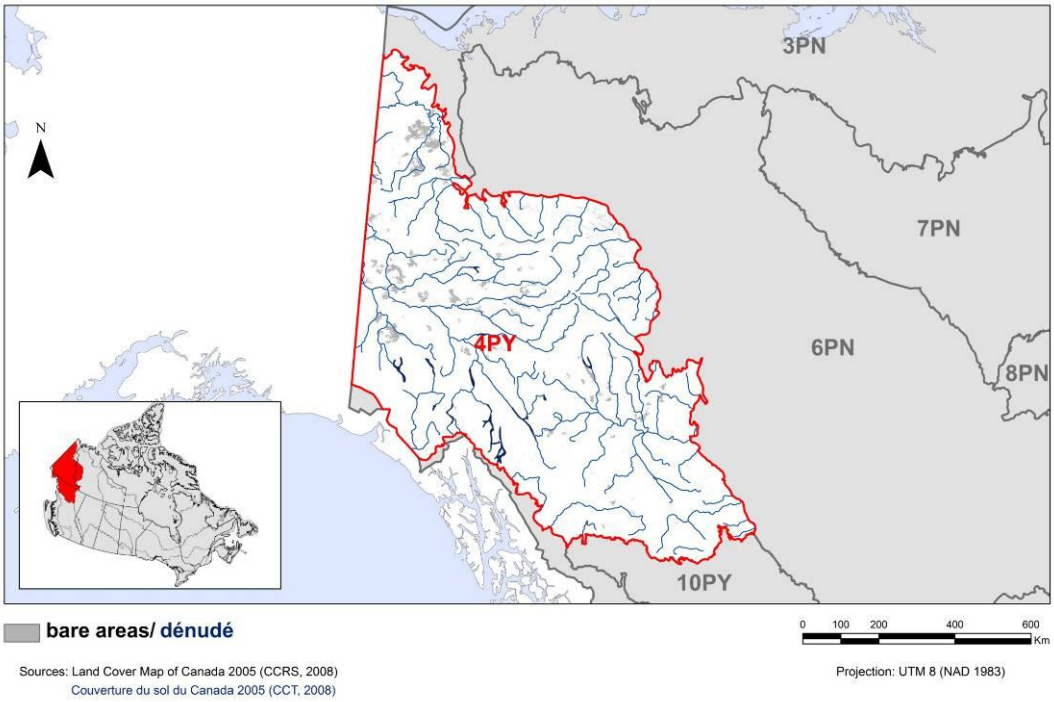

Figure 24. Map of bare areas in BCR 4 in Canada: Northwestern Interior Forest.

There are 7 priority species that use bare areas as primary habitat in BCR 4 (Table 19). These include 3 shorebird, 2 waterbird and 2 landbird species. Of these, one is a species at risk. A further 17 priority species, including one species at risk, use bare areas as secondary habitat. Within the broad bare areas category, regional habitat sub-classes include cliffs and river banks, riparian sand/gravel, exposed sand/gravel, high alpine rock and mudflats. Many of the priority species listed under this habitat type place their nests on bare areas such as cliffs, riverbanks and beaches, while others use bare areas such as mudflats for feeding, especially during staging and migration.

For priority species that use bare areas, 61 threats of high, medium and low magnitude were identified (Fig. 25). Overall, the threat level rolled up to medium magnitude for this habitat, due to high-magnitude threats in the Climate change and severe weather

category, affecting high alpine rock, and medium-magnitude threats in the Residential and Commercial Development category, affecting riparian bare areas (Table 4).

High-magnitude threats were related to habitat shifting and alteration due to climate change, specifically the loss of alpine tundra breeding habitat due to encroachment of shrubs and trees. This threat affected two species: White-tailed Ptarmigan and Gray-crowned Rosy-Finch. Threats to species using riparian beaches include disturbance from recreation and other activities, flow changes due to hydroelectric development, and encroachment of residential development. Recommended actions include protecting large enough areas of tundra habitats to buffer against habitat loss and supporting efforts to reduce climate change, and restricting activities and access around important riparian stopover and breeding areas (Table 20).

Table 19. Priority species that use bare areas in BCR 4 in Canada: Northwestern Interior Forest, with reason for priority and habitat use rank.
Species for which this is a primary habitat are indicated by Habitat use = P, and are in bold. Species for which this is a secondary habitat are indicated by Habitat use = S.

Priority species	Habitat use	Regional habitat sub-class	Population objective	Reason for priority status				
				At Risk	RC	CC	RS	CS
American Golden-Plover	S	mudflats – staging	Assess/Maintain			Yes		
American Wigeon	S	mudflats – staging	Increase 50%		Yes	Yes	Yes	
Arctic Tern	**P**	**riparian sand/gravel**	**Assess/Maintain**			**Yes**		
Bonaparte's Gull	S	mudflats – staging	Assess/Maintain			Yes	Yes	Yes
Common Nighthawk	S	exposed sand/gravel	Assess/Maintain	T		Yes		
Golden Eagle	S	cliffs and river banks	Assess/Maintain				Yes	
Gray-crowned Rosy-Finch	**P**	**high alpine rock**	**Assess/Maintain**				**Yes**	
Green-winged Teal	S	mudflats – staging	Maintain Current				Yes	
Harlequin Duck	S	riparian sand/gravel	Assess/Maintain				Yes	
Herring Gull	**P**	**rocky islands**	**Assess/Maintain**			**Yes**		
Killdeer	**P**	**riparian sand/gravel**	**Assess/Maintain**			**Yes**		
Lesser Yellowlegs	S	mudflats – staging	Increase 50%		Yes	Yes	Yes	
Mallard	S	mudflats – staging	Maintain Current			Yes	Yes	
Mew Gull	S	mudflats – staging	Assess/Maintain				Yes	
Peregrine Falcon	**P**	**cliffs and river banks**	**Assess/Maintain**	**SC**		**Yes**	**Yes**	
Semipalmated Sandpiper	**P**	**mudflats – staging**	**Migrant (no obj.)**			**Yes**		
Short-billed Dowitcher	S	mudflats – staging	Assess/Maintain			Yes		
Solitary Sandpiper	S	mudflats – staging	Assess/Maintain			Yes	Yes	
Spotted Sandpiper	**P**	**riparian sand/gravel**	**Assess/Maintain**				**Yes**	
Thayer's Gull	S	mudflats – staging	Migrant (no obj.)			Yes		Yes
Wandering Tattler	S	riparian sand/gravel	Assess/Maintain			Yes	Yes	
Whimbrel	S	mudflats – staging	Assess/Maintain			Yes		
White-tailed Ptarmigan	S	high alpine rock	Assess/Maintain				Yes	
Wilson's Snipe	S	mudflats – staging	Maintain Current			Yes		

Note: Reasons for inclusion in the priority species list are as follows. At Risk: the species was assessed by COSEWIC as Endangered (E), Threatened (T) or Special Concern (SC); RC (regional concern): the species meets PIF regional concern criteria; CC (continental concern): the species meets conservation concern or continental priority criteria for its bird group, and/or is At Risk nationally; RS (regional stewardship): waterfowl with highest, high or moderate high breeding importance in BCR 4, or the species meets PIF criteria for regional stewardship; CS (continental stewardship): landbirds identified as PIF continental stewardship species, or waterbirds listed in WOW as having at least 50% of global population in Canada. All priority species have PIF Relative Density>1.

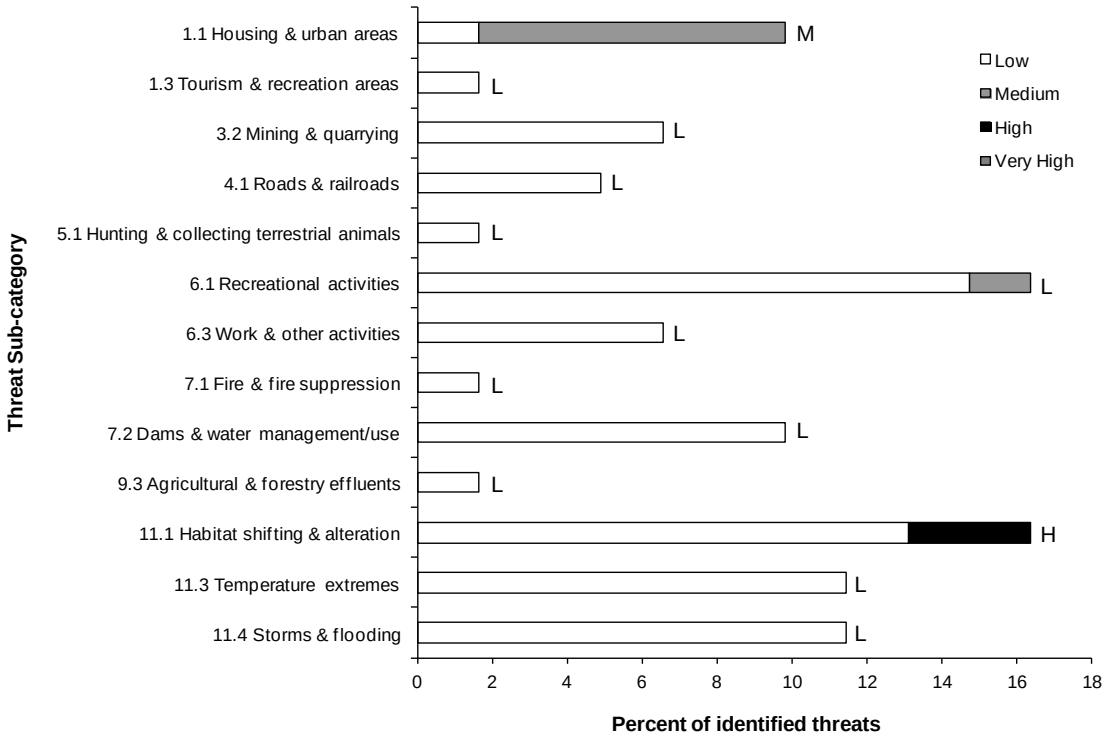

Figure 25. Percent of identified threats to priority species in bare areas in each threat sub-category in BCR 4 in Canada: Northwestern Interior Forest.

Priority species may use bare areas as their primary or secondary habitat. A total of 61 threats were identified.

Each bar represents the percent of the total number of threats identified in each threat sub-category in bare areas (for example, if 100 threats were identified in total for all priority species in bare areas and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category). The overall magnitude of the sub-threat in bare areas is shown at the end of each bar (also presented in Table 4, Relative magnitude of identified threats to priority species within BCR 4 in Canada by threat category and broad habitat class).

Table 20. Threats addressed, conservation objectives, recommended actions and priority species affected for bare areas habitats in BCR 4 in Canada: Northwestern Interior Forest.

Species for which a threat is of medium or high magnitude are in bold. Objectives and actions are presented only for species that use bare areas habitats as a primary habitat. "Priority species affected" are species for which the threat has been documented; additional species that are not listed may also be affected.

Threat category	Threats addressed	Objective category	Objectives	Action category	Recommended actions	Priority species affected
1. Residential and Commercial Development						
1.1 Housing & urban areas	Encroachment of housing developments at staging areas.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain value of important spring staging mudflats for shorebirds.	1.1 Site/area protection	Establish and enforce habitat protection at important spring staging sites.	**Semipalmated Sandpiper**
1.1 Housing & urban areas 1.3 Tourism & recreation areas	Encroachment of housing and recreational developments at nesting areas.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain the quantity and quality of bare riparian sand/gravel habitats within BCR 4 for nesting birds.	1.1 Site/area protection	Establish protection of important nesting areas.	Arctic Tern
6. Human Intrusions and Disturbance						
6.1 Recreational activities	Disturbance at staging areas from recreation.	4.1 Reduce disturbance from human recreation	Maintain value of important spring staging areas for shorebirds.	1.1 Site/area protection	Establish protection at important spring staging sites.	Semipalmated Sandpiper
				2.1 Site/area management	Restrict access to stopover areas during migration (e.g., prohibit boats, off-road vehicles, pets; recommend unobtrusive distances for observing waterbirds).	
				4.3 Awareness and communications	Increase public awareness of the crucial role of stopover sites, and detrimental effects of disturbance on staging birds; establish guidelines/rules for visitors.	
6.1 Recreational activities 6.3 Work & other activities	Disturbance at nest sites from recreation (including people, dogs, ATVs) and work activities.	4.1 Reduce disturbance from human recreation	Minimize human disturbance of priority species.	1.1 Site/area protection	Establish protection of important Arctic Tern nesting sites.	**Arctic Tern**
				2.1 Site/area management	Restrict access to important nesting beaches during the nesting season.	
		4.2 Reduce disturbance from industrial or work activity		4.3 Awareness and communications	Reduce disturbance of nest sites and breeding areas by increasing public awareness of ground-nesting birds, their vulnerability to disturbance, and guidelines around nesting areas.	**Arctic Tern,** Killdeer
					Reduce disturbance of nest sites by watercraft and hikers, by increasing public awareness of Peregrine Falcons, their vulnerability to	Peregrine Falcon

Table 20 continued

Threat category	Threats addressed	Objective category	Objectives	Action category	Recommended actions	Priority species affected
					disturbance, and guidelines around nesting areas.	
7. Natural System Modifications						
7.2 Dams & water management/ use	Flow changes from hydroelectric development.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain the quantity and quality of riparian bare and herbaceous habitats within BCR 4 for nesting birds.	2.1 Site/area management	Work with hydroelectric companies to establish flow agreements that would manipulate water to provide appropriate water levels at critical times.	Arctic Tern, Herring Gull, Killdeer, Spotted Sandpiper
11. Climate Change and Severe Weather						
11.1 Habitat shifting & alteration	Reduction of alpine tundra due to climate change.	1.2 Maintain the size, shape and configuration of habitat within the natural range of variation	Maintain the quantity and quality of alpine tundra habitat within BCR 4 for nesting birds.	1.1 Site/area protection	Create a system of protected areas sufficient to buffer against habitat loss.	**Gray-crowned Rosy-Finch**
				4.3 Awareness and communications 5. Law and policy 6. Livelihood, economic and other incentives	Support efforts to reduce greenhouse gas emissions.	
				8.1 Research	Identify areas of high breeding importance.	
11.1 Habitat shifting & alteration	Incremental wetland loss due to melting permafrost and evapotranspiration	1.2 Maintain the size, shape and configuration of habitat within the natural range of variation	Maintain the quantity and quality of wetland foraging and nesting habitat within BCR 4.	1.1 Site/area protection	Create a system of protected areas large enough to buffer against habitat loss.	Arctic Tern, Peregrine Falcon
				4.3 Awareness and communications 5. Law and policy 6. Livelihood, economic and other incentives	Support efforts to reduce greenhouse gas emissions.	
11.3 Temperature extremes 11.4 Storms & flooding	Vulnerable to increasing severity of temperature extremes and severe weather.	6.3 Manage populations for resilience to increased mortality from climate change	Ensure that population size is large enough to buffer against years of high mortality and reduced productivity due to severe weather.	1.1 Site/area protection	Create a system of protected areas sufficient to support populations that are robust enough to recover from years of high mortality.	Gray-crowned Rosy-Finch, Peregrine Falcon
				4.3 Awareness and communications 5. Law and policy 6. Livelihood, economic and other incentives	Support efforts to reduce greenhouse gas emissions.	
				8.1 Research	Measure the impact of such weather events on populations.	

Artificial Surfaces and Associated Areas

Artificial surfaces and associated areas include areas in cities and towns, mines, quarries, waste disposal sites, and transportation infrastructure that are less than 4% vegetated (Food and Agriculture Organization 2000). These areas are very limited in BCR 4 (Fig. 26), but include roads, parking lots, disturbed gravel surfaces in cities and towns, landfills, mines, sand and gravel quarries, structures associated with hydroelectric dams, and buildings.

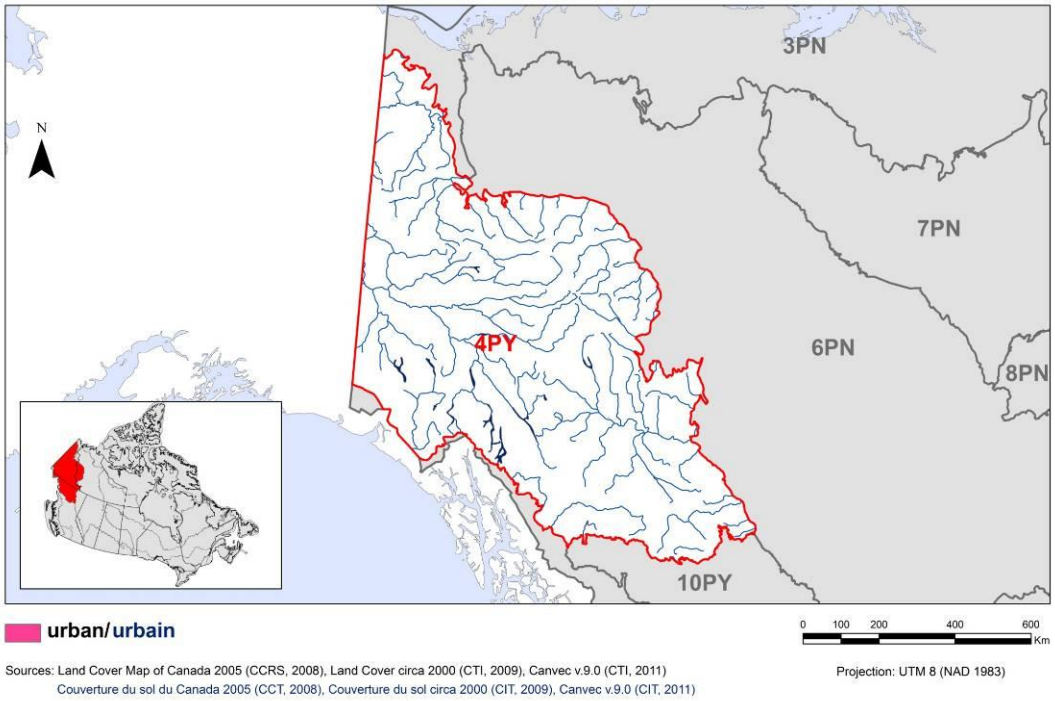

Figure 26. Map of artificial surfaces and associated areas in BCR 4 in Canada: Northwestern Interior Forest.

Only one priority species in BCR 4 uses artificial surfaces and associated areas as a primary habitat type: the Barn Swallow, a species at risk, which frequently nests on buildings such as barns and sheds. Five additional priority species, including one species at risk, make use of these areas as a secondary habitat (3 waterbirds, 1 shorebird, 1 landbird; Table 21). Within this category, regional sub-classes include rural buildings, disturbed sand/gravel, landfill, and power dam structure. Three gull species and Rusty Blackbird regularly feed at the Whitehorse landfill during migration; Killdeer will nest on disturbed gravel areas; and a few Herring Gulls build their nests on concrete structures associated with the Whitehorse hydroelectric power dam.

For the few priority species that use artificial surfaces and associated areas, five threats of medium and low magnitude were identified (Fig. 27). Overall, the threat level rolled up to low magnitude for this habitat (Table 4). The primary threats to Barn Swallows are the loss of nesting substrate as old buildings are modified or removed, and intentional removal of nests. Recommended actions are to increase public awareness of the species, and migratory bird regulations, as well as encouraging the use of alternative nesting structures (Table 22).

Table 21. Priority species that use artificial surfaces and associated areas in BCR 4 in Canada: Northwestern Interior Forest, with reason for priority and habitat use rank.

Species for which this is a primary habitat are indicated by Habitat use = P, and are in bold. Species for which this is a secondary habitat are indicated by Habitat use = S.

Priority species	Habitat use	Regional habitat sub-class	Population objective	Reason for priority status				
				At Risk	RC	CC	RS	CS
Barn Swallow	**P**	**rural buildings**	**Assess/Maintain**	**T**		**Yes**		
Herring Gull	S	landfill, power dam structure	Assess/Maintain			Yes		
Killdeer	S	disturbed sand/gravel	Assess/Maintain			Yes		
Mew Gull	S	landfill	Assess/Maintain				Yes	
Rusty Blackbird	S	landfill	Increase 50%	SC	Yes	Yes	Yes	
Thayer's Gull	**P**	**landfill**	**Migrant (no obj.)**			**Yes**		**Yes**

Note: Reasons for inclusion in the priority species list are as follows. At Risk: the species is assessed by COSEWIC as Endangered (E), Threatened (T) or Special Concern (SC); RC (regional concern): the species meets PIF regional concern criteria; CC (continental concern): the species meets conservation concern or continental priority criteria for its bird group, and/or is At Risk nationally; RS (regional stewardship): waterfowl with highest, high or moderate high breeding importance in BCR 4, or the species meets PIF criteria for regional stewardship; CS (continental stewardship): landbirds identified as PIF continental stewardship species, or waterbirds listed in WOW as having at least 50% of global population in Canada. All priority species have PIF Relative Density>1.

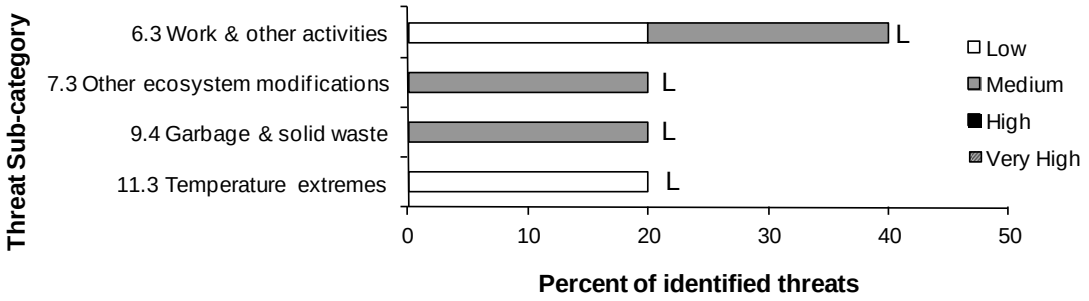

Figure 27. Percent of identified threats to priority species in artificial surfaces and associated areas in each threat sub-category in BCR 4 in Canada: Northwestern Interior Forest.

Priority species may use artificial surfaces and associated areas as their primary or secondary habitat. A total of 5 threats were identified.

Each bar represents the percent of the total number of threats identified in each threat sub-category in artificial surfaces and associated areas (for example, if 100 threats were identified in total for all priority species in artificial surfaces and associated areas, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category). The overall magnitude of the sub-threat in artificial surfaces and associated areas is shown at the end of each bar (also presented in Table 4, Relative magnitude of identified threats to priority species within BCR 4 in Canada by threat category and broad habitat class).

Table 22. Threats addressed, conservation objectives, recommended actions and priority species affected for artificial surfaces and associated areas in BCR 4 in Canada: Northwestern Interior Forest.

Species for which a threat is of medium or high magnitude are in bold. Objectives and actions are presented only for species that use artificial surfaces and associated areas as a primary habitat. "Priority species affected" are species for which the threat has been documented; additional species that are not listed may also be affected.

Threat category	Threats addressed	Objective category	Objectives	Action category	Recommended actions	Priority species affected
6. Human Intrusions and Disturbance						
6.3 Work and other activities	Removal of Barn Swallow nests from homes, businesses, picnic shelters.	2.9 Reduce nest destruction	Ensure that intentional nest destruction is not limiting Barn Swallow populations.	4.3 Awareness and communications	Increase public awareness of Barn Swallows and relevant regulations, and encourage landowners to incorporate nesting ledges on out-buildings.	**Barn Swallow**
7. Natural System Modifications						
7.3 Other ecosystem modifications	Loss of suitable nesting structures as old buildings, bridges, etc. are removed, replaced or renovated.	1.4 Maintain important habitat features on the landscape	Ensure that destruction of nesting structures is not limiting Barn Swallow populations.	4.3 Awareness and communications	Increase public awareness of Barn Swallows and relevant regulations, and encourage use of alternative nest structures	**Barn Swallow**
9. Pollution						
9.4 Garbage & solid waste	Vulnerable to negative effects of eating garbage.	2.2 Reduce mortality and/or sub-lethal effects from exposure to contaminants	Ensure that issues related to garbage are not limiting priority species' populations.	2.1 Site/area management	Manage hazardous materials at landfill sites to reduce contact with birds.	**Thayer's Gull**
11. Climate Change and Severe Weather						
11.3 Temperature extremes	Vulnerable to increasing severity of temperature extremes and storms.	6.1 Support efforts to reduce greenhouse gas emissions	Ensure that population size is large enough to buffer against years of high mortality due to severe weather or reduced food.	4.3 Awareness and communications 5. Law and policy 6. Livelihood, economic and other incentives	Support efforts to reduce greenhouse gas emissions.	Barn Swallow

Waterbodies, Snow and Ice

The Waterbodies, Snow, and Ice habitat category is defined as non-vegetated aquatic areas such as rivers, streams, lakes, ponds, snow and ice (Food and Agriculture Organization 2000). These habitats cover 6.2% of BCR 4 (Fig. 28), with snow and ice accounting for 4.4% and waterbodies covering just 1.8% (EOSD; Wulder and Nelson 2003). Year-round snow and ice are found at high elevations across BCR 4, mostly in the Northwest Territories and in the southwest corner of the BCR; but this cover type is not heavily used by birds. Waterbodies in BCR 4 include many fast-flowing streams, some major rivers, and a variety of lakes and ponds. The largest lakes are in southern Yukon and northern British Columbia, including the Yukon Southern Lakes (e.g., Marsh, Tagish, and Teslin lakes and Lake Laberge) and British Columbia's Atlin Lake.

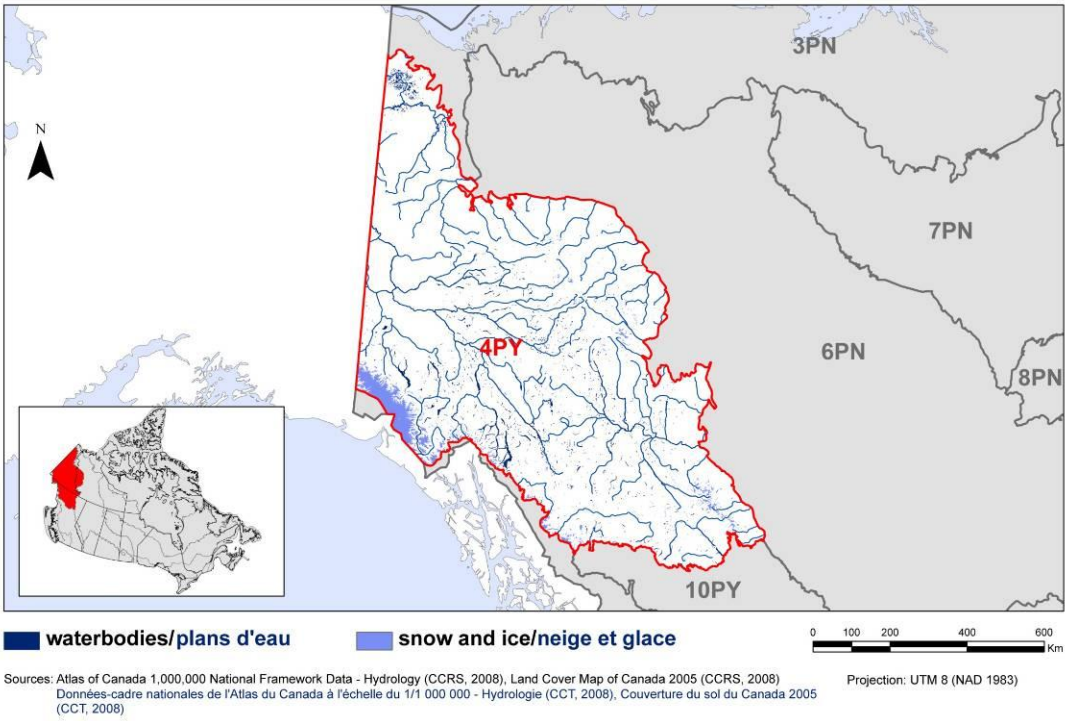

Figure 28. Map of waterbodies, snow and ice in BCR 4 in Canada: Northwestern Interior Forest.

There are 32 priority species that use waterbodies, snow and ice as primary habitat in BCR 4 (Table 23). These include 19 waterfowl, 3 shorebird and 10 waterbird species. Of these, one is a species at risk. A further 2 priority species use waterbodies, snow and ice as secondary habitat. Within the Waterbodies, Snow and Ice category, regional habitat sub-classes include lake, lake/pond and river/creek.

For priority species that use waterbodies, snow and ice, 122 threats of high, medium and low magnitude were identified (Fig. 29). Overall, the threat level rolled up to medium magnitude for this habitat (Table 4), due to medium magnitude rolled-up threats in four categories (Residential and Commercial Development, Agriculture and Aquaculture, Human Intrusions and Disturbance, and Natural System Modifications).

High-magnitude threats include habitat degradation and disturbance from freshwater aquaculture to Black Tern. Medium-magnitude threats include encroachment of residential development and recreation, and associated disturbance, on staging areas and breeding sites; flow changes from hydroelectric dams, and the threat of pollution from mining in or near mountain streams.

Recommended actions include protection and management of important sites, increasing public awareness of the value of waterbodies to birds, and development and enforcement of regulations and policies buffering waterbodies from development (Table 24).

Table 23. Priority species that use waterbodies, snow and ice in BCR 4 in Canada: Northwestern Interior Forest, with reason for priority and habitat use rank.

Species for which this is a primary habitat are indicated by Habitat use = P, and are in bold. Species for which this is a secondary habitat are indicated by Habitat use = S.

Priority species	Habitat use	Regional habitat sub-class	Population objective	Reason for priority status				
				At Risk	RC	CC	RS	CS
American Wigeon	**P**	**lake/pond**	**Increase 50%**		**Yes**	**Yes**	**Yes**	
Arctic Tern	**P**	**lake**	**Assess/Maintain**			**Yes**		
Barrow's Goldeneye	**P**	**lake/pond**	**Assess/Maintain**				**Yes**	
Black Tern	**P**	**lake/pond**	**Assess/Maintain**			**Yes**		
Blue-winged Teal	**P**	**lake/pond**	**Assess/Maintain**			**Yes**		
Bonaparte's Gull	**P**	**lake/pond**	**Assess/Maintain**			**Yes**	**Yes**	**Yes**
Bufflehead	**P**	**lake/pond**	**Assess/Maintain**				**Yes**	
Canada Goose	**P**	**river/creek**	**Assess/Maintain**			**Yes**	**Yes**	
Canvasback	**P**	**lake/pond**	**Assess/Maintain**			**Yes**	**Yes**	
Common Goldeneye	**P**	**lake/pond**	**Assess/Maintain**			**Yes**		
Common Loon	**P**	**lake**	**Assess/Maintain**			**Yes**		**Yes**
Common Nighthawk	S	lake/pond	Assess/Maintain	T		Yes		
Greater White-fronted Goose	**P**	**lake/pond**	**Assess/Maintain**				**Yes**	
Green-winged Teal	**P**	**lake/pond**	**Maintain Current**				**Yes**	
Harlequin Duck	**P**	**river/creek**	**Assess/Maintain**				**Yes**	
Herring Gull	**P**	**lake**	**Assess/Maintain**			**Yes**		
Horned Grebe	**P**	**lake/pond**	**Assess/Maintain**	**SC**		**Yes**	**Yes**	
Lesser Scaup	**P**	**lake/pond**	**Increase 50%**		**Yes**	**Yes**	**Yes**	
Long-tailed Duck	**P**	**lake/pond**	**Assess/Maintain**			**Yes**		
Mallard	**P**	**lake/pond**	**Maintain Current**			**Yes**	**Yes**	
Mew Gull	**P**	**lake/pond**	**Assess/Maintain**				**Yes**	
Northern Pintail	**P**	**lake/pond**	**Assess/Maintain**			**Yes**	**Yes**	
Northern Shoveler	**P**	**lake/pond**	**Assess/Maintain**				**Yes**	
Pacific Loon	**P**	**lake/pond**	**Assess/Maintain**			**Yes**	**Yes**	
Peregrine Falcon	S	river/creek	Assess/Maintain	SC		Yes	Yes	
Red-necked Grebe	**P**	**lake/pond**	**Assess/Maintain**				**Yes**	
Red-necked Phalarope	**P**	**lake/pond**	**Assess/Maintain**			**Yes**		

Table 23 continued

Priority species	Habitat use	Regional habitat sub-class	Population objective	Reason for priority status				
				At Risk	RC	CC	RS	CS
Spotted Sandpiper	P	river/creek	Assess/Maintain				Yes	
Surf Scoter	P	lake/pond	Assess/Maintain			Yes	Yes	
Thayer's Gull	P	lake	Migrant (no obj.)			Yes		Yes
Trumpeter Swan	P	lake/pond	Maintain Current			Yes	Yes	
Tundra Swan	P	lake	Migrant (no obj.)				Yes	
Wandering Tattler	P	river/creek	Assess/Maintain			Yes	Yes	
White-winged Scoter	P	lake/pond	Assess/Maintain			Yes	Yes	

Note: Reasons for inclusion in the priority species list are as follows. At Risk: the species is assessed by COSEWIC as Endangered (E), Threatened (Th) or Special Concern (SC); Pillar Plan: the species is a national or continental priority according to its bird group plan; RC (regional concern): the species meets PIF regional concern criteria; CC (continental concern): the species meets conservation concern or continental priority criteria for its bird group, and/or is At Risk nationally; RS (regional stewardship): waterfowl with highest, high or moderate high breeding importance in BCR 4, or the species meets PIF criteria for regional stewardship; CS (continental stewardship): landbirds identified as PIF continental stewardship species, or waterbirds listed in WOW as having at least 50% of global population in Canada. All priority species have RD>1.

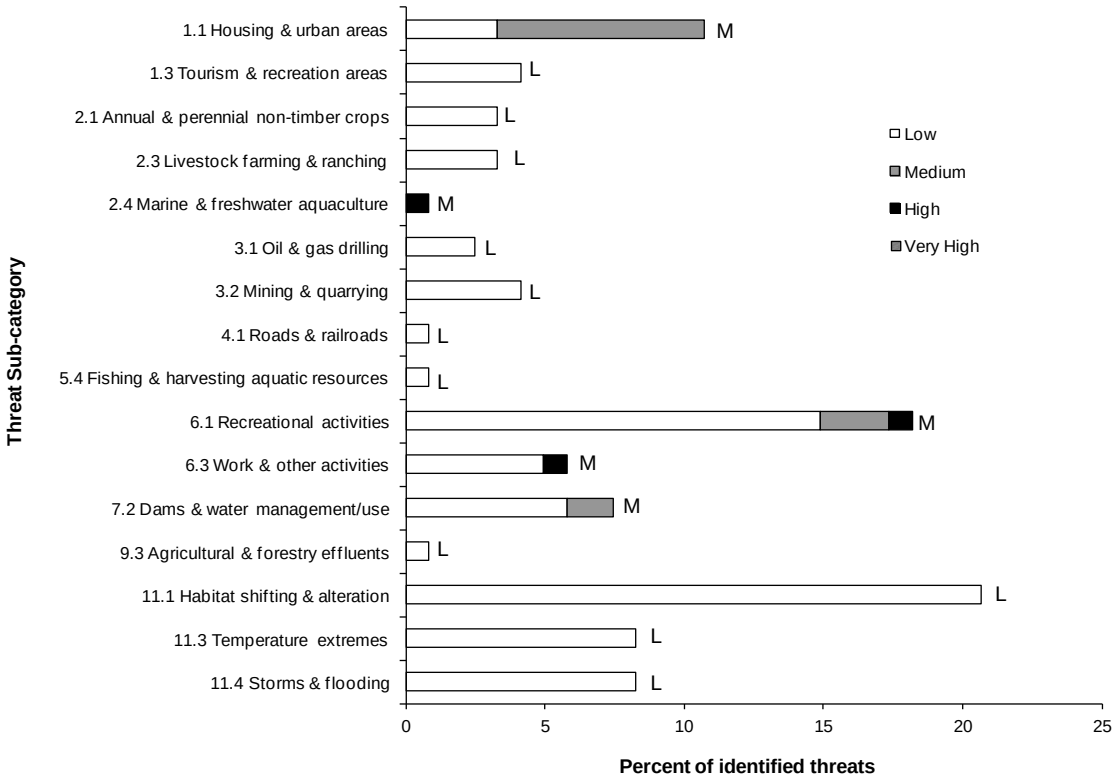

Figure 29. Percent of identified threats to priority species in waterbodies, snow and ice in each threat sub-category in BCR 4 in Canada: Northwestern Interior Forest.

Priority species may use waterbodies, snow and ice as their primary or secondary habitat. A total of 122 threats were identified.

Each bar represents the percent of the total number of threats identified in each threat sub-category in waterbodies, snow and ice (for example, if 100 threats were identified in total for all priority species in waterbodies, snow and ice, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category). The overall magnitude of the sub-threat in waterbodies, snow and ice is shown at the end of each bar (also presented in Table 4, Relative magnitude of identified threats to priority species within BCR 4 in Canada by threat category and broad habitat class).

Table 24. Threats addressed, conservation objectives, recommended actions and priority species affected for waterbodies, snow and ice habitats in BCR 4 in Canada: Northwestern Interior Forest.

Species for which a threat is of medium or high magnitude are in bold. Objectives and actions are presented only for species that use waterbodies, snow and ice as a primary habitat. "Priority species affected" are species for which the threat has been documented; additional species that are not listed may also be affected.

Threat category	Threats addressed	Objective category	Objectives	Action category	Recommended actions	Priority species affected†
1. Residential and Commercial Development						
1.1 Housing & urban areas	Encroachment of housing developments at staging areas.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain value of important early-open-water spring staging areas for waterbirds.	1.1 Site/area protection	Establish and enforce habitat protection at important spring staging sites.	**American Wigeon, Canvasback, Green-winged Teal, Lesser Scaup, Mallard, Northern Pintail, Northern Shoveler, Trumpeter Swan (Pacific Coast), Tundra Swan**
1.1 Housing & urban areas 1.3 Tourism & recreation areas	Encroachment on/loss or degradation of breeding habitat from housing and recreational developments.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain the quantity and quality of wetlands, waterbodies and associated riparian nesting habitat within BCR 4 for nesting waterbirds.	1.1 Site/area protection	Establish protection of important nesting areas.	Arctic Tern, Common Loon, Horned Grebe, Red-necked Grebe, Trumpeter Swan (Pacific Coast), Trumpeter Swan (Rocky Mountain,
2. Agriculture and Aquaculture						
2.1 Annual & perennial non-timber crops 2.3 Livestock farming & ranching	Encroachment on/loss or degradation of wetlands from cropland or livestock farming/ranching.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain the quantity and quality of wetland and lake/pond habitat within BCR 4 for nesting waterbirds.	5.2 Policies and regulations 5.4 Compliance and enforcement	In areas with agricultural operations, establish and enforce habitat protection of wetlands and adjacent areas, including riparian guidelines for agricultural leases.	Horned Grebe, Red-necked Grebe, Trumpeter Swan (Pacific Coast), Trumpeter Swan (Rocky Mountain)
2.4 Marine & freshwater aquaculture	Degradation of habitat from freshwater aquaculture.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain the quantity and quality of wetland and lake/pond habitat within BCR 4 for nesting waterbirds.	5.4 Compliance and enforcement	Establish and enforce freshwater aquaculture guidelines.	**Black Tern**
3. Energy Production and Mining						
3.1 Oil & gas drilling	Encroachment on/degradation of breeding habitat	1.1 Ensure land and resource-use policies and	Maintain the quantity and quality of wetland and	5.4 Compliance and enforcement	Incorporate exclusion zones into oil and gas development and exploration plans to protect habitat.	American Wigeon, Trumpeter Swan (Pacific Coast), Trumpeter Swan (Rocky

Table 24 continued

Threat category	Threats addressed	Objective category	Objectives	Action category	Recommended actions	Priority species affected†
	from petroleum development.	practices maintain or improve bird habitat	lake/pond habitat within BCR 4 for nesting waterbirds.			Mountain)
3.2 Mining & quarrying	Encroachment on/degradation of breeding habitat from mining.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain the quantity and quality of wetland and lake/pond habitat within BCR 4 for nesting waterbirds.	5.4 Compliance and enforcement	Incorporate exclusion zones into mining plans to protect habitat. Incorporate habitat recovery into post-mining site clean-up.	American Wigeon, Trumpeter Swan (Pacific Coast), Trumpeter Swan (Rocky Mountain)
			Maintain the quantity and quality of alpine streams and associated riparian habitat within BCR 4 for nesting birds.			Harlequin Duck, Wandering Tattler
5. Biological Resource Use						
5.4 Fishing & harvesting aquatic resources	Lead poisoning from consumption of lead sinkers.	2.2 Reduce mortality and/or sub-lethal effects from exposure to contaminants	Ensure that issues related to lead sinkers are not limiting priority species' populations.	5.2 Policies and regulations	Restrict use of lead sinkers at lakes where Common Loons nest.	Common Loon
6. Human Intrusions and Disturbance						
6.1 Recreational activities	Disturbance at staging areas from recreation.	4.1 Reduce disturbance from human recreation	Maintain value of important early-open-water spring staging areas for waterbirds.	1.1 Site/area protection	Establish protection at important spring staging sites.	American Wigeon, Canvasback, Green-winged Teal, Lesser Scaup, Mallard, Northern Pintail, Northern Shoveler, **Trumpeter Swan (Pacific Coast), Tundra Swan**,
				2.1 Site/area management	Restrict access to stopover areas during migration (e.g. prohibit boats, off-road vehicles, pets; recommend unobtrusive distances for observing waterbirds).	
				4.3 Awareness and communications	Increase public awareness of the crucial role of stopover sites, and detrimental effects of disturbance on staging birds, and establish guidelines/rules for visitors.	
6.1 Recreational activities 6.3 Work &	Disturbance at nesting areas from recreation, boating, and other activities.	4.1 Reduce disturbance from human recreation	Minimize human disturbance of nesting areas of priority species.	1.1 Site/area protection	Ensure adequate protection of forested boreal lakes suitable for nesting Bufflehead.	Barrow's Goldeneye, Bufflehead, Common Goldeneye
					Establish protection of important Arctic	**Arctic Tern**

Table 24 continued

Threat category	Threats addressed	Objective category	Objectives	Action category	Recommended actions	Priority species affected†
other activities		4.2 Reduce disturbance from industrial or work activity			Tern nesting sites.	
					Ensure adequate protection of lakes suitable for nesting Common Loons.	Common Loon
				2.1 Site/area management	Restrict access to nesting beaches during the nesting season.	**Arctic Tern**
				4.3 Awareness and communications	Reduce disturbance of nest sites and breeding areas, by increasing public awareness of waterfowl and waterbirds, their vulnerability to disturbance, and guidelines around nesting areas.	**Arctic Tern, Black Tern,** Barrow's Goldeneye, Bonaparte's Gull, Bufflehead, Common Goldeneye, Common Loon, Harlequin Duck, Pacific Loon, Red-necked Grebe, Trumpeter Swan (Pacific Coast), Trumpeter Swan (Rocky Mountain)
				5.2 Policies and regulations 5.4 Compliance and enforcement	Restrict use of motorized crafts in known nesting areas during breeding season.	Bonaparte's Gull, Trumpeter Swan (Pacific Coast), Trumpeter Swan (Rocky Mountain)
7. Natural System Modifications						
7.2 Dams & water management /use	Water level changes from hydroelectric development.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Maintain the quantity and quality of alpine stream, lake/pond, and associated riparian nesting habitat within BCR 4 for nesting birds.	2.1 Site/area management	Work with hydroelectric companies to establish in-stream flow agreements that would manipulate water to provide appropriate water levels at critical times, and maintain aquatic plant production.	Arctic Tern, Common Loon, Harlequin Duck, Herring Gull, Mew Gull, Spotted Sandpiper, Red-necked Grebe
			Maintain value of important early-open-water spring staging areas for waterbirds.			**Trumpeter Swan (Pacific Coast), Tundra Swan**

Table 24 continued

Threat category	Threats addressed	Objective category	Objectives	Action category	Recommended actions	Priority species affected†
11. Climate Change and Severe Weather						
11.1 Habitat shifting & alteration	Incremental loss of wetland and ponds to melting permafrost and evapotranspira-tion.	1.2 Maintain the size, shape and configuration of habitat within the natural range of variation	Maintain the quantity and quality of wetland, pond and alpine stream habitat within BCR 4 for waterbirds.	1.1 Site/area protection	Create a system of large protected areas to maintain breeding populations, and to buffer against habitat loss.	American Wigeon, Arctic Tern, Barrow's Goldeneye, Bonaparte's Gull, Bufflehead, Canvasback, Common Goldeneye, Greater White-fronted Goose, Green-winged Teal, Harlequin Duck, Horned Grebe, Lesser Scaup, Long-tailed Duck, Mallard, Mew Gull, Northern Pintail, Northern Shoveler, Pacific Loon, Red-necked Grebe, Red-necked Phalarope, Surf Scoter, Trumpeter Swan (Pacific Coast), Trumpeter Swan (Rocky Mountains), White-winged Scoter
				4.3 Awareness and communications 5. Law and policy 6. Livelihood, economic and other incentives	Support efforts to reduce greenhouse gas emissions.	
11.3 Temperature extremes 11.4 Storms & flooding	Vulnerable to increasing frequency and severity of storms and temperature extremes.	6.3 Manage populations for resilience to increased mortality from climate change	Ensure that population size is large enough to buffer against years of high mortality due to severe weather.	4.3 Awareness and communications 5. Law and policy 6. Livelihood, economic and other incentives	Support efforts to reduce greenhouse gas emissions.	Barrow's Goldeneye, Common Goldeneye, Common Loon, Lesser Scaup, Mallard, Northern Pintail, Northern Shoveler, Wandering Tattler, White-winged Scoter
				1.1 Site/area protection	Create a system of protected areas sufficient to support populations that are robust enough to recover from years of high mortality.	
				8.1 Research	Measure the impact of such weather events on populations..	
11.4 Storms & flooding	Vulnerable to nest failures from heavy rain and flooding.	6.3 Manage populations for resilience to increased mortality from climate change	Ensure that population size is large enough to buffer against years of high mortality due to severe weather.	1.1 Site/area protection	Create a system of protected areas to maintain breeding populations, particularly protecting shallow bays with emergent vegetation from development.	Horned Grebe, Red-necked Grebe

† Priority species not mentioned in this table have no identified threats in this habitat.

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 man-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 is believed to be a significant source of bird mortality in Canada. Estimates of mortality from collisions with houses in Canada (including birds using feeders) range from approximately 15.8–30.5 million birds per year (Machtans et al. 2013). Mortality from collisions with buildings of fewer than 12 storeys is estimated at approximately 0.3–11.4 million birds/year, and for all cities in Canada with tall buildings in an urban core the estimate is 13,000–256,000 birds/year (Machtans et al. 2013). The total estimate of mortality from collisions with buildings in Canada is therefore between 16.1–42.2 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 25 for conservation objectives and actions.

In BCR 4, there are no buildings over 12 storeys tall, and only a few towns. However, birds are killed by window collisions wherever there are buildings, and simple actions can be taken to reduce mortality from window strikes. Priority species affected within the region include Olive-sided and Alder flycatchers, Varied Thrush, Bohemian Waxwing, Blackpoll and Wilson's warblers, White-crowned Sparrow, Pine Grosbeak, and White-winged Crossbill.

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 25 for conservation objectives and actions.

Currently there are only two large wind turbines in BCR 4, both in Whitehorse. One study found no evidence of bird mortality from collisions with these turbines (Mossop 1997). Priority species that may be vulnerable if there were expanded development of wind turbines in the region include Swainson's Hawk, Golden Eagle, American Kestrel, and Peregrine Falcon.

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 25; 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 25 for conservation objectives and actions.

In BCR 4, priority species which may be particularly vulnerable to collisions with communication towers include Townsend's, Blackpoll, and Wilson's warblers.

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). The impact of power lines on bird populations in BCR 4 is unknown.

Vehicles

There are over 1.4 million km of roads and hundreds of airports in Canada (World Bank Indicators 2012) that are often bordered by fences and vegetation 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 cars are influenced by the location of the road, proximity of vegetation, and vehicle speed. Raptors and owls that hunt and forage near roads are particularly vulnerable, but many species that forage for grit and road salt or are otherwise attracted to roads have a high likelihood of being hit by vehicles. The population level effects of this source of mortality are not known. See Table 25 for conservation objectives and actions.

Birds killed on roads per vehicle in BCR 4 may be higher than the national average. Due to the long winter, sand and gravel are applied to roads for at least half of each year, encompassing spring and fall migration periods for many species, including seed-eating birds which seek out and consume sand and gravel to aid in digestion. Also, road rights-of-way form attractive habitats for birds which nest, migrate, forage, or hunt in open, shrubby, and/or edge habitats, which are relatively rare in forested lowland areas in the region. In addition, road-killed small mammals, birds, and larger insects such as dragonflies attract opportunistic species such as Gray Jay to the roadside. Priority species vulnerable to vehicle collisions in BCR 4 include American Kestrel, Upland Sandpiper, Northern Hawk Owl, Great Gray Owl, Short-eared Owl, Boreal Owl, Common Nighthawk, Northern Shrike, Gray Jay, Barn Swallow, Bohemian Waxwing, White-crowned Sparrow, Golden-crowned Sparrow, Gray-crowned Rosy-Finch, Pine Grosbeak, and White-winged Crossbill.

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 25 for conservation objectives and actions.

In BCR 4, the human population is small and so is the domestic and feral cat population. Due to the cold winters, feral cat populations are expected to be low, but they do exist around settlements. Simple actions can be taken to reduce mortality from cats where they do occur. Species which may be vulnerable to domestic and feral cat predation include Killdeer, Spotted Sandpiper, Upland Sandpiper, Common Nighthawk, Varied Thrush, Wilson's Warbler, White-crowned Sparrow, Golden-crowned Sparrow, Pine Grosbeak, and White-winged Crossbill, as well as sparrows and thrushes not on the priority species list.

Pollution

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

Pesticides

The most recent estimate suggests that 0.96–4.4 million birds are killed by pesticides annually in Canada (Mineau 2010). Provinces such as Saskatchewan, which have a large agricultural land base, account for the majority of the estimated kill, and pesticides are thought to be an important contributor to the decline in grassland bird species in Canada (Mineau 2010). Pesticides can kill birds rapidly following contact or may have sub-lethal impacts such as suppressed immune function and reduced stress response. There may also be indirect effects of pesticides such as reduction in prey and changes in vegetation that reduce habitat quality. While the use of the many toxic pesticides has been eliminated in Canada, migratory birds are still exposed while on wintering grounds in countries where their use is still permitted (Mineau 2010). See Table 25 for conservation objectives and actions.

Pesticide use is generally low in BCR 4; *Bacillus thuringiensis* is sprayed for mosquito control, and herbicides such as glyphosate are used for weed control. There has been some use of the insecticide malathion; and the forestry pesticide monosodium methanearsonate (MSMA) was used in northern British Columbia to control spruce bark beetle from the 1980s to 2004, and was toxic to woodpeckers that consumed the beetles.

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 25 for conservation objectives and actions.

In BCR 4, pollution from mining operations may be increasing with the current rapid expansion of this industry in the region. Tailings ponds from old mines remain, some requiring many decades of maintenance and clean-up, posing potentially large threats to birds using nearby waterways. Priority waterfowl, loons, grebes, and shorebirds would be most vulnerable to pollution from mining operations. Lead sinkers may be a threat to Pacific and Common loons and other waterbirds. Other toxic substances such as flame retardants may threaten the many priority species which consume insects and other invertebrates.

Oil Pollution

Oil may enter the environment either accidentally, through deliberate dumping, or in contained tailings ponds. It may be a single large event, as occurred in the Gulf of Mexico in 2010, or numerous smaller events. Annual estimates are that between 217,800 and 458,600 birds are killed by ship-source oil spills annually (Calvert et al. 2013). Typically, diving birds are most at risk of oiling; however any birds that come into contact with oil are vulnerable. Oil can impact birds through direct effects such as hypothermia (resulting from lost water-proofing of feathers following oil contamination), toxicity (from ingesting oil as they preen or by inhaling volatile organic compounds), and indirect effects, such as reduced prey availability and decreased quality of habitat. While techniques exist to clean and rehabilitate oiled birds, many birds die before, during and after rescue attempts (Brown and Lock 2003). See Table 25 for conservation objectives and actions.

BCR 4 in Canada does not include any coastline, so the risk of large oil spills is low; however smaller spills do occur, and waterfowl and waterbirds may be vulnerable.

Table 25. Conservation objectives and actions associated with bird mortality from collisions, cats and contaminants.

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Example priority species affected
Collision mortality						
Collisions with buildings cause bird mortality.	1.1 Housing and urban areas 1.2 Commercial and industrial areas	Reduce incidental mortality from collisions with windows/buildings	2.7 Reduce incidental mortality from collisions	Follow beneficial management practices for bird-friendly buildings including using bird-friendly glass, reducing reflection from windows, providing visual markers to enable birds to perceive windows, and reducing light pollution.	2.1 Site/area management 5.3 Private sector standards and codes	Known in BCR 4: Alder flycatcher, Blackpoll warbler, Bohemian Waxwing, Olive-sided flycatcher, Pine Grosbeak, Varied Thrush, , White-crowned Sparrow, White-winged Crossbill, Wilson's warbler
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. Ensure that wind energy developments will not present significant migration barriers. Locate offshore wind energy developments away from important waterbird foraging areas. Utilize techniques such as radar monitoring to determine pre-construction flight paths and assess the degree to which wind farms present migration barriers, and infrared camera systems to quantify strike rates.	2.1 Site/area management 5.3 Private sector standards and codes 1.2 Resource and habitat protection 8.2 Monitoring	May be vulnerable in BCR 4: American Kestrel, Golden Eagle, Peregrine Falcon, Swainson's Hawk
Collisions with communications towers cause bird mortality, particularly during migration.	1.2 Commercial and industrial areas	Reduce incidental mortality from collisions with human-made structures	2.7 Reduce incidental mortality from collisions.	Follow beneficial management practices for reducing mortality to birds when constructing new communications towers. Switch off solid lights on existing towers and ensure that remaining lights have a synchronized, complete dark phase. Take steps to ensure that new towers avoid guy wires and minimize height, and avoid topographic	2.1 Site/area management 5.3 Private sector standards and codes	Known in BCR 4: Wilson's Warbler; May also be vulnerable: Blackpoll Warbler, Townsend's Warbler

Table 25 continued

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Example priority species affected
				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 of raptors is minimized. In new developments, locate transmission lines underground. Use markers or paint to increase visibility of power lines in high-strike areas. Avoid siting lines over or near wetlands.	2.1 Site/area management	unknown
Collisions with vehicles cause bird mortality.	4.1 Roads and railroads	Reduce mortality from collisions with vehicles	2.7 Reduce incidental mortality from collisions.	Erect road signs or speed bumps to lower vehicle speeds where bird activity is frequent. Remove plants that attract birds from roadsides and medians. Landscape along roads using taller trees and bushes to cause birds to fly higher. Encourage the use of salt management plans to avoid unnecessary use of particulate salt (a bird attractant) on roads. Avoid locating roads in valuable bird habitat.	2.1 Site/area management 1.1 Site/area protection	In BCR 4: American Kestrel, Barn Swallow, Bohemian Waxwing, Boreal Owl, Common Nighthawk, Golden-crowned Sparrow, Gray-crowned Rosy-Finch, Gray Jay, Great Gray Owl, Northern Hawk Owl, Northern Shrike, Pine Grosbeak, Short-eared Owl, Upland Sandpiper, White-crowned Sparrow, and White-winged Crossbill
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						

Table 25 continued

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Example priority species affected
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. Work to reduce feral cat overpopulation through cat control regulations.	5.3 Private sector standards and codes 5.2 Policies and regulations	Ground nesting or ground foraging species; species attracted to feeders; species inhabiting suburban or urban areas – e.g. Common Nighthawk, Golden-crowned Sparrow, Killdeer, Pine Grosbeak, Spotted Sandpiper, Upland Sandpiper, Varied Thrush, White-crowned Sparrow, White-winged Crossbill, Wilson's Warbler
Population effects of cat predation are unknown.	12.1 Information lacking	Improve understanding of population effects of cat predation	7.4 Improve understanding of causes of population declines.	Evaluate which species are most vulnerable to cat predation. Investigate the population-level effects of cat predation through better monitoring of kill rates and the number of feral cats. Continue to monitor bird populations so changes in numbers and distributions can be identified and management of cats can be altered to reflect these changes. Conduct effectiveness monitoring to evaluate if mitigation activities are achieving the desired results.	8.1 Research 8.2 Monitoring	Ground nesting or ground foraging species; species attracted to feeders; species inhabiting suburban or urban areas
Environmental Contaminants						
Mortality, sub-lethal effects, reductions in prey populations and habitat alteration caused by exposure to/use of pesticides.	9.3 Agricultural & forestry effluents	Reduce mortality and sub-lethal effects of pesticides on birds Reduce the effects of pesticides on prey species	2.1 Reduce mortality and/or sub-lethal effects from pesticide use. 5.1 Maintain natural food webs and prey sources.	Substantially reduce the use of pesticides/rodenticides/herbicides in Canada. Where elimination is not possible, they should be used as part of an integrated pest management system. Improve regulation of pesticides/rodenticides/herbicides in Canada to reduce bird mortality.	5.2 Policies and regulations 5.3 Private sector standards and codes	**Known direct or indirect poisoning by pesticides in Canada:** American Wigeon, , Peregrine Falcon (*anatum/tundrius*), **Known reductions in prey due to pesticide use in Canada:** Barn Swallow, Black Tern, Common Nighthawk

Table 25 continued

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Example priority species affected
Mortality from ingestion of lead shot or tackle.	5.1 Hunting & collecting terrestrial animals 5.4 Fishing & harvesting aquatic resources	Reduce mortality and sub-lethal effects of lead shot and fishing tackle on birds	2.2 Reduce mortality and/or sub-lethal effects from exposure to contaminants.	Work with hunters, anglers and industry to eliminate the exposure of birds to shot, sinkers and jigs made of lead. 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.	4.3 Awareness and communications 5.4 Compliance and enforcement	**Known in Canada in:** American Wigeon, Blue-winged Teal, Canvasback, Common Loon, Greater White-fronted Goose, Green-winged Teal, Lesser Scaup, Mallard, Northern Pintail, Northern Shoveler, Trumpeter Swan, Tundra Swan
Mortality from heavy metals and other contaminants.	9.2 Industrial & military effluents	Reduce mortality from heavy metals and other contaminants	2.2 Reduce mortality and/or sub-lethal effects from exposure to contaminants.	Work with industry and policy makers to reduce the quantity of heavy metals and other contaminants released into the environment.	5.3 Private sector standards and codes 5.2 Policies and regulations	**Heavy metals:** Barrow's Goldeneye, Common Goldeneye, Common Loon, Surf Scoter **PCBs:** Barrow's Goldeneye, Common Goldeneye **Other contaminants:** Horned Grebe, Peregrine Falcon (*anatum/tundrius*)
Mortality of waterbirds from oil pollution.	9. Pollution	Reduce mortality from oil pollution	2.3 Reduce mortality and/or sublethal effects of oil pollution. 5.1 Maintain natural food webs and prey sources.	Improve monitoring and enforcement capacity to reduce chronic oil pollution from illegal dumping of bilge waste and cleaning of oil tanks. Improve education/outreach to make sure that the oil industry and its regulators are aware of the potential impacts on birds and take measures to prevent exposure of birds to oil.	5.4 Compliance and enforcement 4.3 Awareness and communications	**Lethal and sublethal effect of oil exposure:** American Golden-Plover, Barrow's Goldeneye, Bufflehead, Common Goldeneye, Common Loon, Harlequin Duck, Horned Grebe, Lesser Scaup, Red-necked Phalarope, Short-billed Dowitcher, Surf Scoter, Surfbird, Thayer's Gull, Wandering Tattler, Whimbrel, White-winged Scoter,
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. Evaluate the extent to which pesticides are reducing prey availability for aerial insectivores. Improve the ability to monitor and	8.1 Research	All species

Table 25 continued

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Example priority species affected
				understand the effects of contaminant concentrations in birds. Continue to acquire information on oiling of waterbirds through programs like Birds Oiled at Sea.	8.2 Monitoring	

Climate Change

The effects of climate change are already measureable 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 which alter habitat structure and community composition (North American Bird Conservation Initiative, U.S. Committee 2009, Faaborg et al. 2010). See Tables 26 and 27 for a summary of impacts of climate change and conservation objectives.

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

In BCR 4, some of the greatest threats to birds from climate change include reduction of alpine tundra habitats as shrubs and trees advance; loss of wetland habitats as permafrost melts and evapo-transpiration increases; mortality and nest failure from increased severity of late snow storms and flooding from rainstorms; and mismatched timing of invertebrate availability with dietary needs of breeding birds. Other climate change effects, such as changes in wind and weather patterns and increased severity of storms, may affect birds while they are in migration outside of BCR 4.

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). In BCR 4, we still have opportunities for systematic conservation planning including large protected areas with connections to allow for species movement, in order to buffer the negative effects of climate change on bird species.

Table 26. 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	Barn Swallow, Lesser Scaup, Olive-sided Flycatcher, Rusty Blackbird
Extended breeding season	*Needs study in BCR 4*
Habitat loss as a result of ecosystem changes (e.g., advances in treeline into tundra areas)	American Golden-Plover, Golden Eagle, Gray-crowned Rosy-Finch, Short-eared Owl, Smith's Longspur, Surfbird, Upland Sandpiper,Wandering Tattler, Whimbrel, White-tailed Ptarmigan, White-winged Crossbill
Increase in severe weather events	American Golden-Plover, Barn Swallow, Barrow's Goldeneye, Common Goldeneye, Common Loon, Common Nighthawk, Dusky Grouse, Golden-crowned sparrow, Gray-crowned Rosy-Finch, Lesser Scaup, Mallard, Northern Pintail, Northern Shoveler, Peregrine Falcon, Red-necked Grebe, Short-eared Owl, Smith's Longspur, urfbird, Upland Sandpiper, Wandering Tattler, Whimbrel, White-crowned sparrow ,White-tailed Ptarmigan, White-winged Scoter
Introduction of new predators and competitors	*Needs study in BCR 4*
Range shifts to the north	*Needs study in BCR 4*
Thawing of permafrost and increased evaporation resulting in vegetation shifts and loss of wetlands	America Wigeon, Arctic Tern, Barrow's Goldeneye, Blackpoll Warbler, Bonaparte's Gull, Bufflehead, Canada Goose, Canvasback, Common Goldeneye, Greater White-fronted Goose, Green-winged Teal, Harlequin Duck, Horned Grebe, Lesser Scaup, Lesser Yellowlegs, Long-tailed Duck, Mallard, Mew Gull, Northern Pintail, Northern Shoveler, Pacific Loon, Peregrine Falcon, Red-necked Grebe, Red-necked Phalarope, Rusty Blackbird, Solitary Sandpiper, Sora, Surf Scoter, Trumpeter Swan, Whimbrel, White-winged Scoter, Wilson's Snipe

Table 27. Proposed conservation objectives and actions to address threats from 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
		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. Manage buffer areas and the matrix between protected areas to enhance movement of species across the landscape. Manage ecosystems to maximize carbon storage and sequestration while simultaneously enhancing bird habitat. Incorporate predicted shifts in habitat into landscape level plans (e.g., when establishing protected areas ensure the maintenance of north-south corridors to facilitate northward range shifts of bird species).	1.1 Site/area protection 2.1 Site/area management 5.2 Policies and regulations	
Population-level effects of climate change are unknown	12.1 Information lacking	Improve understanding of climate change on birds and their habitats	7.5 Improve understanding of potential effects of climate change	Evaluate which species are most vulnerable to climate change. Investigate the cumulative effects of climate change.	8.1 Research	All

Table 27 continued

Threats addressed	Threat sub-category	Objective	Objective category	Recommended actions	Action category	Priority species affected
				Investigate behavioural responses to climate change (such as range shifts, changes in demographic rates, and changes in timing of breeding and migration) through long-term studies. Continue to monitor bird populations so changes in numbers and distributions can be identified. Undertake monitoring to evaluate the effectiveness of mitigation activities.	8.2 Monitoring	

Research and Population Monitoring Needs

Population Monitoring

An estimate of population trend for each species is necessary for the development of elements 1 and 3 (Species Assessment and Population Objectives). However, there are many species for which we are currently unable to estimate a population trend (PT) score. These species were typically assigned a 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.

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

Landbirds

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

Shorebirds

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

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

- review the information needs and expenditures for duck banding programs;
- redesign the Trumpeter Swan surveys; and
- realign resources for scoter monitoring to a more efficient suite of surveys.

In BCR 4, 70% of priority breeding species have unknown regional population trends, while 20% have evidence of stable populations, and 10% have evidence of declines. However, even for most of the 30% of species with some trend information, there are issues of reliability of the data due to low numbers of survey sites and other survey issues. Therefore all of BCR 4's priority breeding species are included in Table 28, which lists the primary and secondary existing survey or information source for each species. For some species, a third and sometimes fourth survey is appropriate, while for a few species, e.g., Swainson's Hawk, Wandering Tattler, Whimbrel, Surfbird, and Gray-headed Chickadee, existing options for monitoring are clearly inadequate.

Local monitoring within BCR 4 should be consistent over time, and should conform to national standards where possible. Monitoring population trends and distribution within parks, First Nation traditional territories, and other local areas should be planned to complement other efforts in the region and continent. Potential monitoring approaches are suggested for poorly-monitored species groups (Table 29), and further monitoring actions to address information gaps for species with poor trend data are also listed (Table 30).

Table 28. Monitoring tools and baseline information sources available for priority breeding species in BCR 4 in Canada: Northwestern Interior Forest.

Species	Population objective	Population trend[11]	Primary survey	Secondary survey
Alder Flycatcher	Assess/Maintain	3	BBS	BC Breeding Bird Atlas
American Golden-Plover	Assess/Maintain	3	NWT Checklist Program	Birds of the Yukon database
American Kestrel	Assess/Maintain	3	BC Breeding Bird Atlas	NWT Checklist Program
American Three-toed Woodpecker	Maintain Current	2	BBS	BC Breeding Bird Atlas
American Wigeon	Increase 50%	4	Yukon Roadside Wetland Survey	USFWS – Old Crow Flats
Arctic Tern	Assess/Maintain	3	BC Breeding Bird Atlas	NWT Checklist Program
Barrow's Goldeneye	Assess/Maintain	3	Yukon Roadside Wetland Survey	BC Breeding Bird Atlas
Black Tern	Assess/Maintain	3	single species survey	Birds of the Yukon database
Blackpoll Warbler	Increase 50%	4	BBS	BC Breeding Bird Atlas
Blue-winged Teal	Assess/Maintain	3	Yukon Roadside Wetland Survey	BC Breeding Bird Atlas
Bohemian Waxwing	Assess/Maintain	3	BBS	BC Breeding Bird Atlas
Bonaparte's Gull	Assess/Maintain	3	Yukon Roadside Wetland Survey	BC Breeding Bird Atlas
Boreal Chickadee	Assess/Maintain	3	BBS	BC Breeding Bird Atlas
Boreal Owl	Assess/Maintain	3	BC Breeding Bird Atlas	Nocturnal Owl Survey
Brewer's Sparrow	Assess/Maintain	3	BC Breeding Bird Atlas	Birds of the Yukon database
Bufflehead	Assess/Maintain	3	Yukon Roadside Wetland Survey	BC Breeding Bird Atlas
Canada Goose	Assess/Maintain	3	Yukon Roadside Wetland Survey	USFWS – Old Crow Flats
Canvasback	Assess/Maintain	3	Yukon Roadside Wetland Survey	USFWS – Old Crow Flats
Common Goldeneye	Assess/Maintain	3	Yukon Roadside Wetland Survey	USFWS – Old Crow Flats
Common Loon	Assess/Maintain	3	Yukon Roadside Wetland Survey	USFWS – Old Crow Flats
Common Nighthawk	Assess/Maintain	3	BC Breeding Bird Atlas	BBS
Dusky Grouse	Assess/Maintain	3	BC Breeding Bird Atlas	NWT Checklist Program
Golden Eagle	Assess/Maintain	3	BC Breeding Bird Atlas	NWT Checklist Program
Golden-crowned Sparrow	Assess/Maintain	3	BC Breeding Bird Atlas	NWT Checklist Program
Gray Jay	Maintain Current	2	BBS	BC Breeding Bird Atlas
Gray-crowned Rosy-Finch	Assess/Maintain	3	BC Breeding Bird Atlas	Birds of the Yukon database
Gray-headed Chickadee	Assess/Maintain	3	Birds of the Yukon database	
Great Gray Owl	Assess/Maintain	3	BC Breeding Bird Atlas	NWT Checklist Program
Greater White-fronted Goose	Assess/Maintain	3	USFWS –- Old Crow Flats	Birds of the Yukon database
Green-winged Teal	Maintain Current	2	Yukon Roadside Wetland Survey	USFWS - Old Crow Flats
Harlequin Duck	Assess/Maintain	3	BC Breeding Bird Atlas	Birds of the Yukon database
Herring Gull	Assess/Maintain	3	BC Breeding Bird Atlas	USFWS - Old Crow Flats
Horned Grebe	Assess/Maintain	3	Yukon Roadside Wetland Survey	USFWS - Old Crow Flats

[1] PIF Regional Population Trend Scores from Partners in Flight database 2007: 1, large increase; 2, stable or possible/moderate increase; 3, unknown; 4, possible or moderate decrease; 5, large decrease. Note that the Birds of the Yukon database is an information source and not truly a survey.

Table 28 continued

Species	Population objective	Population trend[11]	Primary survey	Secondary survey
Killdeer	Assess/Maintain	3	BC Breeding Bird Atlas	BBS
Lesser Scaup	Increase 50%	4	Yukon Roadside Wetland Survey	USFWS - Old Crow Flats
Lesser Yellowlegs	Increase 50%	4	BBS[4]	BC Breeding Bird Atlas
Long-tailed Duck	Assess/Maintain	3	USFWS - Old Crow Flats	Birds of the Yukon database
Mallard	Maintain Current	2	Yukon Roadside Wetland Survey	USFWS - Old Crow Flats
Mew Gull	Assess/Maintain	3	Yukon Roadside Wetland Survey	BC Breeding Bird Atlas
Northern Goshawk	Assess/Maintain	3	BC Breeding Bird Atlas	NWT Checklist Program
Northern Hawk Owl	Assess/Maintain	3	BC Breeding Bird Atlas	NWT Checklist Program
Northern Pintail	Assess/Maintain	3	Yukon Roadside Wetland Survey	USFWS - Old Crow Flats
Northern Shoveler	Assess/Maintain	3	Yukon Roadside Wetland Survey	USFWS - Old Crow Flats
Northern Shrike	Assess/Maintain	3	BC Breeding Bird Atlas	NWT Checklist Program
Olive-sided Flycatcher	Increase 50%	4	BBS	Yukon Roadside Wetland Survey
Pacific Loon	Assess/Maintain	3	Yukon Roadside Wetland Survey	USFWS - Old Crow Flats
Peregrine Falcon	Assess/Maintain	3	single species survey	Birds of the Yukon database
Pine Grosbeak	Assess/Maintain	3	BBS	BC Breeding Bird Atlas
Red-necked Grebe	Assess/Maintain	3	Yukon Roadside Wetland Survey	BC Breeding Bird Atlas
Red-necked Phalarope	Assess/Maintain	3	Yukon Roadside Wetland Survey	NWT Checklist Program
Rufous Hummingbird	Assess/Maintain	3	BC Breeding Bird Atlas	Birds of the Yukon database
Rusty Blackbird	Increase 50%	4	BBS	Yukon Roadside Wetland Survey
Short-billed Dowitcher	Assess/Maintain	3	BC Breeding Bird Atlas	Birds of the Yukon database
Short-eared Owl	Assess/Maintain	3	NWT Checklist Program	Birds of the Yukon database
Smith's Longspur	Assess/Maintain	3	BC Breeding Bird Atlas	NWT Checklist Program
Solitary Sandpiper	Assess/Maintain	3	BC Breeding Bird Atlas	Yukon Roadside Wetland Survey
Sora	Maintain Current	2	Yukon Roadside Wetland Survey	BC Breeding Bird Atlas
Spotted Sandpiper	Assess/Maintain	3	BC Breeding Bird Atlas	BBS
Surf Scoter	Assess/Maintain	3	USFWS - Old Crow Flats	NWT Checklist Program
Surfbird	Assess/Maintain	3	Birds of the Yukon database	
Swainson's Hawk	Assess/Maintain	3	Birds of the Yukon database	
Townsend's Warbler	Assess/Maintain	3	BBS	BC Breeding Bird Atlas
Trumpeter Swan*	Maintain Current	2	single species survey	Birds of the Yukon database
Upland Sandpiper	Assess/Maintain	3	NWT Checklist Program	Birds of the Yukon database
Varied Thrush	Assess/Maintain	3	BBS	BC Breeding Bird Atlas
Wandering Tattler	Assess/Maintain	3	Birds of the Yukon database	
Whimbrel	Assess/Maintain	3	Birds of the Yukon database	

* References for surveys: single species survey for Trumpeter Swan: Anonymous 1986; for Black Tern: Sinclair et al. 2003b; BBS: Bystrak 1981; Birds of the Yukon database: Sinclair et al. 2003; Yukon Roadside Wetland Survey: Hawkings and Hughes 2001; USFWS – Old Crow Flats: Hawkings et al. 1997.

Table 28 continued

Species	Population objective	Population trend[11]	Primary survey	Secondary survey
White-crowned Sparrow	Increase 50%	4	BBS	BC Breeding Bird Atlas
White-tailed Ptarmigan	Assess/Maintain	3	BC Breeding Bird Atlas	NWT Checklist Program
White-winged Crossbill	Assess/Maintain	3	BBS	BC Breeding Bird Atlas
White-winged Scoter	Assess/Maintain	3	Yukon Roadside Wetland Survey	USFWS - Old Crow Flats
Wilson's Snipe	Maintain Current	2	BBS	BC Breeding Bird Atlas
Wilson's Warbler	Assess/Maintain	3	BBS	BC Breeding Bird Atlas

Table 29. Categories of poorly monitored species, possible monitoring approaches, and example priority species in BCR 4 in Canada: Northwestern Interior Forest for which there are currently insufficient data to reliably estimate population trend at the BCR scale.

Category	Possible monitoring approaches	Example priority species
Aerial insectivores	Conduct regular colony counts where applicable. Initial surveys may be required to locate breeding areas, colonies, and/or communal roosts. Implement or expand focused crepuscular surveys for Common Nighthawk. These surveys could be modeled after the United States Nightjar Survey Network (ccb-wm.org/nightjars.htm).	Barn Swallow, Common Nighthawk
Diurnal raptors	Support increased observer training in raptor identification. Sparsely distributed raptors that are not well represented by regular survey efforts such as the Breeding Bird Survey require targeted, species-specific inventory efforts.	American Kestrel, Golden Eagle, Great Gray Owl, Northern Goshawk, Northern Hawk Owl, Peregrine Falcon, Short-eared Owl, Swainson's Hawk,
Nocturnal raptors	Support and expand Nocturnal Owl Surveys.	Boreal Owl
Hummingbirds	Coordinate with the Western Hummingbird Partnership and the Hummingbird Monitoring Network to design and implement an effective hummingbird monitoring program that will build upon existing programs.	Rufous Hummingbird
Colonial waterbirds	Support and expand continued annual surveys of principal colonies across the BCR.	Arctic Tern, Black Tern, Bonaparte's Gull, Herring Gull, Mew Gull

Table 30. Priority species for which population status information was lacking for BCR 4 in Canada: Northwestern Interior Forest.

For the species below, inadequate monitoring information was considered a significant conservation concern; suggested actions to address this lack of monitoring information are provided.

Threat category	Conservation objective category	Conservation objective description	Conservation action category	Conservation action description	Priority species
12.1 Information lacking on population status	7.1. Improve population and demographic monitoring	Develop landbird monitoring programs that adequately survey all landbird species with BCR 4	8.2 Monitoring	Enhance monitoring effort for landbirds with poor trend data or species with inadequate northern coverage; and species that are inadequately monitored by the Breeding Bird Survey (BBS).	Alder Flycatcher, American Kestrel, American Three-toed Woodpecker, Barn Swallow, Blackpoll Warbler, Bohemian Waxwing, Boreal Chickadee, Boreal Owl, Brewer's Sparrow, Common Nighthawk, Dusky Grouse, Golden Eagle, Golden-crowned Sparrow, Gray Jay, Gray-crowned Rosy-Finch, Gray-headed Chickadee, Great Gray Owl, Northern Goshawk, Northern Hawk Owl, Northern Shrike, Olive-sided Flycatcher, Peregrine Falcon, Pine Grosbeak, Rufous Hummingbird , Rusty Blackbird, Short-eared Owl, Smith's Longspur, Swainson's Hawk, Townsend's Warbler, Varied Thrush, White-crowned Sparrow, White-tailed Ptarmigan, White-winged Crossbill , Wilson's Warbler
12.1 Information lacking on population status	7.1. Improve population and demographic monitoring	Develop large-scale, long-term coordinated monitoring programs that assess population status, identify causal factors, set population targets, evaluate conservation actions (management approaches) and document recovery at regional and continental scales.	8.2 Monitoring	Develop a Coordinated Bird Monitoring plan for Canada.	Species of regional concern and/or known to be declining in BCR 4: American Kestrel, American Wigeon, Blackpoll Warbler, Common Nighthawk, Horned Grebe, Lesser Scaup, Lesser Yellowlegs, Olive-sided Flycatcher, Peregrine Falcon, Rusty Blackbird, Short-eared Owl, White-crowned Sparrow

Table 30 continued

Threat category	Conservation objective category	Conservation objective description	Conservation action category	Conservation action description	Priority species
12.1 Information lacking on population status	7.1. Improve population and demographic monitoring	Develop shorebird monitoring programs that adequately survey all shorebird species with BCR 4	8.2 Monitoring	Enhance monitoring effort for shorebirds with poor trend data or species with inadequate northern coverage; and species that are inadequately monitored by the Breeding Bird Survey (BBS); ideally meeting the goals of PRISM.	American Golden-Plover, Killdeer, Lesser Yellowlegs, Red-necked Phalarope, Short-billed Dowitcher, Solitary Sandpiper, Spotted Sandpiper, Surfbird, Upland Sandpiper, Wandering Tattler, Whimbrel, Wilson's Snipe
			8.1 Research	Investigate the need for species-specific shorebird surveys (Short-billed Dowitcher - limited breeding range).	
12.1 Information lacking on population status	7.1. Improve population and demographic monitoring	Develop waterbird monitoring programs that adequately survey all waterbird species with BCR 4	8.2 Monitoring	Develop a probability-based sampling design framework for both colonial and non-colonial species.	Arctic Tern, Black Tern, Bonaparte's Gull, Common Loon, Herring Gull, Horned Grebe, Mew Gull, Pacific Loon, Red-necked Grebe, Sora, Thayer's Gull
			8.2 Monitoring	Enhance monitoring effort for waterbirds with poor trend data or species with inadequate northern coverage; and species that are inadequately monitored by the Breeding Bird Survey (BBS).	

Research

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 (Table 31), and not necessarily a schedule of studies, that are needed to determine the needs of individual species. Undertaking research will allow us to improve future versions of BCR strategies and to focus future implementation, and will also enable the development of new tools for conservation.

Table 31. General research objectives in BCR 4 in Canada: Northwestern Interior Forest.

Objective	Priority species affected
Determine primary drivers of population decline (e.g., adult or juvenile survival, productivity, habitat quality) in priority bird species exhibiting declining trends, or that are known to be declining nationally or continentally.	**Species exhibiting declining trends in BCR 4, and/or species at risk in Canada:** American Kestrel, American Wigeon, Blackpoll Warbler, Barn Swallow, Common Nighthawk,Horned Grebe, Lesser Scaup, Lesser Yellowlegs, Olive-sided Flycatcher,Peregrine Falcon, Rusty Blackbird, Short-eared Owl, White-crowned Sparrow
Map land cover changes that have occurred across the BCR between the baseline time periods established in the BCR strategy and currently in order to correlate habitat loss with species declines and assess the main types of habitat transitions that have occurred (e.g., wetland to urban or agricultural development, old growth to managed forest, increases in road and/or seismic line density, etc.)	All species for which habitat-related declines have occurred or are suspected.
Combine up-to-date land cover information, additional data on bird densities, and detailed bird-habitat relationships for all priority species to allow for the calculation of quantitative habitat targets and to directly link conservation and population objectives.	All priority species.
Identify priority areas for implementation of recommendations in BCR strategies.	All priority species.
Determine specific population connectivity and migration routes between breeding and wintering areas, using techniques such as genetic analysis, stable isotopes and geolocators.	All migratory species.
Where they do not already exist, conduct research to develop sector-specific beneficial management practices documents, with an emphasis on bird and biodiversity conservation. Increase compliance with these and existing BMPs via policy/legislation, bylaws, and public outreach/awareness. Monitor adherence to these BMPs and assess their effectiveness at preserving and/or increasing priority bird populations.	All priority species.

Table 31 continued

Objective	Priority species affected
Determine the population-level significance of bird mortality from collisions with anthropogenic structures of all types and predation by domestic cats. Identify particularly vulnerable species.	All priority species.
Engage in and support climate change research with respect to: - alteration and loss of terrestrial habitats, particularly shifting forest types and loss of alpine and forest habitats and wetlands - range expansion or contraction of priority bird species - range expansion of competing species and predators - identification of vulnerable species - developing a comprehensive protected areas strategy.	All priority species.
Assess the potential effects of wind developments on birds, including both direct (collision mortality) and indirect (habitat loss due to avoidance of turbine installations) effects. Identify particularly vulnerable species.	All priority species.
Engage in research to identify effects of invasive species on priority bird species (e.g., impacts of feral cats, European Starling, House Sparrow, sweet clover).	All priority species.

Some additional research needs and questions for BCR 4

- Collect additional data on bird densities and bird-habitat relationships in all broad habitat types to allow for the calculation of quantitative conservation objectives and to directly link conservation and population objectives.
- Assess and address causes of declines in regionally declining priority species (American Wigeon, Lesser Scaup, Lesser Yellowlegs, Olive-sided Flycatcher, Blackpoll Warbler, White-crowned Sparrow, Rusty Blackbird)
  - Conduct research on breeding success and survival rates of regionally declining priority birds in order to determine demographic mechanisms leading to population declines
  - Investigate specific threats which may be contributing to population decline in regionally declining species
  - Map land cover changes that have occurred between the baseline time periods established in BCR strategies and current day in order to find correlations between habitat loss and species declines, and assess the main types of habitat transitions (e.g., agriculture to forest, wetland to urban development)
- Assess and address threats from expanding industries such as mining, oil and gas, and associated hydroelectric and road development
  - Develop new and improve existing locally applicable beneficial management practices documents for activities in wetland and riparian, tundra, and forest habitats.

- Mining and oil and gas
  - How sufficient are current provisions to avoid disturbance to breeding birds?
  - How is reclamation assessed? What habitat attributes are restored?
  - What is the magnitude of the threat from existing tailings ponds?
- Hydroelectric
  - Determine acceptable bounds of water levels in each season, which will maintain value of staging areas
  - Determine how fluctuating water levels are affecting breeding birds in affected habitat
  - Ongoing monitoring of stopover sites to detect changes that affect suitability for staging waterbirds (e.g., monitor bird numbers, water levels, food availability)
- Roads
  - Investigate the impact of roads on White-tailed Ptarmigan, including disturbance, habitat change, and increased hunting pressure
  - Investigate the tolerance level of birds to road disturbance; determine which species are most susceptible
  - Are there high-risk areas and time periods within BCR 4 for vehicle collisions with birds?
  - Investigate the effectiveness of various strategies, including road signs, to reduce vehicle collisions with birds

➢ Assess the adequacy of protected areas in BCR 4 for protecting habitat of all priority species
- Are all BCR 4 priority species adequately represented in protected areas within BCR 4?
- Are important habitat classes adequately represented in protected areas in BCR 4?
- Is the connectivity between protected areas adequate?
- Will the network of protected areas be adequate in the face of climate change effects?
- Determine whether there is sufficient protection of staging/breeding areas
- Streamline and improve wetland classification and inventory among jurisdictions to facilitate comparison of wetlands in different areas for the purpose of identifying useful attributes for priority birds
- Identify sites and areas of importance to priority species, including spring staging sites, fall staging sites, important breeding areas, etc.
- Habitat suitability mapping to identify areas of highest value to birds and other wildlife species

➢ Investigate effects of climate change on priority species and their habitats in BCR 4.
- Measure the impacts of severe weather events on bird populations
- Investigate climate-change related impacts to bird habitats in BCR 4

    - Nature and extent of habitat changes
    - Timing mismatches (between availability of food and need for food)
    - Changes in aquatic invertebrates
    - Which bird species are most threatened by these changes?
    - Investigate the adequacy of current protected areas for priority species in the face of climate change; develop a protected areas strategy that will provide sufficient protection as well as movement corridors
- Investigate the use and effectiveness of riparian buffers in development
  - Do recommended riparian buffers, which are designed to protect stream integrity and fish habitat, provide sufficient habitat for birds? (e.g., buffer widths recommended in the Habitat Protection Guidelines for Yukon Raptors (Environmental Dynamics Inc. 2011) are wider for many bird species than what appears in the guidelines for resource-based industries)
  - What is the level of compliance with guidelines for riparian buffers in each sector?
- Investigate and develop ways to reduce disturbance to birds
  - Determine which staging sites are at most risk of disturbance, and when disturbance is most likely to occur
  - Identify sites where disturbance to birds nesting along beaches or riverbanks is a concern
  - What efforts have been made to reduce disturbance? Have they been effective?
  - Which species are most susceptible to disturbance in BCR 4, and when are they at most risk (e.g., nesting loons, Harlequin Duck, Peregrine Falcon, Arctic Tern)?
  - Determine whether disturbance from the aquaculture operation at Blind Lake is affecting the breeding success of Black Terns
- Investigate and address effects of forest management on priority birds
  - Identify and maintain old-growth white spruce forest
    - Determine the attributes (structural stage, dead or dying trees, proximity to water, etc.) of old-growth spruce forest that is particularly valuable to birds
    - Mapping and inventory of old-growth white spruce forest in BCR 4
    - Develop information for landscape planning to provide sufficient old-growth white spruce to maintain breeding populations of bird inhabitants
    - Investigate the predicted effects of climate change on spruce forest and map areas expected to be more and less resilient to climate change
  - Maintaining supply of dead and dying trees for cavity nesters and other priority birds
    - How are precautions to reduce fire risk by thinning out forest stands (e.g., FireSmart program) affecting the supply of dead and dying trees for birds?
    - How is the cutting of dead trees for firewood affecting the supply of dead and dying trees?

- Managing forest fire
  - How is current fire management within BCR 4 affecting habitat for birds?
- Live tree harvest in beetle-killed stands
  - Is the supply of White Spruce cones being reduced by timber harvesting? Are species dependent on the cone crop such as White-winged Crossbills adversely affected?

➢ Reducing impacts of pesticides
- Determine whether past, current, or projected future pesticide use within BCR 4 is likely to have significant effects on birds, including community mosquito control
- Which bird species in BCR 4 are most susceptible to pesticide use, and by what means (e.g., toxicity, reduction in forage)?

➢ Threats outside of Canada
- Compile and translate research results from non-English-speaking wintering ground countries

➢ Species-specific research
- Identify areas of high breeding use and suitability for Golden Eagles and Short-eared Owls
- Research reasons for decline of Rusty Blackbirds; variables to measure include population trends, habitat attributes, disturbance and effects (e.g., competition) from other bird species such as Red-winged Blackbirds
- Determine whether West Nile Virus is contributing to the decline of American Kestrel populations
- Investigate whether invertebrate populations have declined in BCR 4, and whether this is affecting insectivorous birds in the region
- Investigate the potential effects of invasive sweet-clover on Spotted Sandpiper and Killdeer
- Identify subspecies/populations for which BCR 4 has high stewardship responsibilities, e.g., Harlan's Hawk, and consider adding to priority list

Threats Outside Canada

Many bird species found in Canada spend a large portion of their lifecycle outside of the country (Fig. 30). These species face threats while they are outside Canada; in fact, threats to some migratory species may be most severe outside of the breeding season (Calvert et al. 2009). For example, no threats were identified for Swainson's Hawk within BCR 4, but several threats outside of Canada were identified for this species. Of the 77 priority species in BCR 4, 64 (83%) are migratory and spend part of their annual cycle—up to half the year or more—outside Canada.

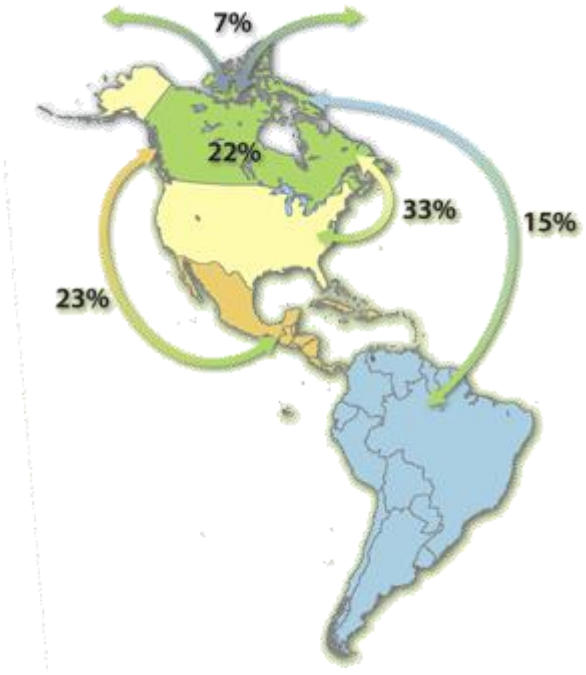

Figure 30. Percent of Canadian breeding birds that migrate to regions outside of Canada for part of their life cycle (North American Bird Conservation Initiative 2012).

Birds are some of the most mobile species on the planet, and some species are true global wanderers. For example, the Arctic Tern, one of the priority species in BCR 4, undergoes one of the longest regular migrations of any bird in the world, breeding in the arctic and spending its non-breeding season along the edges of the pack ice around Antarctica. Although few species travel as far as the Arctic Tern, other priority birds from BCR 4 nonetheless range widely throughout North, Central and South America. While many migrant landbirds from BCR 4 winter relatively far north in southern Canada and the contiguous United States, including Northern Shrike, Gray-crowned Rosy-Finch and Rusty Blackbird, others such as Common Nighthawk and Blackpoll Warbler travel as far as Central and South America. Many of the shorebirds in BCR 4 in Canada winter along the coasts of Mexico, Central America and South America. The central and northern

Pacific coast of North America from California to the Aleutian Islands is a particularly important wintering area for many BCR 4 priority waterbirds and sea ducks, including Harlequin Duck, White-winged Scoter, Long-tailed Duck, Barrow's Goldeneye, Pacific and Common loons and Mew Gull.

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 that 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.

Nonetheless, in many cases enough information is available to inform support of conservation work outside Canada for BCR 4 birds (Fig. 31). Priority birds from BCR 4 face the loss or degradation of key migration and wintering habitats. The primary sources of habitat loss and degradation are conversion of wetlands and coastal areas as a result of residential and commercial development (threat sub-categories 1.1 and 1.2) and the conversion of habitat to cropland (threat sub-category 2.1). The threat of loss and degradation of stopover or overwinter habitat is most immediate for species that have relatively small and concentrated wintering ranges, or concentrate at just a handful of key migratory stopover sites; degradation or loss of these sites could have devastating impacts.

In addition to habitat loss, priority birds from BCR 4 are also affected by increased mortality from human sources during migration and over-wintering. Collisions with structures such as TV towers and buildings were frequently reported (threat sub-category 1.2). Many priority bird species, particularly shorebirds and waterfowl, are affected by hunting (threat sub-category 5.1) and several priority birds from BCR 4 are subject to lead poisoning (threat sub-category 5.1). Other sources of lethal and sub-lethal impacts to priority birds from BCR 4 include exposure to industrial contaminants such as oil pollution and heavy metals (threat sub-category 9.2) and agricultural pesticides (threat sub-category 9.3). Finally, birds in migration and on wintering grounds

are exposed to increased frequency and severity of storms and flooding due to climate change (threat sub-category 11.4).

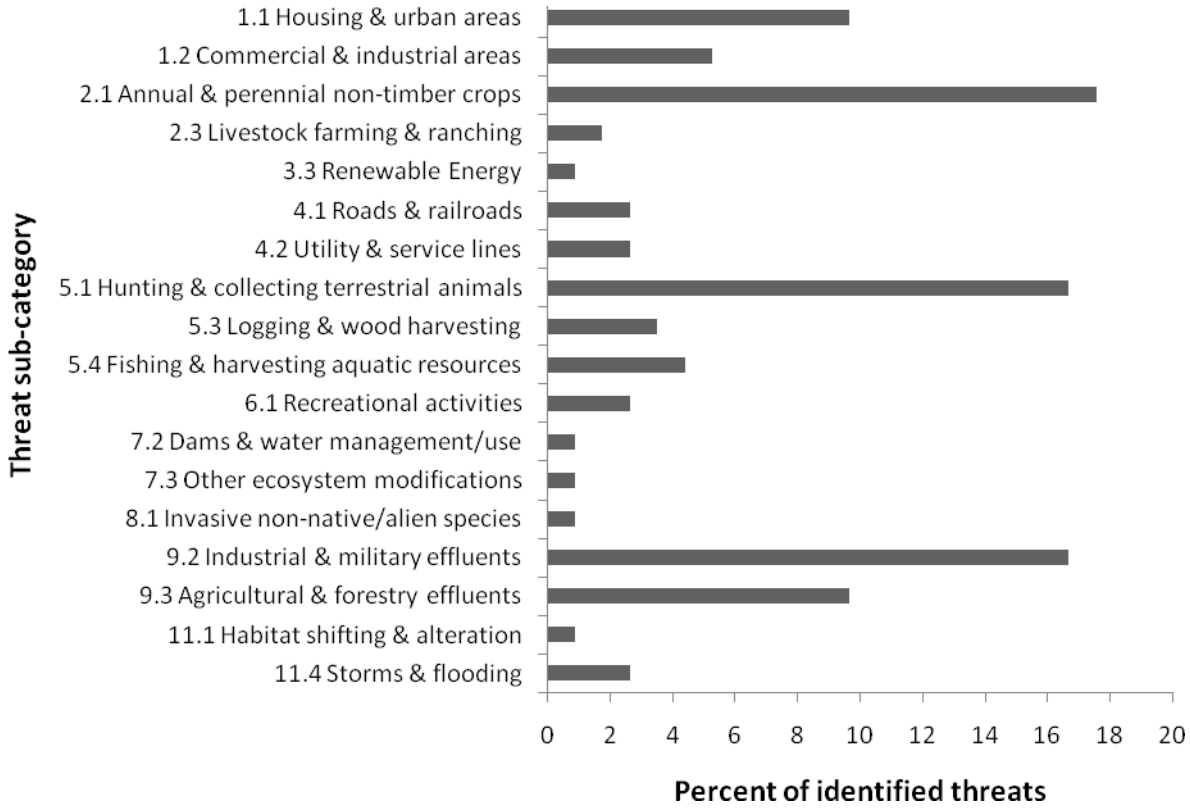

Figure 31. Percent of identified threats to priority species (by threat sub-category) from BCR 4 in Canada: Northwestern Interior Forest, when they are outside Canada.
Note: Magnitudes could not be assigned for threats outside Canada due to lack of information on scope and severity.

Next Steps

The primary aims of BCR strategies are to present Environment Canada's priorities with respect to migratory bird conservation, and to provide a comprehensive overview of the conservation needs of bird populations to practitioners who may then undertake activities that promote bird conservation in Canada and internationally. Users from all levels of government, Aboriginal communities, the private sector, academia, 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.

In BCR 4 there is no overarching body or agreement such as a joint venture that has bird conservation as its mandate. However, major resource management processes such as land use planning are underway in the Yukon, British Columbia, and the Northwest Territories. This strategy is intended to provide guidance regarding bird conservation needs, issues, and opportunities, for land use and other resource planning processes. It is also intended to inform and guide on-the-ground conservation activities undertaken by individuals, conservation groups, and managers of land and resources.

BCR 4 has so far been relatively mildly affected by the development of industrial activities in boreal regions. Due to the small human population and inaccessibility of much of the Northwestern Interior Forest, large areas of habitat are still in a natural state. However, change is occurring; the growing population has growing needs for resources and energy, and climate change effects are becoming increasingly apparent. Many BCR 4 bird species are facing serious conservation threats elsewhere in their breeding ranges, as well as in wintering areas and along migration routes. In more developed regions, conservation options are limited to expensive and complex actions such as habitat restoration and re-introductions of species. Protecting intact natural habitats is generally a far easier and less expensive way to maintain species populations. In BCR 4, the protection of large areas of relatively undisturbed, high-quality bird habitat, with connections for species movement, is given high priority. For many species, large protected areas in BCR 4 could help to buffer against losses in other areas, as well as buffer against effects of climate change. Many additional conservation actions are recommended in this strategy, and implementation of many of those actions will be critical; but providing intact habitat is perhaps the most significant role that this region can play in the conservation of birds in Canada.

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 4 in Canada: Northwestern Interior Forest

Table A1. Complete list of the 219 species which occur regularly in BCR 4, including Canadian and U.S. portions of the region.
Breeding, Migrant, and Wintering status refers to Canadian portion of the BCR only (the 8 species with "No" in all three columns occur regularly in the U.S. portion of the BCR only). The 170 species protected under Canada's *Migratory Birds Convention Act, 1994* are indicated under "MBCA." The 77 priority species found in BCR 4 in Canada: Northwestern Interior Forest are in bold.

Scientific name	English name	French name	Bird group	Breeding	Migrant	Wintering	MBCA	Priority
Empidonax alnorum	**Alder Flycatcher**	**Moucherolle des aulnes**	**Landbird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Corvus brachyrhynchos	American Crow	Corneille d'Amérique	Landbird	Yes	Yes	No		
Cinclus mexicanus	American Dipper	Cincle d'Amérique	Landbird	Yes	No	Yes	Yes	
Falco sparverius	**American Kestrel**	Crécerelle d'Amérique	**Landbird**	**Yes**	**Yes**	**No**		**Yes**
Anthus spinoletta	American Pipit	Pipit d'Amérique	Landbird	Yes	Yes	No	Yes	
Setophaga ruticilla	American Redstart	Paruline flamboyante	Landbird	Yes	Yes	No	Yes	
Turdus migratorius	American Robin	Merle d'Amérique	Landbird	Yes	Yes	No	Yes	
Picoides tridactylus	**American Three-toed Woodpecker**	**Pic à dos rayé**	**Landbird**	**Yes**	**No**	**Yes**	**Yes**	**Yes**
Spizella arborea	American Tree Sparrow	Bruant hudsonien	Landbird	Yes	Yes	No	Yes	
Phylloscopus borealis	Arctic Warbler	Pouillot boréal	Landbird	No	No	No	Yes	
Haliaeetus leucocephalus	Bald Eagle	Pygargue à tête blanche	Landbird	Yes	Yes	No		
Riparia riparia	Bank Swallow	Hirondelle de rivage	Landbird	Yes	Yes	No	Yes	
Hirundo rustica	**Barn Swallow**	**Hirondelle rustique**	**Landbird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Strix varia	Barred Owl	Chouette rayée	Landbird	Yes	No	Yes		
Setophaga castanea	Bay-breasted Warbler	Paruline à poitrine baie	Landbird	Yes	Yes	No	Yes	
Ceryle alcyon	Belted Kingfisher	Martin-pêcheur d'Amérique	Landbird	Yes	Yes	No	Yes	
Picoides arcticus	Black-backed Woodpecker	Pic à dos noir	Landbird	Yes	No	Yes	Yes	
Pica pica	Black-billed Magpie	Pie d'Amérique	Landbird	Yes	No	Yes		
Poecile atricapilla	Black-capped Chickadee	Mésange à tête noire	Landbird	Yes	No	Yes	Yes	
Setophaga striata	**Blackpoll Warbler**	**Paruline rayée**	**Landbird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Vireo solitarius	Blue-headed Vireo	Viréo à tête bleue	Landbird	Yes	Yes	No	Yes	
Luscinia svecica	Bluethroat	Gorgebleue à miroir	Landbird	No	No	No	Yes	
Bombycilla garrulus	**Bohemian Waxwing**	**Jaseur boréal**	**Landbird**	**Yes**	**No**	**Yes**	**Yes**	**Yes**
Poecile hudsonica	**Boreal Chickadee**	**Mésange à tête brune**	**Landbird**	**Yes**	**No**	**Yes**	**Yes**	**Yes**

Table A1 continued

Scientific name	English name	French name	Bird group	Breeding	Migrant	Wintering	MBCA	Priority
Aegolius funereus	**Boreal Owl**	**Nyctale de Tengmalm**	**Landbird**	**Yes**	**No**	**Yes**		**Yes**
Euphagus cyanocephalus	Brewer's Blackbird	Quiscale de Brewer	Landbird	Yes	No	No		
Spizella breweri	**Brewer's Sparrow**	**Bruant de Brewer**	**Landbird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Certhia familiaris	Brown Creeper	Grimpereau brun	Landbird	Yes	Yes	No	Yes	
Molothrus ater	Brown-headed Cowbird	Vacher à tête brune	Landbird	Yes	Yes	No		
Setophaga tigrina	Cape May Warbler	Paruline tigrée	Landbird	Yes	Yes	No	Yes	
Bombycilla cedrorum	Cedar Waxwing	Jaseur d'Amérique	Landbird	Yes	Yes	No	Yes	
Poecile rufescens	Chestnut-backed Chickadee	Mésange à dos marron	Landbird	No	No	No	Yes	
Spizella passerina	Chipping Sparrow	Bruant familier	Landbird	Yes	Yes	No	Yes	
Spizella pallida	Clay-colored Sparrow	Bruant des plaines	Landbird	Yes	Yes	No	Yes	
Hirundo pyrrhonota	Cliff Swallow	Hirondelle à front blanc	Landbird	Yes	Yes	No	Yes	
Chordeiles minor	**Common Nighthawk**	**Engoulevent d'Amérique**	**Landbird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Corvus corax	Common Raven	Grand Corbeau	Landbird	Yes	No	Yes		
Carduelis flammea	Common Redpoll	Sizerin flammé	Landbird	Yes	Yes	Yes	Yes	
Geothlypis trichas	Common Yellowthroat	Paruline masquée	Landbird	Yes	Yes	No	Yes	
Junco hyemalis	Dark-eyed Junco	Junco ardoisé	Landbird	Yes	Yes	No	Yes	
Picoides pubescens	Downy Woodpecker	Pic mineur	Landbird	Yes	No	Yes	Yes	
Empidonax oberholseri	Dusky Flycatcher	Moucherolle sombre	Landbird	Yes	Yes	No	Yes	
Dendragapus obscurus	**Dusky Grouse**	**Tétras sombre**	**Landbird**	**Yes**	**No**	**Yes**		**Yes**
Tyrannus tyrannus	Eastern Kingbird	Tyran tritri	Landbird	Yes	Yes	No	Yes	
Motacilla tschutschensis	Eastern Yellow Wagtail	Bergeronnette de Béringie	Landbird	No	No	No	Yes	
Sturnus vulgaris	European Starling	Étourneau sansonnet	Landbird	Yes	Yes	No		
Coccothraustes vespertinus	Evening Grosbeak	Gros-bec errant	Landbird	Yes	Yes	Yes	Yes	
Passerella iliaca	Fox Sparrow	Bruant fauve	Landbird	Yes	Yes	No	Yes	
Aquila chrysaetos	**Golden Eagle**	**Aigle royal**	**Landbird**	**Yes**	**Yes**	**No**		**Yes**
Regulus satrapa	Golden-crowned Kinglet	Roitelet à couronne dorée	Landbird	Yes	Yes	No	Yes	
Zonotrichia atricapilla	**Golden-crowned Sparrow**	**Bruant à couronne dorée**	**Landbird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Perisoreus canadensis	**Gray Jay**	**Mésangeai du Canada**	**Landbird**	**Yes**	**No**	**Yes**		**Yes**
Catharus minimus	Gray-cheeked Thrush	Grive à joues grises	Landbird	Yes	Yes	No	Yes	
Leucosticte arctoa	**Gray-crowned Rosy-Finch**	**Roselin à tête grise**	**Landbird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Parus cincta	**Gray-headed Chickadee**	**Mésange lapone**	**Landbird**	**Yes**	**No**	**Yes**	**Yes**	**Yes**
Strix nebulosa	**Great Gray Owl**	**Chouette lapone**	**Landbird**	**Yes**	**No**	**Yes**		**Yes**
Bubo virginianus	Great Horned Owl	Grand-duc d'Amérique	Landbird	Yes	No	Yes		

Table A1 continued

Scientific name	English name	French name	Bird group	Breeding	Migrant	Wintering	MBCA	Priority
Falco rusticolus	Gyrfalcon	Faucon gerfaut	Landbird	Yes	No	Yes		
Picoides villosus	Hairy Woodpecker	Pic chevelu	Landbird	Yes	No	Yes	Yes	
Empidonax hammondii	Hammond's Flycatcher	Moucherolle de Hammond	Landbird	Yes	Yes	No	Yes	
Catharus guttatus	Hermit Thrush	Grive solitaire	Landbird	Yes	Yes	No	Yes	
Carduelis hornemanni	Hoary Redpoll	Sizerin blanchâtre	Landbird	Yes	No	Yes	Yes	
Eremophila alpestris	Horned Lark	Alouette hausse-col	Landbird	Yes	Yes	No	Yes	
Passer domesticus	House Sparrow	Moineau domestique	Landbird	Yes	No	Yes		
Calcarius lapponicus	Lapland Longspur	Plectrophane lapon	Landbird	Yes	Yes	No	Yes	
Ammodramus leconteii	Le Conte's Sparrow	Bruant de Le Conte	Landbird	Yes	Yes	No	Yes	
Empidonax minimus	Least Flycatcher	Moucherolle tchébec	Landbird	Yes	Yes	No	Yes	
Melospiza lincolnii	Lincoln's Sparrow	Bruant de Lincoln	Landbird	Yes	Yes	No	Yes	
Asio otus	Long-eared Owl	Hibou moyen-duc	Landbird	Yes	Yes	No		
Geothlypis tolmiei	MacGillivray's Warbler	Paruline des buissons	Landbird	Yes	Yes	No	Yes	
Setophaga magnolia	Magnolia Warbler	Paruline à tête cendrée	Landbird	Yes	Yes	No	Yes	
Falco columbarius	Merlin	Faucon émerillon	Landbird	Yes	Yes	No		
Sialia currucoides	Mountain Bluebird	Merlebleu azuré	Landbird	Yes	Yes	No	Yes	
Poecile gambeli	Mountain Chickadee	Mésange de Gambel	Landbird	Yes	No	Yes	Yes	
Geothlypis philadelphia	Mourning Warbler	Paruline triste	Landbird	Yes	Yes	No	Yes	
Colaptes auratus	Northern Flicker	Pic flamboyant	Landbird	Yes	Yes	No	Yes	
Accipiter gentilis	**Northern Goshawk**	**Autour des palombes**	**Landbird**	**Yes**	**No**	**Yes**		**Yes**
Circus cyaneus	Northern Harrier	Busard Saint-Martin	Landbird	Yes	Yes	No		
Surnia ulula	**Northern Hawk Owl**	**Chouette épervière**	**Landbird**	**Yes**	**No**	**Yes**		**Yes**
Glaucidium gnoma	Northern Pygmy-Owl	Chevêchette naine	Landbird	Yes	No	Yes		
Stelgidopteryx serripennis	Northern Rough-winged Swallow	Hirondelle à ailes hérissées	Landbird	Yes	Yes	No	Yes	
Aegolius acadicus	Northern Saw-whet Owl	Petite Nyctale	Landbird	Yes	Yes	No		
Lanius excubitor	**Northern Shrike**	**Pie-grièche grise**	**Landbird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Parkesia noveboracensis	Northern Waterthrush	Paruline des ruisseaux	Landbird	Yes	Yes	No	Yes	
Oenanthe oenanthe	Northern Wheatear	Traquet motteux	Landbird	Yes	Yes	No	Yes	
Contopus borealis	**Olive-sided Flycatcher**	**Moucherolle à côtés olive**	**Landbird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Oreothlypis celata	Orange-crowned Warbler	Paruline verdâtre	Landbird	Yes	Yes	No	Yes	
Pandion haliaetus	Osprey	Balbuzard pêcheur	Landbird	Yes	Yes	No		
Seiurus aurocapilla	Ovenbird	Paruline couronnée	Landbird	Yes	Yes	No	Yes	
Troglodytes pacificus	Pacific Wren	Troglodyte de Baird	Landbird	Yes	Yes	No	Yes	

Table A1 continued

Scientific name	English name	French name	Bird group	Breeding	Migrant	Wintering	MBCA	Priority
Setophaga palmarum	Palm Warbler	Paruline à couronne rousse	Landbird	Yes	Yes	No	Yes	
Falco peregrinus	**Peregrine Falcon**	**Faucon pèlerin**	**Landbird**	**Yes**	**Yes**	**No**		**Yes**
Vireo philadelphicus	Philadelphia Vireo	Viréo de Philadelphie	Landbird	Yes	Yes	No	Yes	
Dryocopus pileatus	Pileated Woodpecker	Grand Pic	Landbird	Yes	No	Yes	Yes	
Pinicola enucleator	**Pine Grosbeak**	**Durbec des sapins**	**Landbird**	**Yes**	**No**	**Yes**	**Yes**	**Yes**
Carduelis pinus	Pine Siskin	Tarin des pins	Landbird	Yes	Yes	No	Yes	
Carpodacus purpureus	Purple Finch	Roselin pourpré	Landbird	Yes	Yes	No	Yes	
Loxia curvirostra	Red Crossbill	Bec-croisé des sapins	Landbird	Yes	Yes	No	Yes	
Sitta canadensis	Red-breasted Nuthatch	Sittelle à poitrine rousse	Landbird	Yes	Yes	Yes	Yes	
Sphyrapicus ruber	Red-breasted Sapsucker	Pic à poitrine rouge	Landbird	Yes	Yes	No	Yes	
Vireo olivaceus	Red-eyed Vireo	Viréo aux yeux rouges	Landbird	Yes	Yes	No	Yes	
Buteo jamaicensis	Red-tailed Hawk	Buse à queue rousse	Landbird	Yes	Yes	No		
Agelaius phoeniceus	Red-winged Blackbird	Carouge à épaulettes	Landbird	Yes	Yes	No		
Columba livia	Rock Pigeon	Pigeon biset	Landbird	Yes	No	Yes		
Lagopus muta	Rock Ptarmigan	Lagopède alpin	Landbird	Yes	No	Yes		
Pheucticus ludovicianus	Rose-breasted Grosbeak	Cardinal à poitrine rose	Landbird	Yes	Yes	No	Yes	
Buteo lagopus	Rough-legged Hawk	Buse pattue	Landbird	Yes	Yes	No		
Regulus calendula	Ruby-crowned Kinglet	Roitelet à couronne rubis	Landbird	Yes	Yes	No	Yes	
Bonasa umbellus	Ruffed Grouse	Gélinotte huppée	Landbird	Yes	No	Yes		
Selasphorus rufus	**Rufous Hummingbird**	**Colibri roux**	**Landbird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Euphagus carolinus	**Rusty Blackbird**	**Quiscale rouilleux**	**Landbird**	**Yes**	**Yes**	**No**		**Yes**
Passerculus sandwichensis	Savannah Sparrow	Bruant des prés	Landbird	Yes	Yes	No	Yes	
Sayornis saya	Say's Phoebe	Moucherolle à ventre roux	Landbird	Yes	Yes	No	Yes	
Accipiter striatus	Sharp-shinned Hawk	Épervier brun	Landbird	Yes	Yes	No		
Tympanuchus phasianellus	Sharp-tailed Grouse	Tétras à queue fine	Landbird	Yes	No	Yes		
Asio flammeus	**Short-eared Owl**	**Hibou des marais**	**Landbird**	**Yes**	**Yes**	**No**		**Yes**
Calcarius pictus	**Smith's Longspur**	**Plectrophane de Smith**	**Landbird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Plectrophenax nivalis	Snow Bunting	Plectrophane des neiges	Landbird	Yes	Yes	No	Yes	
Melospiza melodia	Song Sparrow	Bruant chanteur	Landbird	Yes	Yes	No	Yes	
Dendragapus canadensis	Spruce Grouse	Tétras du Canada	Landbird	Yes	No	Yes		
Cyanocitta stelleri	Steller's Jay	Geai de Steller	Landbird	No	No	No		
Buteo swainsonii	**Swainson's Hawk**	**Buse de Swainson**	**Landbird**	**Yes**	**Yes**	**No**		**Yes**
Catharus ustulatus	Swainson's Thrush	Grive à dos olive	Landbird	Yes	Yes	No	Yes	

Table A1 continued

Scientific name	English name	French name	Bird group	Breeding	Migrant	Wintering	MBCA	Priority
Melospiza georgiana	Swamp Sparrow	Bruant des marais	Landbird	Yes	Yes	No	Yes	
Oreothlypis peregrina	Tennessee Warbler	Paruline obscure	Landbird	Yes	Yes	No	Yes	
Myadestes townsendi	Townsend's Solitaire	Solitaire de Townsend	Landbird	Yes	Yes	No	Yes	
Setophaga townsendi	**Townsend's Warbler**	**Paruline de Townsend**	**Landbird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Tachycineta bicolor	Tree Swallow	Hirondelle bicolore	Landbird	Yes	Yes	No	Yes	
Ixoreus naevius	**Varied Thrush**	**Grive à collier**	**Landbird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Tachycineta thalassina	Violet-green Swallow	Hirondelle à face blanche	Landbird	Yes	Yes	No	Yes	
Vireo gilvus	Warbling Vireo	Viréo mélodieux	Landbird	Yes	Yes	No	Yes	
Piranga ludoviciana	Western Tanager	Piranga à tête rouge	Landbird	Yes	Yes	No	Yes	
Contopus sordidulus	Western Wood-Pewee	Pioui de l'Ouest	Landbird	Yes	Yes	No	Yes	
Zonotrichia leucophrys	**White-crowned Sparrow**	**Bruant à couronne blanche**	**Landbird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Lagopus leucura	**White-tailed Ptarmigan**	**Lagopède à queue blanche**	**Landbird**	**Yes**	**No**	**Yes**		**Yes**
Zonotrichia albicollis	White-throated Sparrow	Bruant à gorge blanche	Landbird	Yes	Yes	No	Yes	
Loxia leucoptera	**White-winged Crossbill**	**Bec-croisé bifascié**	**Landbird**	**Yes**	**No**	**Yes**	**Yes**	**Yes**
Lagopus lagopus	Willow Ptarmigan	Lagopède des saules	Landbird	Yes	No	Yes		
Cardellina pusilla	**Wilson's Warbler**	**Paruline à calotte noire**	**Landbird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Setophaga petechia	Yellow Warbler	Paruline jaune	Landbird	Yes	Yes	No	Yes	
Empidonax flaviventris	Yellow-bellied Flycatcher	Moucherolle à ventre jaune	Landbird	Yes	Yes	No	Yes	
Sphyrapicus varius	Yellow-bellied Sapsucker	Pic maculé	Landbird	Yes	Yes	No	Yes	
Setophaga coronata	Yellow-rumped Warbler	Paruline à croupion jaune	Landbird	Yes	Yes	No	Yes	
Pluvialis dominica	**American Golden-Plover**	**Pluvier bronzé**	**Shorebird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Calidris bairdii	Baird's Sandpiper	Bécasseau de Baird	Shorebird	Yes	Yes	No	Yes	
Pluvialis squatarola	Black-bellied Plover	Pluvier argenté	Shorebird	No	Yes	No	Yes	
Tringa melanoleuca	Greater Yellowlegs	Grand Chevalier	Shorebird	Yes	Yes	No	Yes	
Limosa haemastica	Hudsonian Godwit	Barge hudsonienne	Shorebird	Yes	Yes	No	Yes	
Charadrius vociferus	**Killdeer**	**Pluvier kildir**	**Shorebird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Calidris minutilla	Least Sandpiper	Bécasseau minuscule	Shorebird	Yes	Yes	No	Yes	
Tringa flavipes	**Lesser Yellowlegs**	**Petit Chevalier**	**Shorebird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Limnodromus scolopaceus	Long-billed Dowitcher	Bécassin à long bec	Shorebird	No	Yes	No	Yes	
Calidris melanotos	Pectoral Sandpiper	Bécasseau à poitrine cendrée	Shorebird	No	Yes	No	Yes	
Phalaropus lobatus	**Red-necked Phalarope**	**Phalarope à bec étroit**	**Shorebird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Charadrius semipalmatus	Semipalmated Plover	Pluvier semipalmé	Shorebird	Yes	Yes	No	Yes	
Calidris pusilla	**Semipalmated Sandpiper**	**Bécasseau semipalmé**	**Shorebird**	**No**	**Yes**	**No**	**Yes**	**Yes**

Table A1 continued

Scientific name	English name	French name	Bird group	Breeding	Migrant	Wintering	MBCA	Priority
Limnodromus griseus	**Short-billed Dowitcher**	**Bécassin roux**	**Shorebird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Tringa solitaria	**Solitary Sandpiper**	**Chevalier solitaire**	**Shorebird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Actitis macularius	**Spotted Sandpiper**	**Chevalier grivelé**	**Shorebird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Calidris himantopus	Stilt Sandpiper	Bécasseau à échasses	Shorebird	No	Yes	No	Yes	
Aphriza virgata	**Surfbird**	**Bécasseau du ressac**	**Shorebird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Bartramia longicauda	**Upland Sandpiper**	**Maubèche des champs**	**Shorebird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Heteroscelus incanus	**Wandering Tattler**	**Chevalier errant**	**Shorebird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Numenius phaeopus	**Whimbrel**	**Courlis corlieu**	**Shorebird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Phalaropus tricolor	Wilson's Phalarope	Phalarope de Wilson	Shorebird	Yes	Yes	No	Yes	
Gallinago delicata	**Wilson's Snipe**	**Bécassine de Wilson**	**Shorebird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Fulica americana	American Coot	Foulque d'Amérique	Waterbird	Yes	Yes	No	Yes	
Sterna paradisaea	**Arctic Tern**	**Sterne arctique**	**Waterbird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Chlidonias niger	**Black Tern**	**Guifette noire**	**Waterbird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Rissa tridactyla	Black-legged Kittiwake	Mouette tridactyle	Waterbird	No	No	No	Yes	
Larus philadelphia	**Bonaparte's Gull**	**Mouette de Bonaparte**	**Waterbird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Gavia immer	**Common Loon**	**Plongeon huard**	**Waterbird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Phalacrocorax auritus	Double-crested Cormorant	Cormoran à aigrettes	Waterbird	Yes	Yes	No		
Larus hyperboreus	Glaucous Gull	Goéland bourgmestre	Waterbird	No	Yes	No	Yes	
Larus glaucescens	Glaucous-winged Gull	Goéland à ailes grises	Waterbird	No	No	No	Yes	
Larus argentatus	**Herring Gull**	**Goéland argenté**	**Waterbird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Podiceps auritus	**Horned Grebe**	**Grèbe esclavon**	**Waterbird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Stercorarius longicaudus	Long-tailed Jaeger	Labbe à longue queue	Waterbird	Yes	Yes	No	Yes	
Larus canus	**Mew Gull**	**Goéland cendré**	**Waterbird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Gavia pacifica	**Pacific Loon**	**Plongeon du Pacifique**	**Waterbird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Stercorarius parasiticus	Parasitic Jaeger	Labbe parasite	Waterbird	Yes	Yes	No	Yes	
Podilymbus podiceps	Pied-billed Grebe	Grèbe à bec bigarré	Waterbird	Yes	Yes	No	Yes	
Podiceps grisegena	**Red-necked Grebe**	**Grèbe jougris**	**Waterbird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Gavia stellata	Red-throated Loon	Plongeon catmarin	Waterbird	Yes	Yes	No	Yes	
Grus canadensis	Sandhill Crane	Grue du Canada	Waterbird	Yes	Yes	No	Yes	
Porzana carolina	**Sora**	**Marouette de Caroline**	**Waterbird**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Larus thayeri	**Thayer's Gull**	**Goéland de Thayer**	**Waterbird**	**No**	**Yes**	**No**	**Yes**	**Yes**
Anas americana	**American Wigeon**	**Canard d'Amérique**	**Waterfowl**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Bucephala islandica	**Barrow's Goldeneye**	**Garrot d'Islande**	**Waterfowl**	**Yes**	**Yes**	**No**	**Yes**	**Yes**

Table A1 continued

Scientific name	English name	French name	Bird group	Breeding	Migrant	Wintering	MBCA	Priority
Melanitta nigra	Black Scoter	Macreuse à bec jaune	Waterfowl	No	No	No	Yes	
Anas discors	**Blue-winged Teal**	**Sarcelle à ailes bleues**	**Waterfowl**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Branta bernicla	Brant	Bernache cravant	Waterfowl	No	Yes	No	Yes	
Bucephala albeola	**Bufflehead**	**Petit Garrot**	**Waterfowl**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Branta hutchinsii	Cackling Goose	Bernache d'Alaska	Waterfowl	No	Yes	No	Yes	
Branta canadensis	**Canada Goose**	**Bernache du Canada**	**Waterfowl**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Aythya valisineria	**Canvasback**	**Fuligule à dos blanc**	**Waterfowl**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Anas cyanoptera	Cinnamon Teal	Sarcelle cannelle	Waterfowl	Yes	Yes	No	Yes	
Bucephala clangula	**Common Goldeneye**	**Garrot à oeil d'or**	**Waterfowl**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Mergus merganser	Common Merganser	Grand Harle	Waterfowl	Yes	Yes	No	Yes	
Anas strepera	Gadwall	Canard chipeau	Waterfowl	Yes	Yes	No	Yes	
Aythya marila	Greater Scaup	Fuligule milouinan	Waterfowl	Yes	Yes	No	Yes	
Anser albifrons	**Greater White-fronted Goose**	**Oie rieuse**	**Waterfowl**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Anas crecca	**Green-winged Teal**	**Sarcelle d'hiver**	**Waterfowl**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Histrionicus histrionicus	**Harlequin Duck**	**Arlequin plongeur**	**Waterfowl**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Lophodytes cucullatus	Hooded Merganser	Harle couronné	Waterfowl	Yes	Yes	No	Yes	
Aythya affinis	**Lesser Scaup**	**Petit Fuligule**	**Waterfowl**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Clangula hyemalis	**Long-tailed Duck**	**Harelde kakawi**	**Waterfowl**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Anas platyrhynchos	**Mallard**	**Canard colvert**	**Waterfowl**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Anas acuta	**Northern Pintail**	**Canard pilet**	**Waterfowl**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Anas clypeata	**Northern Shoveler**	**Canard souchet**	**Waterfowl**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Mergus serrator	Red-breasted Merganser	Harle huppé	Waterfowl	Yes	Yes	No	Yes	
Aythya americana	Redhead	Fuligule à tête rouge	Waterfowl	Yes	Yes	No	Yes	
Aythya collaris	Ring-necked Duck	Fuligule à collier	Waterfowl	Yes	Yes	No	Yes	
Oxyura jamaicensis	Ruddy Duck	Érismature rousse	Waterfowl	Yes	Yes	No	Yes	
Chen caerulescens	Snow Goose	Petite oie des neiges	Waterfowl	No	Yes	No	Yes	
Melanitta perspicillata	**Surf Scoter**	**Macreuse à front blanc**	**Waterfowl**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Cygnus buccinator	**Trumpeter Swan**	**Cygne trompette**	**Waterfowl**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Cygnus columbianus	**Tundra Swan**	**Cygne siffleur**	**Waterfowl**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Melanitta fusca	**White-winged Scoter**	**Macreuse brune**	**Waterfowl**	**Yes**	**Yes**	**No**	**Yes**	**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,

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

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

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

Additional methods used for species assessment in BCR 4:

- We did not consider species with low Relative Density (RD=1, "Breeds regularly but in very small numbers or in only a very small part of the region", or RD=p, "has bred only irregularly, or strong evidence of regular breeding is lacking"; Panjabi et al. 2005) in BCR 4 as candidates for the priority species list.
- Partners in Flight (PIF) assessment methods designed for landbirds (Panjabi et al. 2005) were also applied to shorebirds and waterbirds to identify Regional Concern (RC) and Regional Stewardship (RS) species, as these were not identified in the Canadian Shorebird Conservation Plan (Donaldson et al. 2000) or Canada's waterbird conservation plan, "Wings over Water" (WOW, Milko et al. 2003)
- For waterfowl, species of continental priority in the North American Waterfowl Management Plan (North American Waterfowl Management Plan, Plan Committee 2004) were considered as Continental Concern (CC) species in BCR 4, and species of regional importance in the plan were considered as Regional Stewardship (RS) species in BCR 4.
- For waterbirds, species identified by Milko et al. (2003) as having over 50% of their global population in Canada were considered as Continental Stewardship (CS) species for BCR 4.
- General Status ranks were not used in the species assessment for BCR 4.
- We had regional experts review the PIF assessment scores for all BCR 4 species, and modified them in cases where we had consensus among experts that a change was warranted (PIF assessment scores are available online for landbirds, and by request for the other three bird groups, at www.rmbo.org/pif/pifdb.html)
- Based on regional expert opinion, we added any priority species not identified using the assessment methods above, where there was consensus among regional experts; reasons for adding these priority species were documented.

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.

Additional methods used for habitat associations in BCR 4:

- For each species, the LCCS habitat classes assigned were ranked as "Primary" or "Secondary" habitat, based on regional expert opinion. Up to 3 Primary habitat classes, and up to 8 habitat classes overall, were assigned to each species.
- We also assigned each species to a regional habitat sub-class within each LCCS class, in order to provide more specific descriptions of the regional habitats used by priority species. The regional habitat classes used are descriptive and general, and do not follow an existing habitat classification; they were agreed upon by regional experts.
- The "Generalist" habitat class described in the BCR planners' manual (Kennedy et al. 2012) was not used, as this class was not deemed appropriate for any priority species in BCR 4.

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.

Additional methods used for setting population objectives in BCR 4:

- In BCR 4, the baseline for population objectives is the late 1980s/early 1990s, when relatively consistent bird monitoring began.
- Population trend information from the entire BCR, including the Alaskan portion, was used as well as trend information from the Canadian portion of the BCR.
- For BCR 4, population objectives are based on population trends. Population objectives are based on the PIF Population Trend (PT) score for the entire BCR, including the Alaskan portion (PIF species assessment database) unless more recent or more reliable information was available from BBS trends (i.e., 1980–2007 trend from the USGS BBS website, for the entire BCR, and 1986–2009 trend from the Canadian BBS website) or from regional surveys (Yukon roadside waterfowl surveys, Trumpeter Swan survey, Peregrine Falcon survey).
- Population objectives were not set for the 3 priority species that do not breed within BCR 4 (Tundra Swan, Semipalmated Sandpiper, Thayer's Gull).

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.

Additional methods used for threats assessment in BCR 4:

- For BCR 4, specific threats to priority species from climate change effects were considered in this section, although climate change is also treated as a "widespread issue" later in the plan.
- Little published information is available documenting conservation issues and threats to birds within BCR 4. Therefore, threats to BCR 4 priority species that are documented for similar habitats and circumstances in adjacent regions were considered to be potential threats within BCR 4.
- The threats assessment is based on documented threats to priority species. Thus in order to be included in the threats assessment, a threat must be identified in the literature as affecting or potentially affecting one of BCR 4's priority species within this region or another adjacent and/or similar region. Because there is little published information on threats to birds in BCR 4 and the boreal region in general, many threats may be missing from this assessment, or their magnitudes underestimated. Future revisions of the plan will incorporate any new information, both published and from regional expert opinion.

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

Habitat Associations for BCR 4 Priority Species

Table A2. Habitat associations for each of the 77 priority species in BCR 4 in Canada: Northwestern Interior Forest.

P = primary habitats, S = secondary.

Priority Species	Coniferous	Deciduous	Mixed	Shrub/Early Successional	Herbaceous	Lichens/ Mosses	Cultivated and Managed Areas	Wetland	Bare Areas	Artificial Surfaces and Associated Areas	Waterbodies, Snow and Ice
Alder Flycatcher		S	S	**P**				**P**			
American Golden-Plover				**P**	S	S		S	S		
American Kestrel	S	S	**P**	**P**	S		S	S			
American Three-toed Woodpecker	**P**		S	S				S			
American Wigeon	S	S	S	**P**	S			**P**	S		**P**
Arctic Tern				S	S	S			**P**		**P**
Barn Swallow				S			S	**P**		**P**	
Barrow's Goldeneye	**P**	S	S					**P**			**P**
Black Tern								**P**			**P**
Blackpoll Warbler	**P**		S	**P**				**P**			
Blue-winged Teal				**P**	S			**P**			**P**
Bohemian Waxwing	**P**	S	**P**				S	S			
Bonaparte's Gull	**P**							**P**	S		**P**
Boreal Chickadee	**P**	S	**P**				S	S			
Boreal Owl	**P**		S								
Brewer's Sparrow				**P**							
Bufflehead	**P**	S	S					**P**			**P**
Canada Goose	S	S	S	**P**	S		S	**P**			**P**
Canvasback								**P**			**P**
Common Goldeneye	**P**	S	S					**P**			**P**
Common Loon								S			**P**
Common Nighthawk	**P**		S	S				**P**	S		S
Dusky Grouse	**P**		S	**P**							
Golden Eagle				**P**	**P**	S			S		
Golden-crowned Sparrow	**P**			**P**	S						
Gray Jay	**P**	S	**P**	S			S				
Gray-crowned Rosy-Finch				**P**	S	S		S	**P**		
Gray-headed Chickadee	**P**			**P**							
Great Gray Owl	**P**		S					**P**			
Greater White-fronted Goose				**P**	S		S	**P**			**P**
Green-winged Teal	S	S	S	**P**	S			**P**	S		**P**
Harlequin Duck				**P**				S	S		**P**

Table A2 continued

Priority Species	Coniferous	Deciduous	Mixed	Shrub/Early Successional	Herbaceous	Lichens/ Mosses	Cultivated and Managed Areas	Wetland	Bare Areas	Artificial Surfaces and Associated Areas	Waterbodies, Snow and Ice
Herring Gull					S				**P**	S	**P**
Horned Grebe								**P**			**P**
Killdeer					S		S	S	**P**	S	
Lesser Scaup	S			**P**	S			**P**			**P**
Lesser Yellowlegs	**P**		S	**P**	S			**P**	S		
Long-tailed Duck				S				**P**			**P**
Mallard	S	S	S	**P**	S			**P**	S		**P**
Mew Gull	S			S	S			**P**	S	S	**P**
Northern Goshawk	**P**		**P**	S				S			
Northern Hawk Owl	**P**		**P**	S				S			
Northern Pintail				**P**	S			**P**			**P**
Northern Shoveler				**P**	S			**P**			**P**
Northern Shrike				**P**	S		S	S			
Olive-sided Flycatcher	**P**			S				**P**			
Pacific Loon								**P**			**P**
Peregrine Falcon				S	S	S		**P**	**P**		S
Pine Grosbeak	**P**	S	S	S			S	S			
Red-necked Grebe								**P**			**P**
Red-necked Phalarope								**P**			**P**
Rufous Hummingbird	S		**P**	S			**P**				
Rusty Blackbird	**P**			**P**	S		S	**P**		S	
Semipalmated Sandpiper[1]								S	**P**		
Short-billed Dowitcher	S			**P**	S			**P**	S		
Short-eared Owl				**P**	**P**	S	S	**P**			
Smith's Longspur				**P**	S						
Solitary Sandpiper	**P**		S	**P**	S			**P**	S		
Sora								**P**			
Spotted Sandpiper				S	**P**			S	**P**		**P**
Surf Scoter	S			**P**				**P**			**P**
Surfbird				**P**	S	S					
Swainson's Hawk	**P**			**P**	S						
Thayer's Gull[1]									S	P	**P**
Townsend's Warbler	**P**										
Trumpeter Swan							S	**P**			**P**
Tundra Swan[1]							S	P			**P**
Upland Sandpiper	S			**P**	**P**		S				
Varied Thrush	**P**	S	**P**								
Wandering Tattler				**P**	S	S			S		**P**

[1] Species that are priorities as migrants only.

Table A2 continued

Priority Species	Coniferous	Deciduous	Mixed	Shrub/Early Successional	Herbaceous	Lichens/ Mosses	Cultivated and Managed Areas	Wetland	Bare Areas	Artificial Surfaces and Associated Areas	Waterbodies, Snow and Ice
Whimbrel				**P**	S	S		**P**	S		
White-crowned Sparrow	**P**		S	**P**			S	S			
White-tailed Ptarmigan				**P**	S	**P**			S		
White-winged Crossbill	**P**		S					S			
White-winged Scoter	S			**P**				**P**			**P**
Wilson's Snipe	S			**P**	S			**P**	S		
Wilson's Warbler		S		**P**				**P**			

Appendix 4

Threat, Objective and Action Categories

Table A3: IUCN Threat Categories

1. Residential and commercial development
1.1 Housing and urban areas
1.2 Commercial and industrial areas
1.3 Tourism and recreation areas
2. Agriculture and aquaculture
2.1 Annual and perennial non-timber crops
2.2 Wood and pulp plantations
2.3 Livestock farming and ranching
2.4 Marine and freshwater aquaculture
3. Energy production and mining
3.1 Oil and gas drilling
3.2 Mining and quarrying
3.3 Renewable energy
4. Transportation and service corridors
4.1 Roads and railroads
4.2 Utility and service lines
4.3 Shipping lanes
4.4 Flight paths
5. Biological resource use
5.1 Hunting and collecting terrestrial animals
5.2 Gathering terrestrial plants
5.3 Logging and wood harvesting
5.4 Fishing and harvesting aquatic resources
6. Human intrusions and disturbance
6.1 Recreational activities
6.2 Civil unrest and military exercises
6.3 Work and other activities
7. Natural system modifications
7.1 Fire and fire suppression
7.2 Dams and water management/use
7.3 Other ecosystem modifications
8. Invasive and other problematic species and genes
8.1 Invasive non-native/alien species
8.2 Problematic native species
8.3 Introduced genetic material
9. Pollution
9.1 Household sewage and urban waste water
9.2 Industrial and military effluents
9.3 Agricultural and forestry effluents
9.4 Garbage and solid waste
9.5 Air-borne pollutants
9.6 Excess energy

Table A3 continued

10. Geological events
10.1 Volcanoes
10.2 Earthquake/tsunamis
10.3 Avalanche/landslides
11. Climate change and severe weather
11.1 Habitat shifting and alteration
11.2 Droughts
11.3 Temperature extremes
11.4 Storms and flooding

Table A4: Conservation Objective Categories
(developed by Environment Canada for this BCR planning process)

1. Ensure adequate habitat
1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat.
1.2 Maintain the size, shape and configuration of habitat within the natural range of variation.
1.3 Ensure the continuation of natural processes that maintain bird habitat.
1.4 Maintain important habitat features on the landscape.
1.5 Reduce habitat degradation from contaminants.
2. Reduce mortality/increase productivity
2.1 Reduce mortality and/or sub-lethal effects from pesticide use.
2.2 Reduce mortality and/or sub-lethal effects from exposure to contaminants.
2.3 Reduce mortality and/or sub-lethal effects of oil pollution.
2.4 Reduce incidental mortality.
2.5 Reduce parasitism/predation.
2.6 Reduce the spread of disease.
2.7 Reduce incidental mortality from collisions.
2.8 Reduce mortality from legal or illegal hunting, and persecution.
2.9 Reduce nest destruction.
3. Manage individual species
3.1 Reduce competition with invasive species.
3.2 Reduce competition with problematic native species.
3.3 Reduce parasitism/predation.
3.4 Implement recovery plans for species at risk.
3.5 Prevent and control the spread of invasive and exotic species.
3.6 Reduce overabundant species.
4. Reduce disturbance
4.1 Reduce disturbance from human recreation.
4.2 Reduce disturbance from industrial or work activity.
4.3 Reduce disturbance from research.
4.4 Reduce disturbance from aircraft.
5. Ensure adequate food supplies
5.1 Maintain natural food webs and prey sources.
5.2 Manage decreases in prey due to contaminants.
5.3 Reduce human competition for food resources or foraging sites.
6. Manage for climate change
6.1 Support efforts to reduce greenhouse gas emissions.
6.2 Manage for habitat resilience as climate changes.
6.3 Manage populations for resilience to increased mortality from climate change.
7. External capacity building
7.1 Improve population/demographic monitoring.
7.2 Improve harvest monitoring.
7.3 Improve habitat monitoring.
7.4 Improve understanding of causes of population declines.
7.5 Improve understanding of potential effects of climate change.
7.6 Identify priority sites.

Table A5: IUCN Conservation Action Categories

1. Land/water protection
1.1 Site/area protection
1.2 Resource and habitat protection
2. Land/water management
2.1 Site/area management
2.2 Invasive/problematic species control
2.3 Habitat and natural process restoration
3. Species management
3.1 Species management
3.2 Species recovery
3.3 Species re-introduction
3.4 *Ex-situ* conservation
4. Education and awareness
4.1 Formal education
4.2 Training
4.3 Awareness and communications
5. Law and policy
5.1 Legislation
5.2 Policies and regulations
5.3 Private sector standards and codes
5.4 Compliance and enforcement
6. Livelihood, economic and other incentives
6.1 Linked enterprises and livelihood alternatives
6.2 Substitution
6.3 Market forces
6.4 Conservation payments
6.5 Non-monetary values
7. External capacity building
7.1 Institutional and civil society development
7.2 Alliance and partnership development
7.3 Conservation finance

Appendix 5

Acronyms and Terms

BBA: Breeding Bird Atlas
BBS: North American Breeding Bird Survey
BCR: Bird Conservation Region
CBC: Christmas Bird Count
CC: Continental Concern
COSEWIC: Committee on the Status of Wildlife in Canada
CS: Continental Stewardship
CSCP: Canadian Shorebird Conservation Plan
EC: Environment Canada, Canada's federal environment department
EOSD: Earth Observation for Sustainable Development, a land cover classification system (see Wulder and Nelson 2003)
IUCN: International Union for the Conservation of Nature
LCCS: Land Cover Classification System (developed by the Food and Agriculture Organization)
MSMA: Monosodium methanearsonate
NABCI: North American Bird Conservation Initiative
NAWMP: North American Waterfowl Management Plan
NGO: Non-government organization
NWA: National Wildlife Area
PBDE: Polybrominated diphenyl ether
PIF: Partners in Flight, the North American conservation partnership for landbirds
Bird groups: The four groups of bird species (Waterfowl, Waterbirds, Shorebirds, Landbirds)
Pillar Plans: The continental or national conservation plans for each of the four groups of birds (Waterfowl, Waterbirds, Shorebirds, Landbirds)
PT: Population Trend, one of the PIF factors used in species assessment
RC: Regional Concern
RD: Relative Density, one of the PIF factors used in species assessment
RS: Regional Stewardship
SARA: Canada's *Species at Risk Act*
UNFAO: United Nations Food and Agriculture Organization
WOW: Wings over Water, Canada's Waterbird Conservation Plan

Appendix 6

Modifications of Partners in Flight (PIF) Population Trend (PT) Scores

Trumpeter Swan. Change from PT=3 to PT=2. Trumpeter Swan surveys in BCR 4 show increasing trend

American Wigeon. Change from PT=2 to PT=4. Roadside Survey in southern Yukon indicates decreasing trend.

Lesser Scaup. Change from PT=3 to PT=4. Roadside Survey in southern Yukon indicates decreasing trend.

Lesser Yellowlegs. Change from PT=5 to PT=4. Canadian BBS analysis for the Canadian portion of the BCR for 1986-2009 shows non-significant positive trend, while US BBS analysis for the entire BCR for 1980-2007 shows significant negative trend.

American Three-toed Woodpecker. Change from PT=1 to PT=2. Canadian BBS analysis for 1986-2009 shows non-significant positive trend, while US BBS analysis for 1980-2007 shows near-significant negative trend.

Blackpoll Warbler. Change from PT=5 to PT=4. Canadian BBS analysis shows non-significant negative trend for 1986-2009, but non-significant positive trend for 1999-2009; US BBS analysis for 1980-2007 shows significant negative trend.

Wilson's Warbler. Change from PT=5 to PT=3. Canadian BBS shows non-significant positive trend while US BBS shows non-significant negative trend.

White-crowned Sparrow. Change PT=5 to PT=4. Canadian BBS shows non-significant negative trend for 1986-2009, but non-significant positive trend for 1999-2009; US BBS analysis for 1980-2007 shows significant negative trend.

Pine Grosbeak. Change from PT=4 to PT=3. Both Canadian and U.S. BBS analyses show non-significant negative trend.

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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