Environment Canada Environnement Canada

Bird Conservation Strategy for Bird Conservation Region 9
Pacific and Yukon Region: Great Basin

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Preface

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

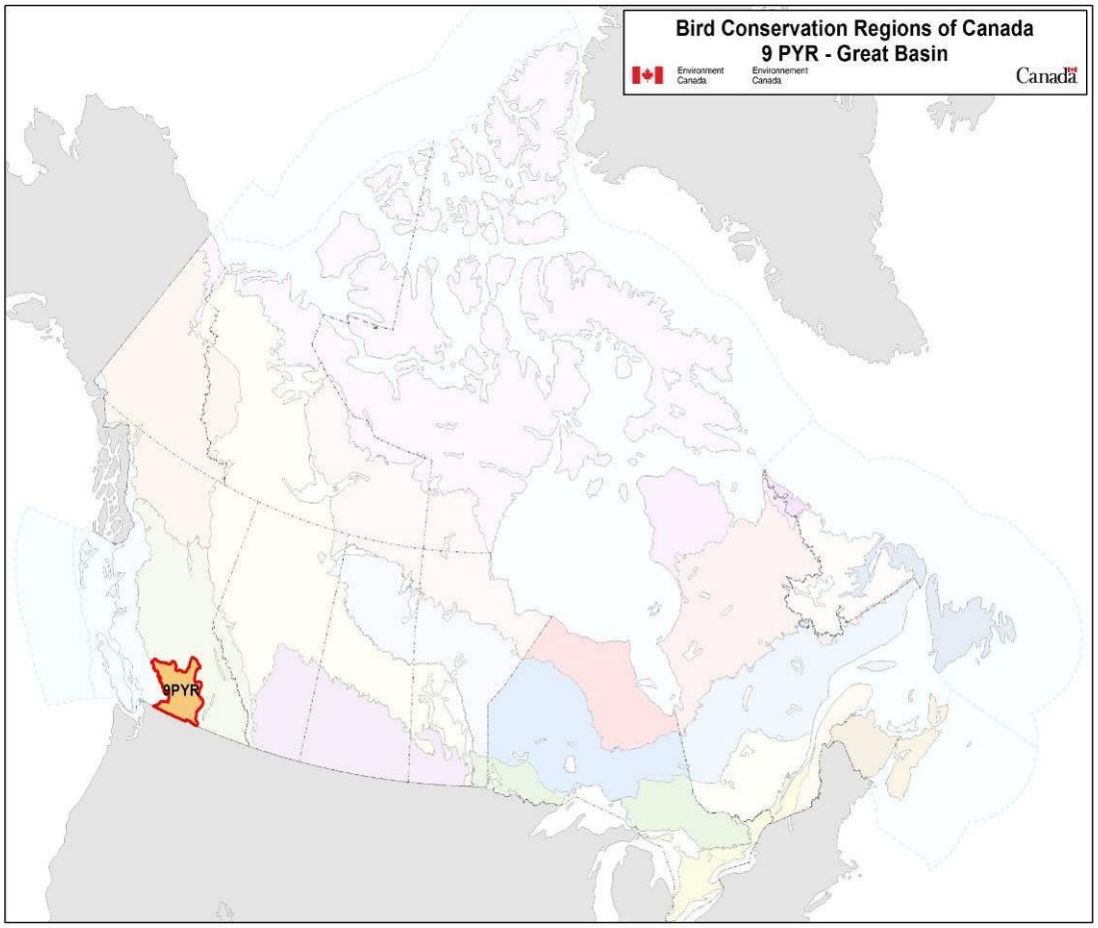
Environment Canada has developed national standards for strategies to ensure consistency of approach across BCRs. Bird Conservation Strategies will provide the context from which specific implementation plans can be developed for each BCR, building on the programs currently in place through Joint Ventures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

Conservation objectives and recommended actions from the conservation strategies will be used as the biological basis to develop guidelines and beneficial management practices that support compliance with regulations under the *Migratory Birds Convention Act, 1994.*

Acknowledgements

Ivy Whitehorne, Paul Levesque, Veronique Connolly, Tanya Luszcz, Alicia Newbury and Elsie Krebs were the main authors of this document. This strategy follows templates developed by Alaine Camfield, Judith Kennedy and Elsie Krebs with the help of the BCR planners in each of the Canadian Wildlife Service regions throughout Canada. However, work of this scope cannot be accomplished without the contribution of other colleagues who provided or validated technical information, commented on earlier draft versions of the strategy, and supported the planning process. We would like to thank the following people: André Breault, Rob Butler, Dick Cannings, Krista De Groot, Wendy Easton, Kevin Fort, Bruce Harrison, Nancy Mahony and Kathleen Moore.

Bird Conservation Strategy for Bird Conservation Region 9 Pacific and Yukon Region: Great Basin



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Executive Summary

Bird Conservation Region (BCR) 9, the Great Basin, is a dry and cold northern desert extending south from south-central British Columbia through portions of six states: Washington, Oregon, Idaho, California, Utah and most of Nevada. The Canadian portion of BCR 9 is about 5.7 million ha in size and lies in the rain shadow of the Cascade Range to its west, is bounded by the Columbia Mountains in the east, and extends north to the southern edge of the central interior plateau of British Columbia. Dominant physiographic features of the region include mountains and high-elevation plateaus, with moist montane-boreal communities, and prominent lowland valleys and basins, which serve as reservoirs for semi-arid grasslands, shrubsteppe and dry woodland communities. Some of these ecosystems are found nowhere else in Canada. BCR 9 contains much of the remaining grasslands, shrubsteppe, and low elevation dry forests in British Columbia.

This conservation strategy for BCR 9 in the Pacific and Yukon Region (PYR) builds on existing bird conservation strategies and complements those created for the other BCRs across Canada. BCR strategies will serve as a framework for implementing bird conservation nationally, and also identify international conservation issues for Canada's priority birds. This strategy is not intended to be highly prescriptive, but rather is intended to guide future implementation efforts undertaken by various partners and stakeholders.

BCR 9 is one of the most diverse regions in Canada. Two hundred and fifty-nine (259) species of birds regularly breed, overwinter, reside year-round or routinely migrate through the region. It also has a disproportionately high number of bird species considered at risk (Special Concern, Threatened or Endangered) by COSEWIC, the Committee on the Status of Endangered Wildlife in Canada. Of these, 98 species were identified as priority species. All bird groups were represented on the priority species list, although the list is dominated by landbirds (61% of the total list). The list also includes waterbirds (13%), waterfowl (19 %) and shorebirds (6 %). Over half of the waterfowl occurring in BCR 9 (58%) were identified as priority species, as compared to 42% of the waterbirds, 35% of the landbirds and only 24% of shorebirds. Forty-six percent (46%) of the priority species are considered at risk, either federally or provincially.

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. In BCR 9, a maximum of two broad-scale habitat associations were identified for each priority species. Herbaceous habitats (grassland, shrubsteppe and agricultural areas) are used by the greatest number of priority species (37), some of which reach the northern limits of their range in the Canadian portion of BCR 9. Coniferous forests (31 species), waterbodies (30 species) and wetlands (26 species) are also widely used.

The population objectives in this strategy are categorical 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." Forty-two percent (42%) of priority species, with representatives from all bird groups, were assigned an objective to "assess"

population status while “maintaining” current levels in the interim. For 18% of species, population levels were deemed to be at or near the objective. Sixteen percent (16%) and 11% of species were assigned objectives to increase the population by 50% and to double the population, respectively. For a small proportion of species (5%), all listed under the *Species at Risk Act*, we have deferred to the population objectives developed in Recovery Strategies.

An assessment of threats identified a number of conservation issues facing priority species in the various habitats of PYR’s BCR 9. Residential and Commercial development was a major threat, especially in valley-bottom habitats (Herbaceous, Wetland, Waterbodies and Riparian). Priority species impacted by this threat include the Barn Owl, Western Screech Owl and Western Meadowlark. Threats from agricultural practices were equally significant, largely as a result of habitat loss and degradation due to the booming viticulture industry in the herbaceous (grassland and shrubsteppe) habitats of the valley bottoms, but also due to ranching and cattle-grazing practices in forested and riparian areas at all elevations. Threatened species in herbaceous habitats include the Grasshopper Sparrow, Long-billed Curlew and Bobolink, while those in forested areas include Lewis’s Woodpecker, Flammulated Owl and MacGillivray’s Warbler. Loss and degradation of forest habitats through logging and forest harvesting (coniferous, mixed and riparian) were identified as major threats. Impacted species include Olive-sided Flycatcher, Black-backed Woodpecker and Northern Goshawk. Natural system modifications, in the form of the mountain pine beetle outbreak in coniferous and mixed forests (e.g., Purple Finch, Dusky Flycatcher, Pygmy Nuthatch), and fire suppression in lower-elevation coniferous forest and herbaceous habitats (e.g., Lark Sparrow, Sage Thrasher, Sharp-tailed Grouse), also emerged as high-level threats. Another high-level threat was pollution, chiefly associated with the use of pesticides in the agricultural sector, which may increase mortality directly through exposure (e.g., Horned Lark, Double-crested Cormorant), or indirectly through reduction of prey availability (e.g., White-throated Swift, Barn Swallow).

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. The majority of conservation objectives for BCR 9 relate to maintaining or enhancing habitat quality and quantity. Included in these objectives are the maintenance of the full range of naturally occurring habitat types, maintaining the quality of existing habitats and retaining important features on the landscape (e.g., standing dead snags for cavity-nesting birds). Also important is the need to reduce mortality of priority species, which includes reducing collisions with human-made structures, pesticide poisoning, mortality caused by ingestion of lead shot, destruction of nests and illegal harvest. Other objectives address the need to manage impacts of climate change and to reduce human disturbance of breeding birds.

Recommended actions indicate on-the-ground activities that will help to achieve the conservation objectives. Actions are strategic rather than highly detailed and prescriptive. Whenever possible, recommended actions benefit multiple species and/or respond to more than one threat. Given the prevalence of threats relating to loss and degradation of valley-

bottom habitats due to development, agriculture and grazing practices, it is not surprising that habitat management and protection emerge as dominant themes. Actions relating to the development of beneficial management practices or other voluntary private sector codes of practice comprise 35% of the total recommended actions, in part because many different kinds of actions, including habitat management and protection, have aspects that relate to the development of voluntary practices. Actions recommending restoration of natural processes also were frequently suggested, driven in part by the role of fire suppression and grazing practices in altering natural cycles.

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 9: Great Basin

Bird Conservation Region (BCR) 9, the Great Basin, is a dry and cold northern desert extending south from south-central British Columbia through portions of six states: Washington, Oregon, Idaho, California, Utah and most of Nevada (Partners in Flight British Columbia and Yukon 2003; Bird Studies Canada 2001). The Canadian portion of BCR 9 is about 5.7 million ha in size and lies in the rain shadow of the Cascade Range to its west, is bounded the Columbia Mountains in the east, and extends north to the southern edge of the central interior plateau of British Columbia (Brussard et al. 1995; Bird Studies Canada 2001; Fig. 1). In Canada, BCR 9 corresponds to BC's Southern Interior Ecoprovince (5.65 million ha). Dominant physiographic features of the ecoprovince include mountains and high-elevation plateaus, with moist montane-boreal communities, and prominent lowland valleys and basins, which serve as reservoirs for semi-arid grasslands, shrubsteppe and dry woodland communities (Lloyd et al. 1990). Some of these ecosystems are found nowhere else in Canada (Pryce et al. 2006). BCR 9 contains much of the remaining grasslands, shrubsteppe, and low elevation dry forests in British Columbia. BCR 9 is one of the most diverse regions in Canada with 259 species of birds that regularly breed, overwinter, reside year-round, or routinely migrate through the region. It also has a disproportionately high number of bird species (n=19) considered at risk (either Special Concern, Threatened, or Endangered) by COSEWIC. About 10% (over 550 000 ha) of the BCR is contained within parks or other protected areas (CIJV Technical Committee 2010; Fig. 2).

The climate and natural resources of BCR 9 have attracted intensive land use in the form of urban, industrial and agricultural development, mainly in valley bottoms. Most development in the BCR is concentrated in the Okanagan and Thompson valleys, where the two major urban centres are found (Kelowna, pop. 162,000 and Kamloops, pop. 93,000; Statistics Canada 2008). The cumulative impacts of this development, as well as widespread grazing by livestock, fire suppression and invasion of non-native plants have severely degraded the integrity of natural habitats for landbirds and other taxa in BCR 9. For example, approximately one quarter of the historic grasslands in BCR 9 have been lost to development and agricultural conversion (Grasslands Conservation Council of BC 2004), and 67% of the landbase of BCR 9 is under grazing tenure (Sara Loos, NCC, pers. comm.). The current outbreak of mountain pine beetle in BCR 9, and the resultant loss of mature pine forest to both the beetle and salvage logging activity also pose unique conservation problems to a number of priority species.

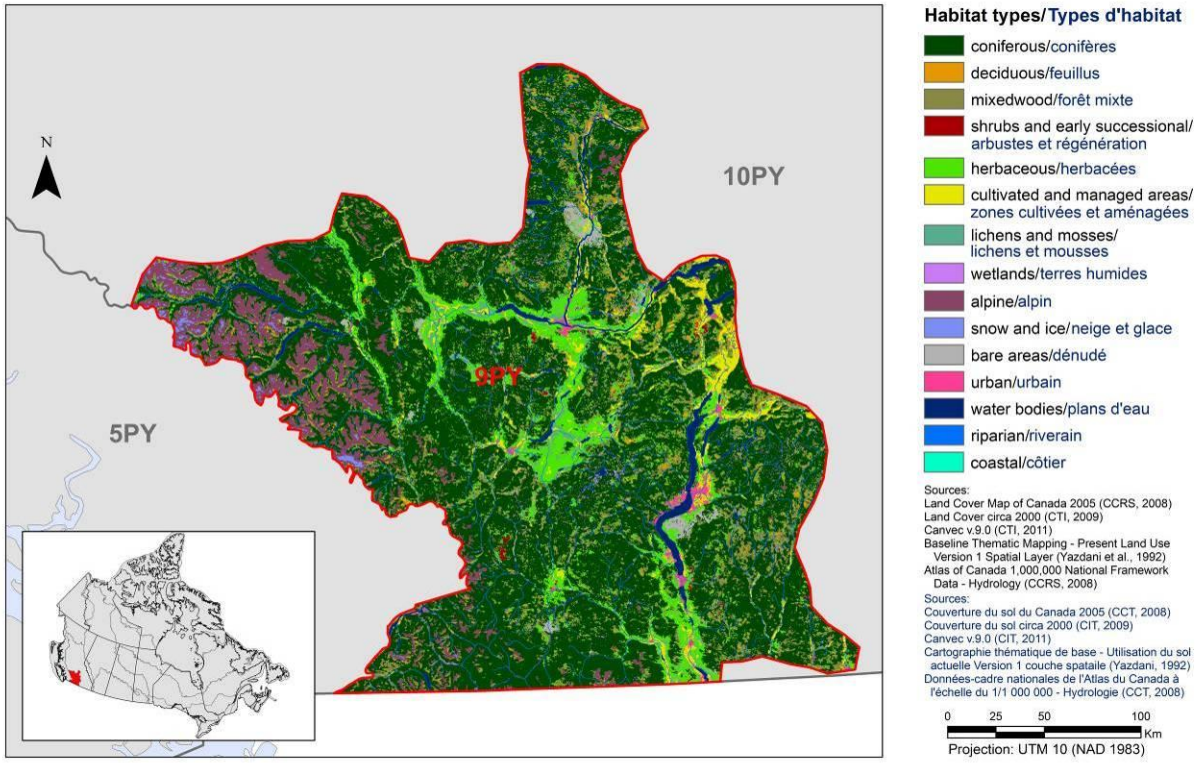

Figure 1. Landcover in BCR 9 Pacific and Yukon Region.

Urban, industrial and agricultural development continues to threaten remaining native habitats in BCR 9. Water availability is going to be a major issue as the human population increases, especially in the Okanagan Basin, which has the lowest per capita availability of freshwater in Canada (Statistics Canada 2003). Climate change is also expected to have broad impacts across the BCR, particularly in wetland habitats (CIJV Technical Committee 2010).

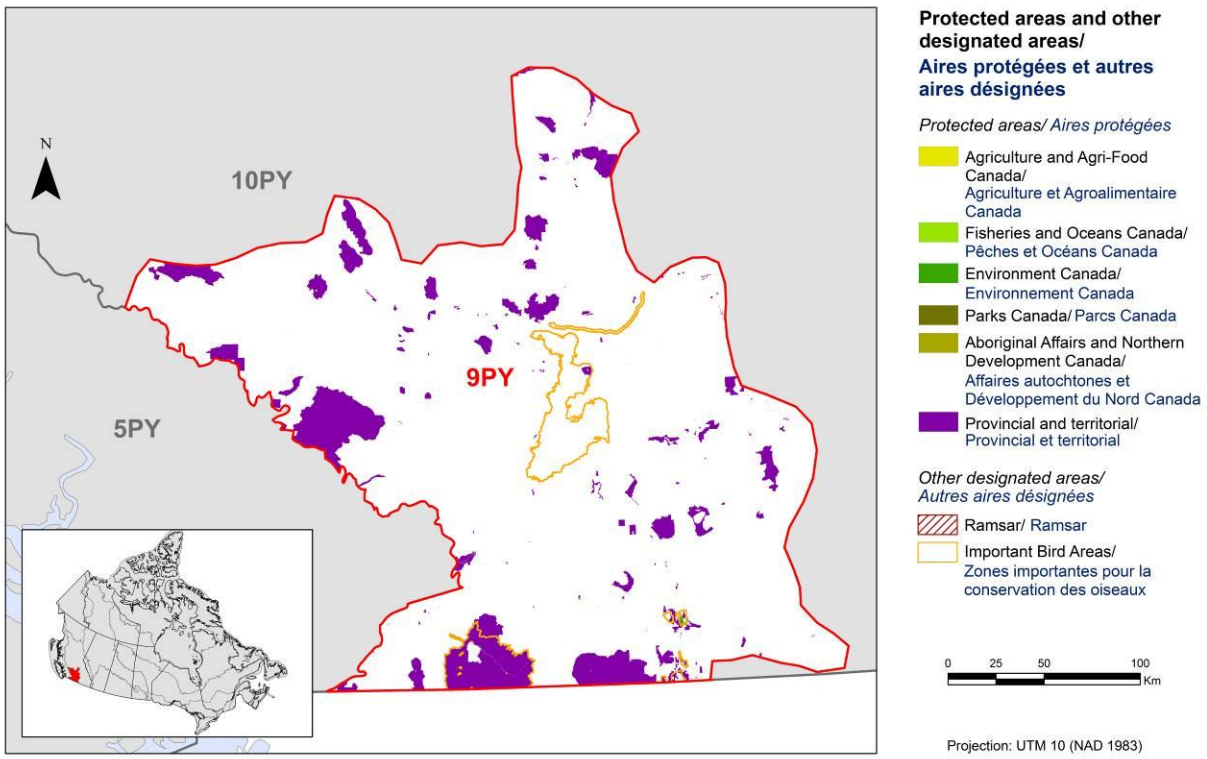

Figure 2. Map of protected and designated areas in BCR 9 Pacific and Yukon Region.

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

Element 1: Priority Species Assessment

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

The purpose of the prioritization exercise is to focus implementation efforts on the issues of greatest significance for Canadian avifauna. Table 1 provides a full list of all priority species and their reason for inclusion. Tables 2 and 3 summarize the number of priority species in BCR 9 Pacific and Yukon Region by bird group and by the reason for priority status.

In BCR 9, the priority species list is dominated by landbirds (60 of 98 priority species) but also includes waterbirds (13 species), waterfowl (19 species) and shorebirds (6 species). However, over half of the waterfowl occurring in BCR 9 (58%) were identified as priority species, as compared to 42% of the waterbirds, 35% of the landbirds, and only 24% of shorebirds. Forty-six percent (46%) of the priority species are considered at risk, either federally or provincially.

In BCR 9, the Canada Goose was identified as a priority species. Historically, Canada Goose populations in southern B.C. were characterized by very low densities and a scattered distribution, but through transplant programs and natural dispersal, this species has expanded its distribution and abundance in BCR 9 significantly over the last three decades (e.g., Okanagan Valley). In this plan, habitat associations, population objectives, identified threats, conservation objectives and recommended actions related to the Canada Goose refer solely to migratory populations, and do not refer to resident populations that both breed and winter in urban areas. These resident populations are responsible for a high incidence of conflicts with humans, and urban authorities (such as municipal governments) may elect to set population objectives for Canada geese and manage toward that goal through habitat modification and control measures.

Table 1. Priority species in BCR 9 Pacific and Yukon Region, population objective, and the reason for priority status.

Priority species	Bird group	Population trend score (PIF[1])	Population trend score (CSCP,[2] WOW[3])	Population objective[4]	COSEWIC[5]	SARA[6]	British Columbia provincial listing[7]	National/continental concern (landbirds, shorebirds, waterbirds)	Regional concern (landbirds only)	Continental stewardship (landbirds only)	Regional stewardship (landbirds, shorebirds, waterbirds)	NAWMP[8] priority (waterfowl only)	NAWMP rank (waterfowl only)	Expert review (changes to priority list)
American Kestrel	Landbird	4		Increase 50%					Y		Y			
Band-tailed Pigeon	Landbird	3		Assess / Maintain	SC	SC	Blue	Y						
Bank Swallow	Landbird	3		Assess / Maintain							Y			
Barn Owl	Landbird	3		Assess / Maintain	T	SC	Blue							
Barn Swallow	Landbird	5		Increase 100%	T		Blue		Y		Y			
Black Swift	Landbird	3		Assess / Maintain				Y						
Black-backed Woodpecker	Landbird	3		Assess / Maintain					Y		Y			
Black-billed Magpie	Landbird	3		Assess / Maintain							Y			
Bobolink	Landbird	5		Increase 100%	T		Blue							
Brewer's Sparrow (*breweri*)	Landbird	5		Increase 100%			Red	Y	Y	Y	Y			
Burrowing Owl	Landbird	3		Recovery objective	E	E	Red		Y		Y			
Calliope Hummingbird	Landbird	3		Assess / Maintain				Y		Y				
Canyon Wren	Landbird	3		Assess / Maintain			Blue							
Cassin's Finch	Landbird	3		Assess / Maintain						Y				

[1] PIF: Partners in Flight (Rocky Mountain Bird Observatory 2005)
[2] CSCP: Canadian Shorebird Conservation Plan (Donaldson et al. 2000)
[3] WOW: Wings Over Water (Milko et al. 2003)
[4] Population objectives were modified based on expert review so may not correspond directly with the population trend (PT) score. In addition, waterfowl objectives were taken from the Canadian Intermountain Joint Venture's Biological Foundation and Prospectus (CIJV 2003) and Implementation Plan (CIJV Technical Committee 2010).
[5] Assessed by COSEWIC (Committee on the Status of Endangered Wildlife in Canada) as: E, Endangered; T, Threatened; SC, Special Concern
[6] Species listed on Schedule 1 of the Species at Risk Act as E, Endangered; T, Threatened; SC, Special Concern (Species at Risk Public Registry).
[7] Red: Red Listed, Blue: Blue Listed by the British Columbia Conservation Data Centre
[8] NAWMP: North American Waterfowl Management Plan (North American Waterfowl Management Plan, Plan Committee, 2004)

Table 1 continued

Priority species	Bird group	Population trend score (PIF[1])	Population trend score (CSCP,[2] WOW[3])	Population objective[4]	COSEWIC[5]	SARA[6]	British Columbia provincial listing[7]	National/continental concern (landbirds, shorebirds, waterbirds)	Regional concern (landbirds only)	Continental stewardship (landbirds only)	Regional stewardship (landbirds, shorebirds, waterbirds)	NAWMP[8] priority (waterfowl only)	NAWMP rank (waterfowl only)	Expert review (changes to priority list)
Common Nighthawk	Landbird	3		Assess / Maintain	T									
Common Poorwill	Landbird	3		Assess / Maintain							Y			
Dusky Flycatcher	Landbird	4		Increase 50%					Y		Y			
Dusky Grouse	Landbird	5		Increase 100%				Y	Y		Y			
Ferruginous Hawk	Landbird	3		Assess / Maintain	T	T			Y		Y			
Flammulated Owl	Landbird	3		Assess / Maintain	SC	SC	Blue	Y	Y		Y			
Golden Eagle	Landbird	4		Increase 50%					Y		Y			
Grasshopper Sparrow	Landbird	5		Increase 100%			Red		Y		Y			
Gray Flycatcher	Landbird	3		Assess / Maintain			Blue			Y				
Great Gray Owl	Landbird	3		Assess / Maintain					Y		Y			
Gyrfalcon	Landbird	3		Assess / Maintain			Blue							
Horned Lark (*merrilli*)	Landbird	4		Increase 50%			Blue							
Lark Sparrow	Landbird	4		Increase 50%			Red		Y		Y			
Lazuli Bunting	Landbird	3		Assess / Maintain							Y			
Lewis's Woodpecker	Landbird	5		Increase 100%	T	T	Red	Y	Y	Y	Y			
Long-eared Owl	Landbird	3		Assess / Maintain							Y			
MacGillivray's Warbler	Landbird	4		Increase 50%					Y		Y			
Mountain Chickadee	Landbird	4		Increase 50%					Y		Y			
Northern Goshawk	Landbird	4		Increase 50%					Y		Y			
Northern Harrier	Landbird	3		Assess / Maintain							Y			
Northern Saw-whet Owl	Landbird	4		Increase 50%					Y		Y			
Olive-sided Flycatcher	Landbird	5		Increase 100%	T	T	Blue	Y	Y		Y			
Peregrine Falcon (*anatum/tundrius*)	Landbird	3		Assess / Maintain	SC	SC	Red							
Prairie Falcon	Landbird	3		Assess / Maintain			Red		Y		Y			

Table 1 continued

Priority species	Bird group	Population trend score (PIF[1])	Population trend score (CSCP,[2] WOW[3])	Population objective[4]	COSEWIC[5]	SARA[6]	British Columbia provincial listing[7]	National/continental concern (landbirds, shorebirds, waterbirds)	Regional concern (landbirds only)	Continental stewardship (landbirds only)	Regional stewardship (landbirds, shorebirds, waterbirds)	NAWMP[8] priority (waterfowl only)	NAWMP rank (waterfowl only)	Expert review (changes to priority list)
Purple Finch	Landbird	5		Increase 100%					Y		Y			
Pygmy Nuthatch	Landbird	2		Maintain current					Y		Y			
Red Crossbill	Landbird	3		Assess / Maintain					Y		Y			
Rock Wren	Landbird	4		Increase 50%							Y			
Rough-legged Hawk	Landbird	3		Assess / Maintain			Blue							
Rufous Hummingbird	Landbird	3		Assess / Maintain				Y						
Rusty Blackbird	Landbird	3		Assess / Maintain	SC	SC	Blue							
Sage Thrasher	Landbird	4		Increase 50%	E	E	Red		Y	Y	Y			
Sharp-tailed Grouse (*columbianus*)	Landbird	5		Increase 100%			Blue		Y		Y			
Short-eared Owl	Landbird	4		Increase 50%	SC	SC	Blue	Y	Y		Y			
Spotted Owl	Landbird	5		Recovery objective	E	E	Red							
Swainson's Hawk	Landbird	3		Assess / Maintain			Red	Y	Y		Y			
Townsend's Solitaire	Landbird	3		Assess / Maintain							Y			
Townsend's Warbler	Landbird	4		Increase 50%					Y		Y			
Vaux's Swift	Landbird	3		Assess / Maintain					Y		Y			
Western Meadowlark	Landbird	4		Increase 50%					Y		Y			
Western Screech-Owl (*macfarlanei*)	Landbird	3		Recovery objective	T	E	Red		Y		Y			
White-headed Woodpecker	Landbird	4		Increase 50%	E	E	Red	Y	Y		Y			
White-throated Swift	Landbird	3		Assess / Maintain				Y						
Williamson's Sapsucker	Landbird	4		Recovery objective	E	E	Red		Y		Y			
Willow Flycatcher	Landbird	5		Increase 100%				Y	Y		Y			
Yellow-breasted Chat	Landbird	3		Recovery objective	E	E	Red							
American Avocet	Shorebird	3	3	Assess / Maintain			Red							

Table 1 continued

Priority species	Bird group	Population trend score (PIF[1])	Population trend score (CSCP,[2] WOW[3])	Population objective[4]	COSEWIC[5]	SARA[6]	British Columbia provincial listing[7]	National/continental concern (landbirds, shorebirds, waterbirds)	Regional concern (landbirds only)	Continental stewardship (landbirds only)	Regional stewardship (landbirds, shorebirds, waterbirds)	NAWMP[8] priority (waterfowl only)	NAWMP rank (waterfowl only)	Expert review (changes to priority list)
American Golden-Plover	Shorebird	3	4	Migrant (no population objective)			Blue	Y						
Long-billed Curlew	Shorebird	3	5	Assess / Maintain	SC	SC	Blue	Y						
Red-necked Phalarope	Shorebird	3	4	Migrant (no population objective)			Blue							
Sanderling	Shorebird	3	5	Migrant (no population objective)				Y						
Wilson's Phalarope	Shorebird	3	4	Assess / Maintain				Y						
American Bittern	Waterbird	3	4	Assess / Maintain			Blue							
American White Pelican	Waterbird	3	3	Assess / Maintain			Red							
Black Tern	Waterbird	4	5	Increase 50%				Y			Y			
California Gull	Waterbird	3	3	Assess / Maintain			Blue				Y			
Caspian Tern	Waterbird	3	2	Assess / Maintain			Blue							
Clark's Grebe	Waterbird	3	3	Assess / Maintain			Red				Y			
Common Tern	Waterbird	3	3	Migrant (no population objective)							Y			
Double-crested Cormorant	Waterbird	3	1	Assess / Maintain			Blue							
Great Blue Heron (*herodias*)	Waterbird	2	1	Maintain current			Blue							
Horned Grebe	Waterbird	3	4	Assess / Maintain	SC									
Thayer's Gull	Waterbird	3	3	Assess / Maintain							Y			
Virginia Rail	Waterbird	3		Assess / Maintain							Y[9]			
Western Grebe	Waterbird	3	3	Increase 100%			Red				Y			
American Wigeon	Waterfowl	2		Maintain current								Y	Mod High	
Barrow's Goldeneye	Waterfowl	3		Maintain current								Y	High	

[9] Virginia Rail was assessed using PIF methods

Table 1 continued

Priority species	Bird group	Population trend score (PIF[1])	Population trend score (CSCP,[2] WOW[3])	Population objective[4]	COSEWIC[5]	SARA[6]	British Columbia provincial listing[7]	National/continental concern (landbirds, shorebirds, waterbirds)	Regional concern (landbirds only)	Continental stewardship (landbirds only)	Regional stewardship (landbirds, shorebirds, waterbirds)	NAWMP[8] priority (waterfowl only)	NAWMP rank (waterfowl only)	Expert review (changes to priority list)
Bufflehead	Waterfowl	3		Maintain current								Y	Mod High	
Canada Goose	Waterfowl	2		Maintain current								Y	High	
Canvasback	Waterfowl	3		Maintain current								Y	Mod High	
Cinnamon Teal	Waterfowl	4		Maintain current								Y	Mod High	
Gadwall	Waterfowl	1		Maintain current								Y	Mod High	
Greater Scaup	Waterfowl	3		Maintain current								Y	Mod High	
Greater White-fronted Goose	Waterfowl	3		Migrant (no population objective)								Y	Highest	
Green-winged Teal	Waterfowl	2		Maintain current								Y	Mod High	
Harlequin Duck	Waterfowl	3		Maintain current								Y	High	
Lesser Snow Goose	Waterfowl	3		Migrant (no population objective)								Y	High	
Mallard	Waterfowl	1		Maintain current								Y	High	
Northern Pintail	Waterfowl	5		Maintain current								Y	High	
Northern Shoveler	Waterfowl	2		Maintain current								Y	Mod High	
Redhead	Waterfowl	3		Maintain current								Y	Mod High	
Surf Scoter	Waterfowl	3		Migrant (no population objective)			Blue							
Trumpeter Swan	Waterfowl	5		Maintain current								Y	High	
Tundra Swan	Waterfowl	3		Maintain current			Blue					Y	High	

Table 2. Summary of priority species, by bird group, in BCR 9 Pacific and Yukon Region.

Bird Group	Total Species	Total Priority Species	Percent Listed as Priority	Percent of Priority List
Landbird	170	60	35%	61%
Shorebird	25	6	24%	6%
Waterbird	31	13	42%	13%
Waterfowl	33	19	58%	20%
Total	**259**	**98**		**100%**

Table 3. Number of priority species in BCR 9 Pacific and Yukon Region by reason for priority status.

Reason for Priority Listing[1]	Landbirds	Shorebirds	Waterbirds	Waterfowl
COSEWIC[2]	19	1	1	0
Federal SARA listed[3]	16	1	0	0
Provincially listed[4]	28	4	8	2
NAWMP[5]	-	-	-	18
National/Continental Concern	14	4	1	-
Regional Concern	34	-	-	-
National/Continental Stewardship	6	-	-	-
Regional Stewardship	41	0	7[6]	-

[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 "-"). See Appendix 2 for details of the species assessment process.
[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.
[4] *Provincially Listed* indicates species Red-listed or Blue-listed by British Columbia's Conservation Data Centre.
[5] NAWMP indicates species ranked in the North American Waterfowl Management Plan (Plan Committee 2004) as having Highest, High or Moderately High breeding or non-breeding conservation and/or monitoring need in the BCR.
[6] Includes Virginia Rail, which was assessed by PIF methods.

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 9, a maximum of two broad-scale habitat associations were identified for each priority species. Herbaceous habitats (grassland, shrubsteppe and agricultural areas) are used by the greatest number of priority species (37), some of which reach the northern limits of their range in the Canadian portion of BCR 9. Coniferous forests (31 species), waterbodies (30 species) and wetlands (26 species) are also widely used (Fig. 3).

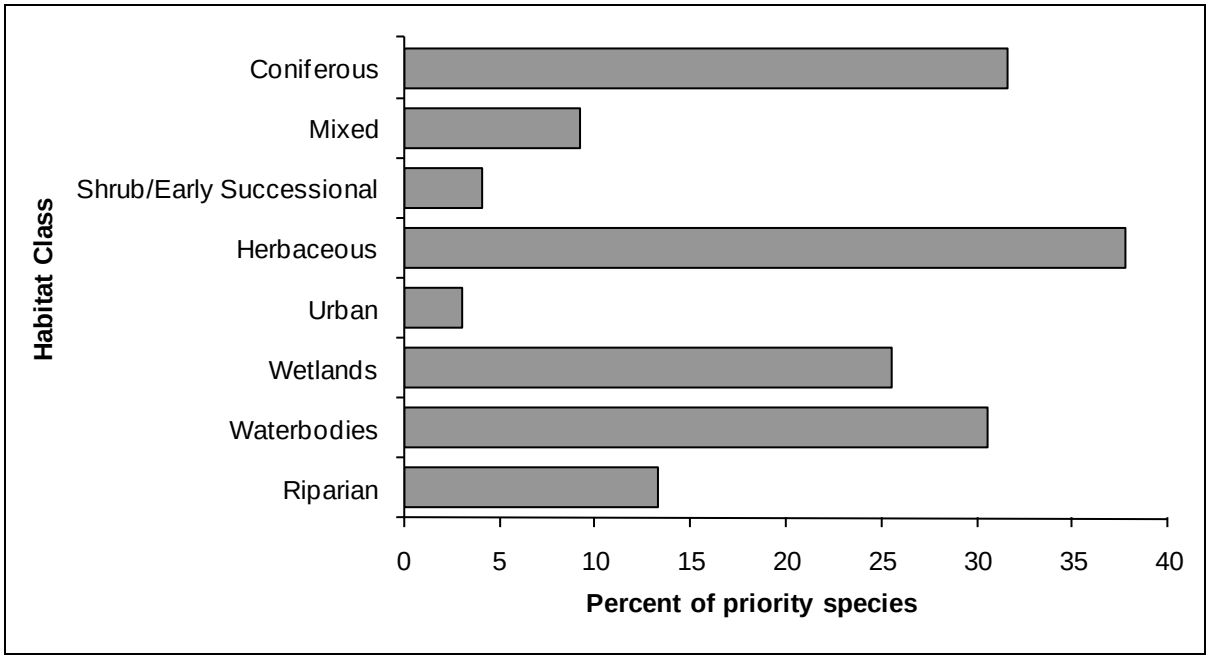

Figure 3. Percent of priority species that are associated with each habitat type in BCR 9 Pacific and Yukon Region.
Note: The total exceeds 100% because each species may be assigned to more than one habitat.

Element 3: Population Objectives

Population objectives allow us to measure and evaluate conservation success. The objectives in this strategy are assigned to categories and are based on a quantitative or qualitative assessment of species' population trends. If the population trend of a species is unknown, the objective is set as "assess and maintain", and a monitoring objective is given (see 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.

The population objectives in this strategy are categorical 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". Forty-two percent (42%) of priority species, with representatives from all bird groups, were assigned an objective to "assess" population status while "maintaining" current levels in the interim (Fig. 4). For 18% of species, population levels were deemed to be at or near the objective. Sixteen percent (16%) and 11% of species were assigned objectives to increase the population by 50% and to double the population, respectively. For a small proportion of species (5%), all SARA-listed, we have deferred to the population objectives developed in Recovery Strategies.

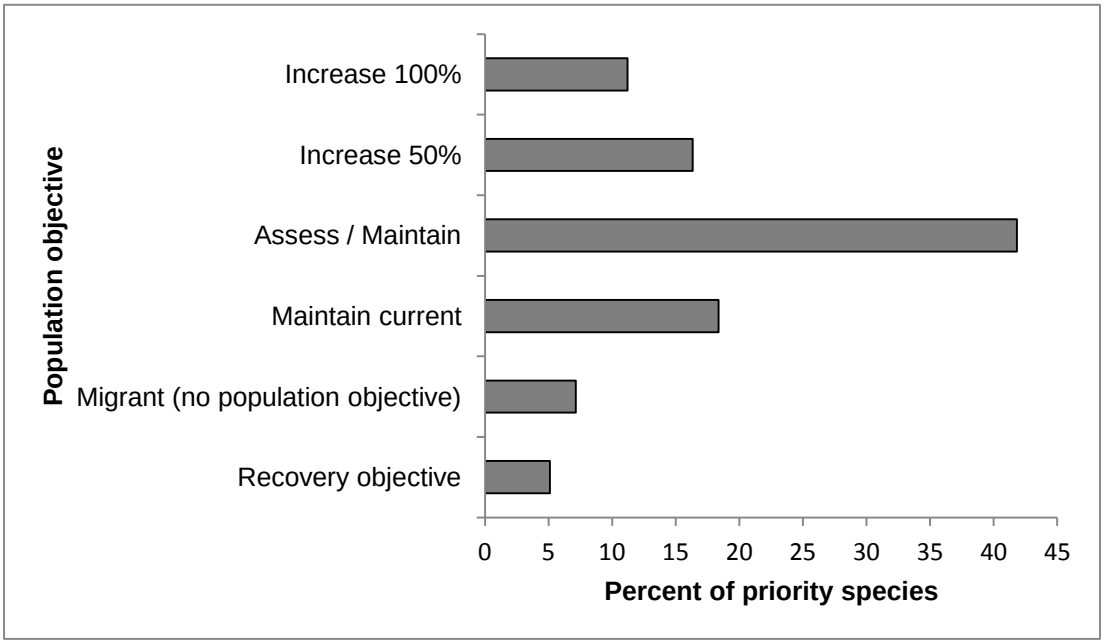

Figure 4. Percent of priority species that are associated with each population objective category in BCR 9 Pacific and Yukon Region: Great Basin.

Element 4: Threat Assessment for Priority Species

The threats assessment process (see Element 4: Threat Assessment for Priority Species) 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.

An assessment of threats identified a number of conservation issues facing priority species in the various habitats of PYR's BCR 9. Residential and Commercial development was a major threat, especially in valley-bottom habitats (Herbaceous, Wetland, Waterbodies, and Riparian; Fig. 5 and Table 4). Priority species impacted by this threat include the Barn Owl, Western Screech Owl and Western Meadowlark. Threats from agricultural practices were equally significant, largely as a result of habitat loss and degradation due to the booming viticulture industry in the herbaceous (grassland and shrubsteppe) habitats of the valley bottoms, but also due to ranching and cattle-grazing practices in forested and riparian areas at all elevations. Threatened species in herbaceous habitats include the Grasshopper Sparrow, Long-billed

Curlew, and Bobolink, while those in forested areas include Lewis's Woodpecker, Flammulated Owl and MacGillivray's Warbler. Loss and degradation of forest habitats through logging and forest harvesting (coniferous, mixed, and riparian) were identified as major threats. Impacted species include Olive-sided Flycatcher, Black-backed Woodpecker and Northern Goshawk. Natural system modifications, in the form of the mountain pine beetle outbreak in coniferous and mixed forests (e.g., Purple Finch, Dusky Flycatcher, Pygmy Nuthatch), and fire suppression in lower elevation coniferous forest and herbaceous habitats (e.g., Lark Sparrow, Sage Thrasher, Sharp-tailed Grouse), also emerged as a high-level threats. Also a high-level threat was pollution, chiefly associated with the use of pesticides in the agricultural sector, which may increase mortality directly through exposure (e.g., Horned Lark, Double-crested Cormorant), or indirectly through reduction of prey availability (e.g., White-throated Swift, Barn Swallow).

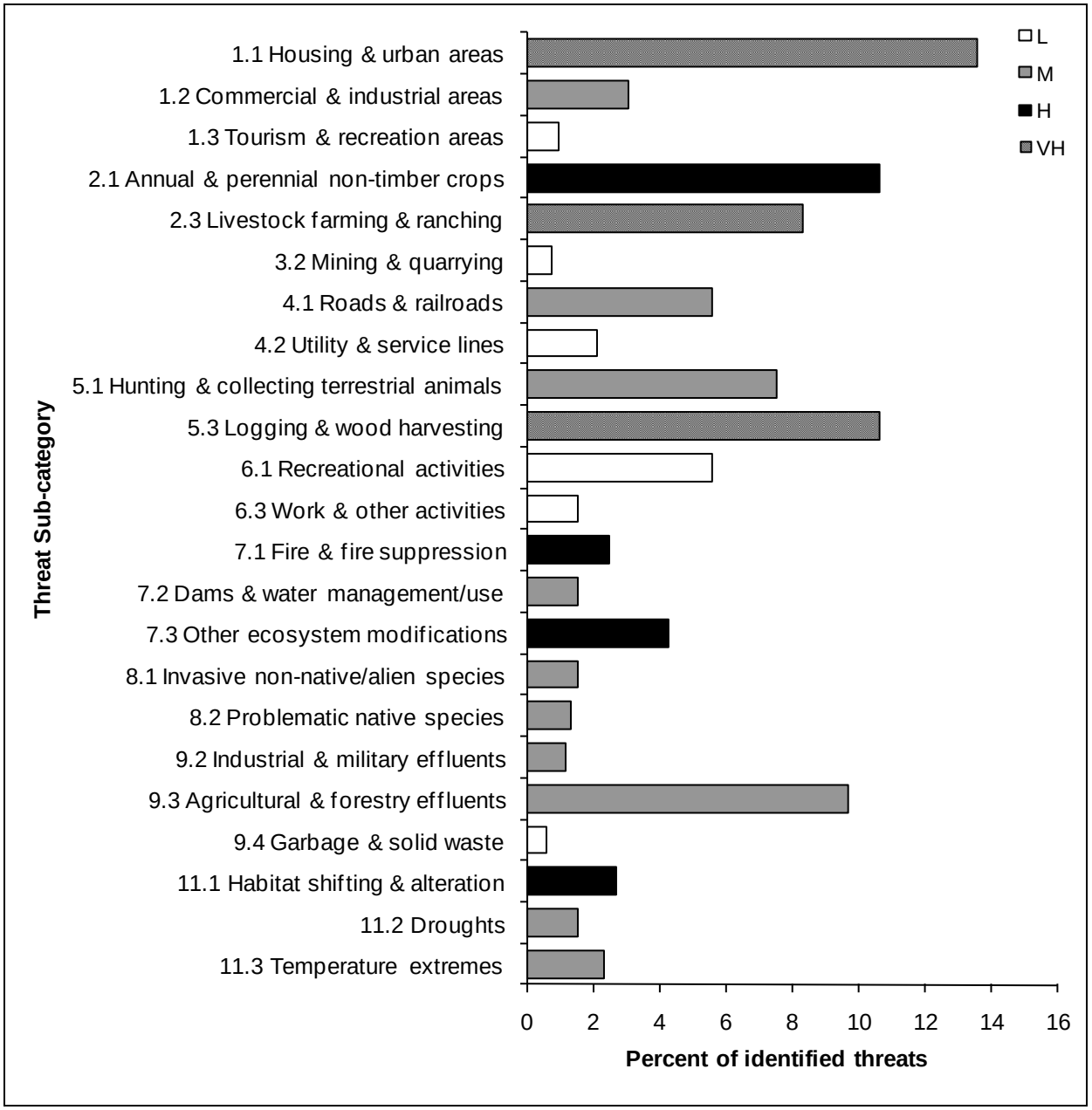

Figure 5. Percent of identified threats to priority species within BCR 9 Pacific and Yukon by threat sub-category.

Each bar represents the percent of the total number of threats identified in each sub-threat category in BCR 9 (for example, if 100 threats were identified in total for all priority species in BCR 9, 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 For BCR 9, population objectives for waterfowl were taken from the Canadian Intermountain Joint Venture's Biological Foundation and Prospectus (CIJV 2003) and Implementation Plan (CIJV Technical Committee 2010). Population objectives for landbirds, waterbirds and shorebirds were assigned based on the species' population trend (PT) score. For each priority species, the PT score for the entire BCR was provided by Partners in Flight, and the PT score for the Canadian portion of the BCR was calculated from BBS data following PIF protocols (Panjabi et al. 2005). Conservatively, the higher of the two PT scores was used to assign a population objective. Priority species exhibiting declines (PT = 4) were set an objective of "increase population by 50%," while strongly declining species (PT

= 5) had an objective identified as “increase population by 100%.” For species with PT = 3 (uncertain or unknown trend), objectives were set as “maintain and assess.” Finally, species with stable or increasing populations (PT = 1 or 2) had an objective set to “maintain current.” Population objectives were not set for priority species which only occur in the BCR on migration and do not breed or winter in the region.

Element 4: Threat Assessment for Priority Species for details on how magnitude was assessed). Threats under *5.1 Hunting and collecting terrestrial* animals include illegal harvest and persecution, and poisoning from ingestion of lead shot. 6*.1 Recreation activities* and *6.3 Work & other activities* refer to the impacts of human disturbance from these activities. Threats under *7.3 Other ecosystem modifications* are changes in forest structure due to the mountain pine beetle outbreak. *9.3 Agricultural and forestry effluents* refers primarily to effects of pesticide use. See Section 2 for a more detailed breakdown for each habitat class.

Table 4. Relative magnitude of identified threats to priority species within BCR 9 Pacific and Yukon 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 category	**Habitat class**								
	Coniferous	Mixed	Shrub/Early Successional	Herbaceous	Urban	Wetlands	Waterbodies	Riparian	**Overall**
Overall	**VH**	**H**	**L**	**VH**	**M**	**H**	**H**	**VH**	
1 Residential & commercial development	M	M	L	VH	H	H	M	VH	**VH**
2 Agriculture & aquaculture	H	H		VH		H	L	H	**VH**
3 Energy production & mining	L			L			L		**L**
4 Transportation & service corridors	M	L	L	M	M	L	M	L	**M**
5 Biological resource use	VH	VH	M	M	M	L	L	H	**VH**
6 Human intrusions & disturbance	L	L		M		L	M	L	**M**
7 Natural system modifications	H	H		VH	M	M	M	M	**H**
8 Invasive & other problematic species & genes	M			H		L	L	H	**H**
9 Pollution	M	L	L	H	L	H	H	L	**H**
11 Climate change & severe weather	H	M		M	L	H	M	M	**H**

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

Element 5: Conservation Objectives

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).

The majority of conservation objectives for BCR 9 relate to maintaining or enhancing habitat quality and quantity (Fig. 6). Included in these objectives are the maintenance of the full range of naturally-occurring habitat types, maintaining the quality of existing habitats, and retaining important features on the landscape (e.g., standing dead snags for cavity nesting birds). Also important is the need to reduce mortality of priority species, which includes reducing collisions with man-made structures, pesticide poisoning, mortality caused by ingestion of lead shot, destruction of nests, and illegal harvest. Other objectives address the need to manage impacts of climate change, and reduce human disturbance of breeding birds.

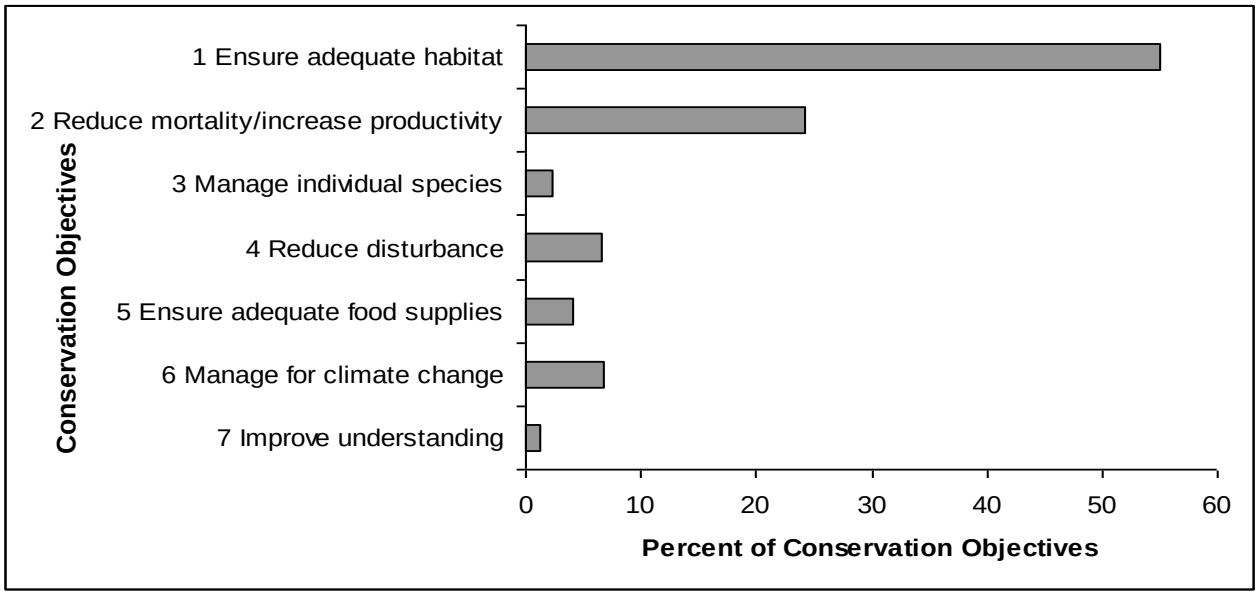

Figure 6. Percent of all conservation objectives assigned to each conservation objective category in BCR 9 Pacific and Yukon Region.

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.

Given the prevalence of threats relating to loss and degradation of valley-bottom habitats due to development, agriculture and grazing practices, it is not surprising that habitat management and protection emerge as dominant themes. Actions relating to the development of beneficial management practices (BMPs) or other voluntary private sector codes of practice comprise 35% of the total recommended actions, in part because many different kinds of actions, including habitat management and protection, have aspects that relate to the development of voluntary beneficial practices. Actions recommending restoration of natural processes also were frequently suggested, driven in part by the role of fire suppression and grazing practices in altering natural cycles.

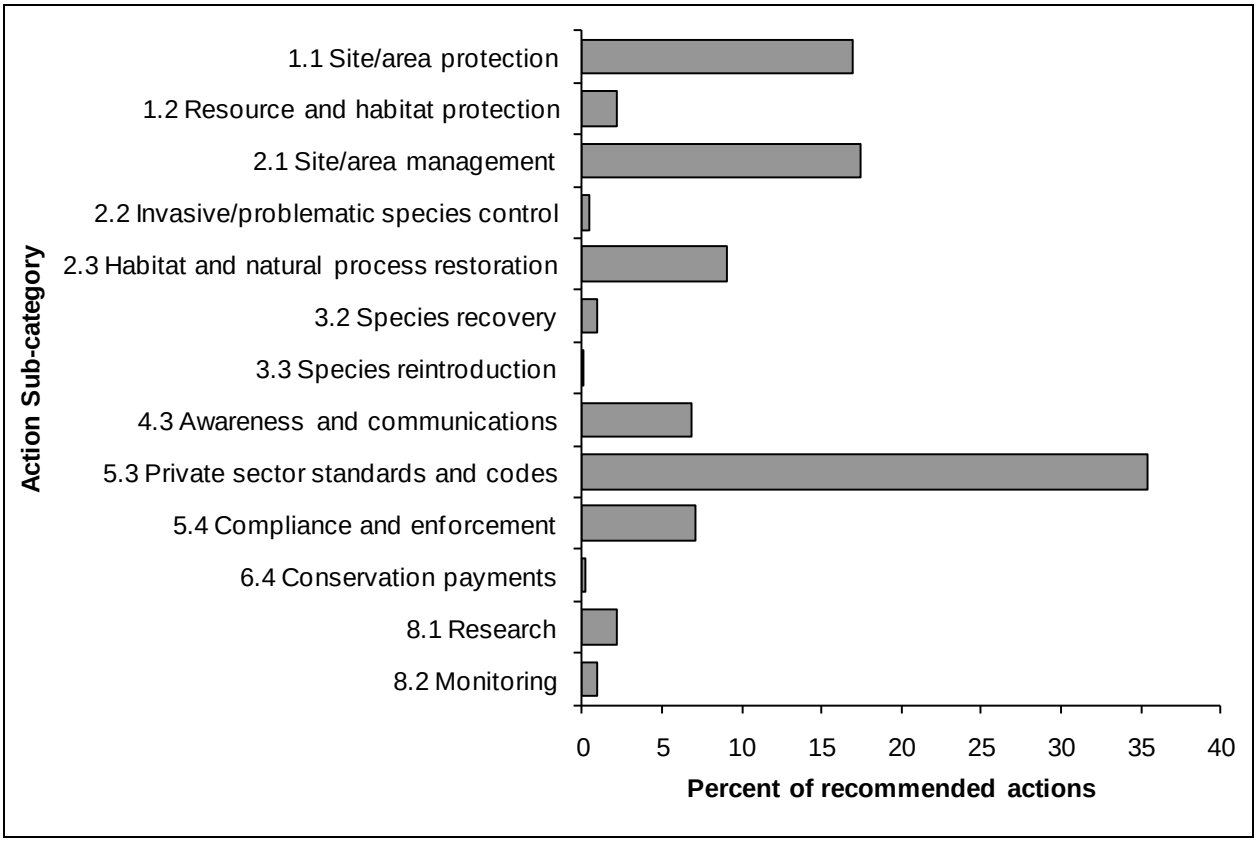

Figure 7. Percent of recommended actions assigned to each sub-category in BCR 9 Pacific and Yukon Region.

"Research" and "monitoring" refers to specific species where additional information is required. For a discussion of broad-scale research and monitoring requirements, see Research and Population Monitoring Needs in Section 3. *5.3 Private sector standards and codes* includes adoption of voluntary codes of practice, including sector-specific Beneficial Management Practices for bird conservation. *8.1 Research* and *8.2 Monitoring* refer to specific species where information is required before conservation actions can be formulated. For a discussion of broad-scale research and monitoring requirements, see the section on Research and Monitoring Needs.

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 9 Pacific and Yukon Region. Where appropriate, habitat information is provided at a finer scale than the broad habitat categories in order to coincide with other land management exercises in the region. Some species do not appear in the threats table because their low level threats have not been assigned objectives or actions and/or identified threats are addressed in the Widespread Issues section of the strategy.

Coniferous Forest

Coniferous forests (defined as where >75% of the basal tree area consists of conifers) cover the majority (58%) of the landscape in the Canadian portion of BCR 9 (CIJV 2009; Fig. 8). At low to middle elevations, BCR 9's coniferous forests are dominated by Douglas-fir (*Pseudotsuga menziesii*) and ponderosa pine (*Pinus ponderosa*), while lodgepole pine (*P. contorta*) and white (*Picea glauca*)/hybrid spruce occur at higher elevations (Partners in Flight British Columbia and Yukon 2003). Thirty-one (31) priority species were identified as using coniferous forest habitat (Table 5), all of which are landbirds. The majority of these (19 species) were identified as using dry ponderosa pine and/or Douglas-fir forests.

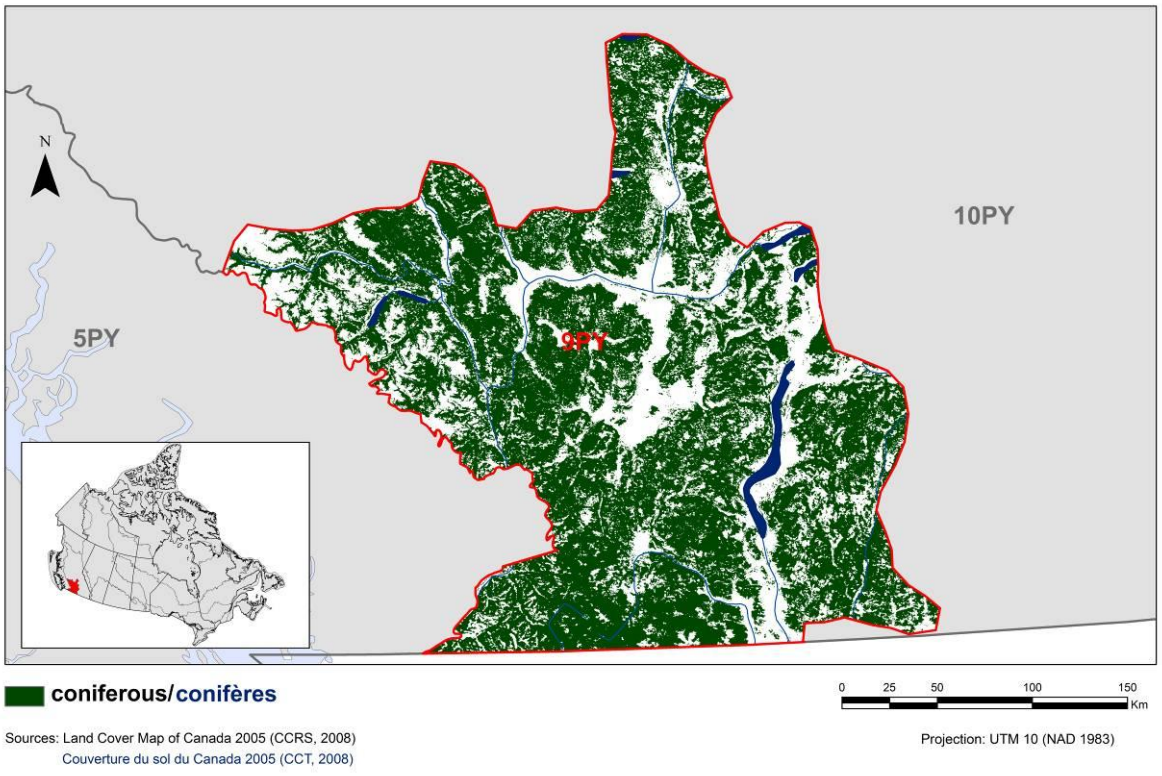

Figure 8. Map of coniferous habitat in BCR 9 Pacific and Yukon Region: Great Basin.

The primary threats to priority species in coniferous forest habitats are the loss of habitat and alteration of forest composition and structure through timber harvest and fire suppression (Fig. 10). The current mountain pine beetle infestation (both its effects on forest structure and associated salvage logging activities) also pose unique conservation problems (see the section on Mountain Pine Beetle for more information). Key actions to address these threats are the management of both regular timber harvest and mountain pine beetle logging and restoration activities for the protection of biodiversity, including maintenance of important habitat features for priority species (Table 6). Reintroduction of natural fire regimes to fire-maintained forest types, and protection of key areas of coniferous habitat is also crucial.

Mountain Pine Beetle

British Columbia is currently experiencing the largest outbreak of mountain pine beetle (*Dendroctonus ponderosae*) ever recorded in the province. The scope of the current outbreak is due, at least in part, to past forest management practices and fire suppression which have increased availability of susceptible (mature) lodgepole pine in the interior of British Columbia. Recent climactic warming also favours the mountain pine beetle, with a series of mild winters enabling high overwinter survival of beetle larvae (Austin et al. 2008). In addition to killing mature lodgepole pine, the current mountain pine beetle outbreak is killing ponderosa, whitebark (*Pinus albicaulis*) and western white pine (*P. monticola*), spruce trees (*Picea* spp.), and younger lodgepole pine (Westfall and Ebata 2009). Approximately 16.3 million ha of forest in British Columbia is currently affected (BC Ministry of Forests and Range 2010). While the most heavily affected area lies to the north of BCR 9 in the central plateau of British Columbia, much of the Southern Interior (BCR 9) is also impacted (Fig. 9). As of 2010, 49% of the pine in BCR 9 has been killed (Hectares BC 2012).

Birds that feed on mountain pine beetle adults or larvae (such as woodpeckers, chickadees and nuthatches) can benefit during early stages of infestation due to the increased food resources, but typically decline again after the infestation has peaked (Adamson et al. 2009). Species reliant on canopy foliage and mature forest-dependent species are expected to be negatively impacted by the loss of mature lodgepole pine (Chan-McLeod 2006). In addition, mountain pine beetle-killed trees are often unsuitable for cavity excavators due to their decay patterns, frequently falling before they have decayed enough to be of use (Chan-McLeod 2006).

Salvage logging and restoration (planting) activities can remove important features such as large live trees, large snags, downed wood and understory vegetation, and increase forest fragmentation. Future forests will depend on current harvest and restoration strategies, and care must be taken to avoid creating homogenous, even-aged stands which will be highly susceptible to future attack by mountain pine beetle or other host-specific diseases (Klenner 2006, Mahon and Martin 2009; see Appendix 3 for recommendations).

Short-term response to the mountain pine beetle outbreak in BC has now shifted from containment measures to salvage logging. There has been a substantial increase in the allowable annual cut in affected areas to increase the amount of beetle-killed wood that can be harvested before it loses economic value (BC Ministry of Forests and Range 2006b). While there

is some guidance on maintaining habitat and biodiversity values in conjunction with salvage logging (Klenner 2006, Snetsinger 2005) it is not legally binding and to date, it does not appear that retention targets are being met (Lewis et al. 2008). Consequently, there are concerns about current and future biodiversity conservation in salvage-logged areas (Lewis et al. 2008). In the longer term, mountain pine beetle mitigation plans include extensive site restoration and replanting efforts to ensure future timber supply, and economic diversification of forestry-dependent towns in heavily affected areas (BC Ministry of Forests and Range 2006a, b).

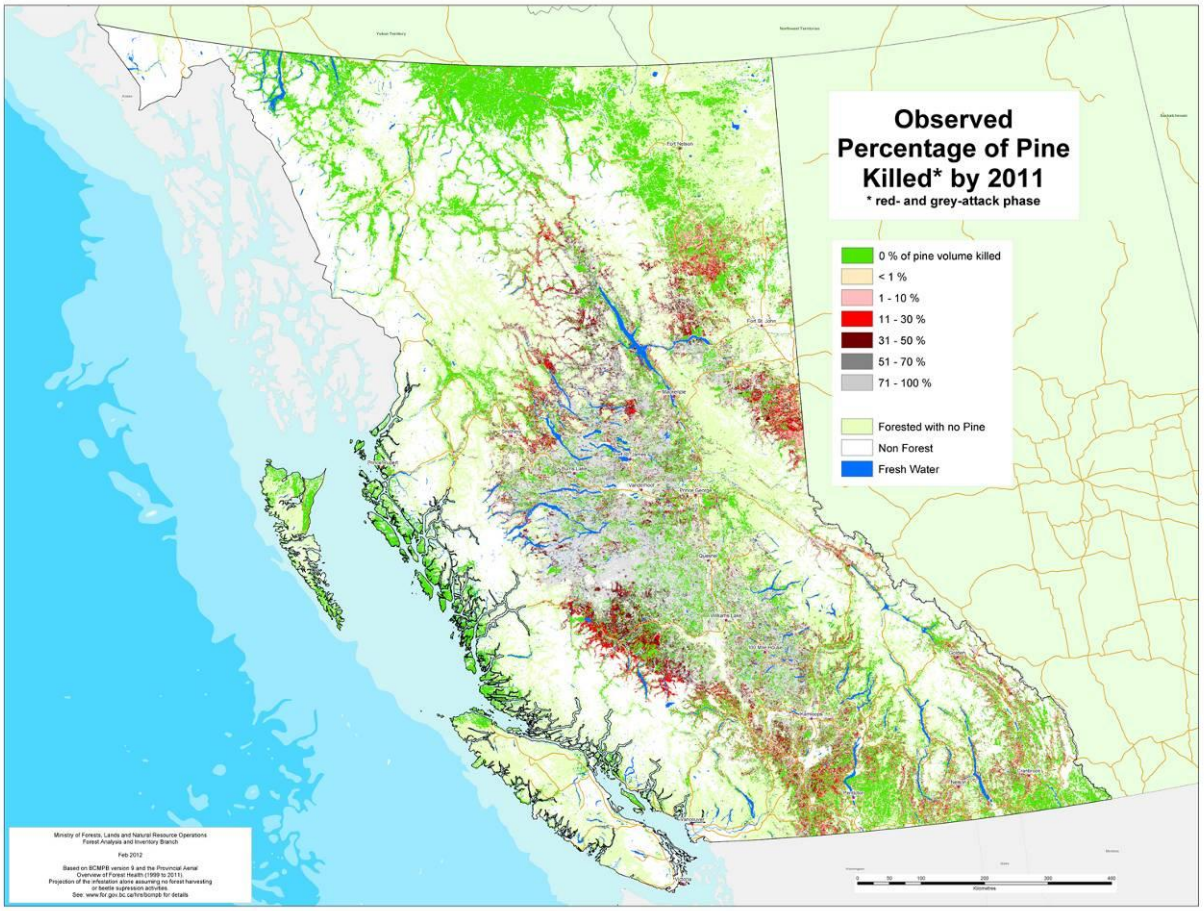

Figure 9. Extent and severity of the mountain pine beetle outbreak in British Columbia.
Note: Original image from Forest Analysis and Inventory Branch, BC Ministry of Forests, Lands and Natural Resource Operations.. Available at www.for.gov.bc.ca/hfp/mountain_pine_beetle/maps.htm. Accessed 29 November 2012.

Table 5. Priority species that use coniferous habitat, regional habitat sub-class, important habitat features, population objectives and reason for priority status in BCR 9 Pacific and Yukon Region.

Priority species	Regional habitat sub-class	Important habitat features	Population objective	Reason for priority status			
				At Risk	CC	S	NAWMP
American Kestrel	Ponderosa pine	cavities, openings/clearings, aspen groves	Increase 50%		Y	Y	
Band-tailed Pigeon	mature	mineral springs, openings/clearings, fruiting understory shrubs	Assess / Maintain	Y	Y		
Black-backed Woodpecker	mature, old growth	snags, veteran trees, recent burns, openings/clearings	Assess / Maintain		Y		
Calliope Hummingbird	Ponderosa pine	openings/clearings	Assess / Maintain		Y	Y	
Canyon Wren	Ponderosa pine, Douglas-fir	cliffs/canyons, outcrops/bluffs	Assess / Maintain	Y			
Cassin's Finch	Ponderosa pine, Douglas-fir	cone crops	Assess / Maintain			Y	
Common Nighthawk	Ponderosa pine	recent burns, clearcuts, rocky clearings, outcrops/bluffs	Assess / Maintain	Y			
Common Poorwill	Ponderosa pine	openings/clearings	Assess / Maintain			Y	
Dusky Flycatcher	Ponderosa pine, Douglas-fir	openings/clearings, clearcuts, burns, young aspen copses	Increase 50%		Y		
Dusky Grouse	Ponderosa pine, Douglas-fir	subalpine meadows, aspen groves, openings/clearings, burns	Increase 100%		Y		
Flammulated Owl	Ponderosa pine, Douglas-fir	cavities	Assess / Maintain	Y	Y		
Gray Flycatcher	Ponderosa pine		Assess / Maintain	Y		Y	
Great Gray Owl	mature, Ponderosa pine, Douglas-fir	openings/clearings	Assess / Maintain		Y		
Lewis's Woodpecker	Ponderosa pine, Douglas-fir	snags, recent burns, openings/clearings, low stem density, cottonwood	Increase 100%	Y	Y	Y	
Mountain Chickadee	Ponderosa pine, Douglas-fir	cavities, aspen groves	Increase 50%		Y		
Northern Goshawk	mature/old growth		Increase 50%		Y		
Northern Saw-whet Owl	mature, old growth, Ponderosa pine, Douglas-fir	cavities, snags	Increase 50%		Y		
Olive-sided Flycatcher	mature, Douglas-fir, Ponderosa Pine	recent burns, snags, openings/clearings	Increase 100%	Y	Y		
Purple Finch	mature	openings/clearings	Increase 100%		Y		
Pygmy Nuthatch	Ponderosa pine, Douglas-fir	cavities, snags	Maintain current		Y		
Red Crossbill	mature, old growth	cone crops	Assess / Maintain		Y		
Rock Wren	Ponderosa pine, Douglas-fir	outcrops/bluffs	Increase 50%			Y	
Rufous Hummingbird	mature, old-growth	openings/clearings	Assess / Maintain		Y		
Rusty Blackbird	mature, old growth	forested wetlands, bogs, openings	Assess / Maintain	Y			

Table 5 continued

Priority species	Regional habitat sub-class	Important habitat features	Population objective	Reason for priority status			
				At Risk	CC	S	NAWMP
Spotted Owl	old growth	cavities, snags	Recovery objective	Y			
Townsend's Solitaire	Ponderosa pine, Douglas-fir	aspen groves, recent burns, openings/clearings, clearcuts, steep dirt banks, fruiting understory shrubs	Assess / Maintain			Y	
Townsend's Warbler	mature, old growth, Douglas-fir		Increase 50%		Y		
Vaux's Swift	old growth	cavities, snags, cottonwood riparian, rooftops (chimney)	Assess / Maintain		Y		
White-headed Woodpecker	Ponderosa pine	snags, cone crops	Increase 50%	Y	Y		
White-throated Swift	Ponderosa pine, Douglas-fir	cliffs/canyons, cavities	Assess / Maintain		Y		
Williamson's Sapsucker	old growth, mature, Ponderosa pine, Douglas-fir	snags, veteran trees, aspen groves, larch	Recovery objective	Y	Y		

Note: Reasons for inclusion in the priority species list are as follows. At Risk: the species is assessed as either Endangered, Threatened or Special Concern by COSEWIC, or the species is on the Red or Blue lists in BC; CC: the species meets Conservation Concern criteria for its bird group; S: the species meets Stewardship criteria for its bird group; NAWMP: the species has NAWMP priority of Moderate-High, High or Highest in the BCR.

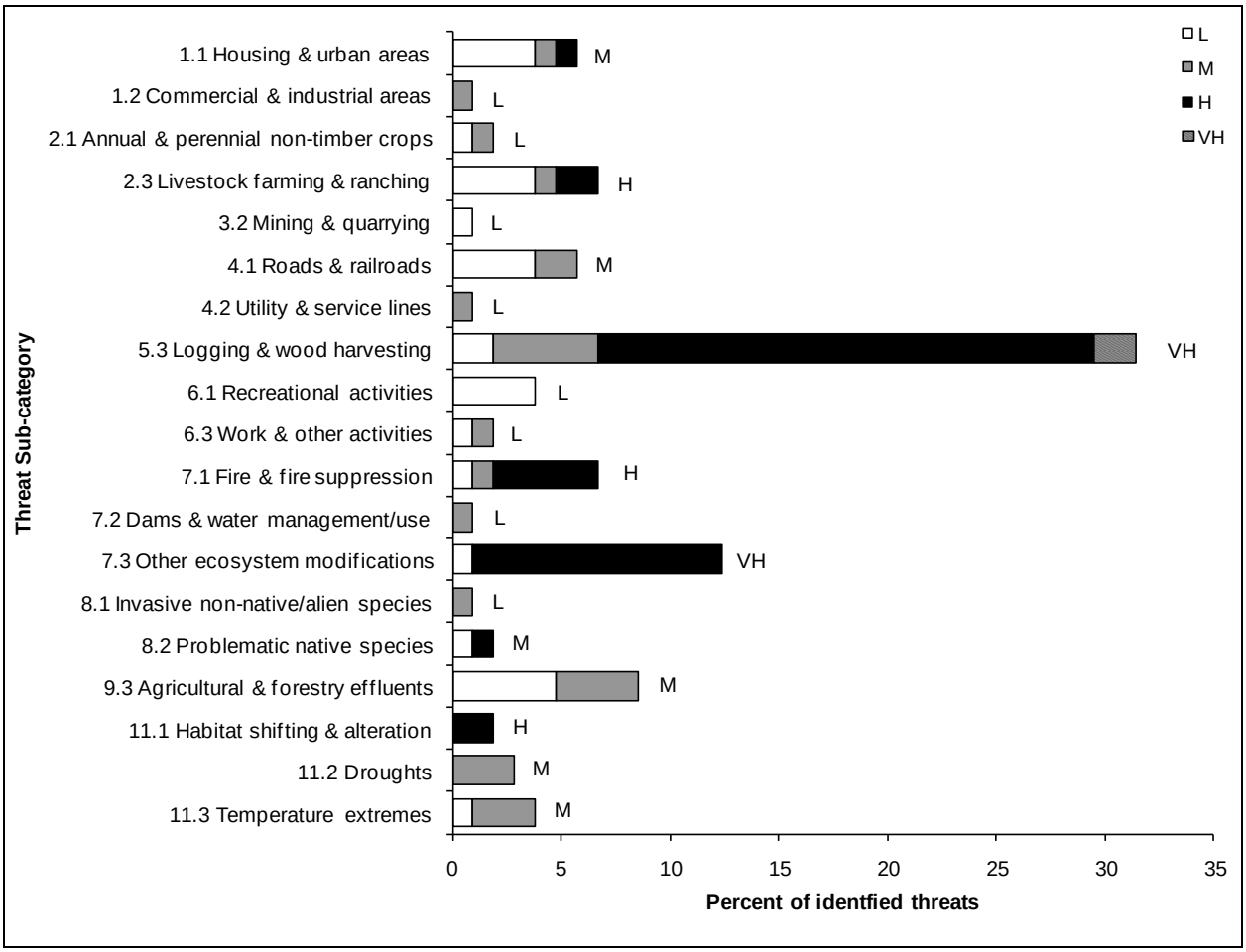

Figure 10. Percent of identified threats to priority species in coniferous in each threat sub-category

Each bar represents the percent of the total number of threats identified in each sub-threat 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 9 Pacific and Yukon by threat category and broad habitat class).

Note: The overall rolled-up magnitude of the threats in each sub-category is shown at the end of each bar. Threats of all magnitudes are included, although low ranked threats affecting only a single species were not assigned conservation objectives or recommended actions. *7.3 Other ecosystem modifications* refers to changes in forest structure associated with the current mountain pine beetle outbreak. *8.1 Invasive non-native/alien species* refers to competition from European Starling, and *8.2 Problematic native species* refers to predation by and competition from the Barred Owl. *9.3 Agricultural and forestry effluents* refers to effects of pesticide use**.**

Table 6. Threats addressed, conservation objectives, recommended actions and priority species affected for coniferous habitat in BCR 9 Pacific and Yukon Re

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Priority species affected
Loss of habitat to residential and commercial development, agricultural conversion or rangeland clearing.	1.1 Housing & urban areas 1.2 Commercial & industrial areas 2.1 Annual & perennial non-timber crops 2.3 Livestock farming & ranching	Maintain and enhance the quantity, quality and diversity of coniferous habitats.	1.2 Maintain the size, shape and configuration of habitat within the natural range of variation.	Secure and manage coniferous habitat for priority birds through various methods such as establishment of formal parks, protected areas, or management areas (such as Wildlife Tree Retention Areas, Wildlife Habitat Areas and Old Growth Management Areas). Avoid further fragmentation and maximize connectivity of existing coniferous habitats. This includes reducing trails and roads through these habitats. Ensure that the full range of seral stages and habitat types are represented to benefit a wide variety of priority species.	1.1 Site/area protection 5.3 Private sector standards and codes	Common Poorwill, Dusky Grouse, Lewis's Woodpecker, Pygmy Nuthatch, Williamson's Sapsucker
Loss of coniferous habitats and changes in structural diversity due to forest management.	5.3 Logging & wood harvesting	Maintain and enhance the quantity, quality and diversity of coniferous habitats.	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.	Use a variety of methods, such as creation of protected areas, Wildlife Tree Retention Areas, Wildlife Habitat Areas and Old Growth Management Areas to manage forests to maintain a mosaic of all habitat types and seral stages. Use harvest techniques such as selective harvest and partial retention (including some patches greater than 4 ha in size) that mimic natural disturbance regimes and retain important habitat features, such as wildlife trees. Maintain structural diversity by managing for a variety of species in multi-aged stands, with well-developed shrub understory and canopy closure. Protect all remaining old-growth stands and maintain large contiguous tracts of mature trees. Maximize connectivity of old-growth and mature forest patches. Plan location, size and shape of harvest areas and roads to minimize the effects of forest fragmentation.	5.2 Policies and regulations 5.3 Private sector standards and codes	Band-tailed Pigeon, Cassin's Finch, Dusky Grouse, Great Gray Owl, Mountain Chickadee, Northern Goshawk, Olive-sided Flycatcher, Purple Finch, Pygmy Nuthatch, Red Crossbill, Rusty Blackbird, Spotted Owl, Townsend's Warbler, Williamson's Sapsucker

Table 6 continued

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Priority species affected
Loss of trees to mountain pine beetle infestation. Loss of coniferous habitats to post-outbreak salvage logging.	7.3 Other ecosystem modifications	Maintain and enhance the quantity, quality and diversity of coniferous habitats.	1.2 Maintain the size, shape and configuration of habitat within the natural range of variation.	Avoid salvage operations in areas with high residual habitat value, such as areas with developed shrub layers and surviving non-pine trees. Where salvage logging occurs, use partial retention harvesting, and retain structural features such as deciduous trees, snags, veteran trees and cavity-bearing trees within retention patches to maintain habitat values for priority forest species. Focus restoration efforts on stands that are not already regenerating. Convert single-species stands by retaining live non-pine trees and planting a mix of species.	2.1 Site/area management 5.3 Private sector standards and codes	Cassin's Finch, Dusky Flycatcher, Dusky Grouse, Flammulated Owl, Lewis's Woodpecker, Mountain Chickadee, Northern Goshawk, Northern Saw-whet Owl, Olive-sided Flycatcher, Purple Finch, Pygmy Nuthatch, Red Crossbill, Williamson's Sapsucker
Loss of important habitat features to forest management or firewood cutting.	5.3 Logging & wood harvesting	Maintain key habitat features in coniferous forests, including wildlife trees.	1.4 Maintain important habitat features on the landscape.	Manage forests to maintain key habitat features such as large veteran trees, snags, cavity-bearing trees, and successional openings. Increase public awareness of the importance and rarity of wildlife trees, and alternatives to complete removal of danger trees. Use wildlife tree signs on wildlife trees to identify their importance and enhance their protection. Have potential danger trees properly assessed so that every effort can be made to retain (and if necessary, modify to remove dangerous portions) wildlife trees as an alternative to removal. Only standing dead trees (less than 40 cm in diameter) with limited wildlife value should be felled for salvage or firewood cutting. Enforce the use and compliance of permits.	4.3 Awareness and communica-tions 5.2 Policies and regulations 5.3 Private sector standards and codes	American Kestrel, Black-backed Woodpecker, Flammulated Owl, Lewis's Woodpecker, Northern Goshawk, Northern Saw-whet Owl, Pygmy Nuthatch, Vaux's Swift, White-headed Woodpecker, Williamson's Sapsucker
Degradation of habitat from mechanical thinning and herbicides which reduce deciduous cover.	5.3 Logging & wood harvesting 9.3 Agricultural & forestry effluents	Maintain key habitat features in coniferous forests, including shrub layers in successional openings and aspen.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat.	Maintain a diversity of structural stages and important habitat components (e.g., snags, aspen of all size classes, shrubby openings, deciduous cover) across the forested landscape. Strive to mimic, retain, or restore pre-settlement proportions and distribution of forest types, structural stages, and habitat components. Confine herbicide control of shrubs competing with regenerating forest to the area immediately surrounding affected trees so some shrub cover is retained for birds and other wildlife.	5.3 Private sector standards and codes	Dusky Flycatcher, Mountain Chickadee

Table 6 continued

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Priority species affected
Degradation of coniferous forest habitats due to grazing practices.	2.3 Livestock farming & ranching	Maintain and enhance the quantity, quality and diversity of coniferous habitats.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat.	Manage grazing to maintain the composition, density and vigour of natural undergrowth and avoid soil damage. Maintain a well-developed woody and herbaceous understory. Where necessary, use fencing to control livestock access.	5.3 Private sector standards and codes	Dusky Flycatcher, Dusky Grouse, Flammulated Owl, Lewis's Woodpecker, Mountain Chickadee, Olive-sided Flycatcher
Harvested areas may function as ecological traps.	5.3 Logging & wood harvesting	Maintain and enhance the quantity, quality and diversity of coniferous habitats.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat.	Research is needed to determine if and how clearcuts function as ecological traps for Olive-sided Flycatcher.	8.1 Research	Olive-sided Flycatcher
Changes in forest structure due to fire suppression.	7.1 Fire & fire suppression	Maintain and enhance fire-dependent ecosystems in coniferous habitats.	1.3 Ensure the continuation of natural processes that maintain bird habitat.	Wherever possible, re-introduce or mimic historic fire regimes in fire-dependent ecosystems to maintain a full range of structural stages and features such as fire-created snags. Conduct prescribed burning in early spring, fall or winter. Avoid post-fire salvage logging.	2.3 Habitat and natural process restoration 5.3 Private sector standards and codes	Black-backed Woodpecker, Common Nighthawk, Flammulated Owl, Lewis's Woodpecker, Olive-sided Flycatcher, Pygmy Nuthatch, Williamson's Sapsucker
Fragmentation of habitat from transmission line creation and hydro-electric development. Degradation of old growth habitat due to forest management for even-aged forests.	4.2 Utility & service lines 5.3 Logging & wood harvesting 7.2 Dams & water management/use	Maintain and enhance the quality, configuration and connectivity of old-growth coniferous habitats.	1.2 Maintain the size, shape and configuration of habitat within the natural range of variation.	Within the Spotted Owl's range, create Wildlife Habitat Areas for Spotted Owl. Avoid further fragmentation and maximize connectivity of existing old growth coniferous habitats. Maintain areas of approximately 3600-ha, two-thirds of which should be old growth forest. Maintain linkages among nest sites and other suitable habitats to provide avenues for dispersal. Retain old growth forest and components: large, dominant, live and dead wildlife trees (especially trees with large cavities, broken tops or dwarf mistletoe infections); coarse woody debris and open multilayer, multispecies canopies with no fewer than 240 stems/ha.	1.1 Site/area protection 5.2 Policies and regulations 5.3 Private sector standards and codes	Spotted Owl
Reduction in prey availability due to pesticide	9.3 Agricultural & forestry effluents	Adopt integrated pest management	5.1 Maintain natural food webs and prey sources.	Avoid use of pesticides. When necessary, use only as part of an integrated pest management system to minimize destruction of non-target invertebrate species.	5.3 Private sector standards and codes	Common Nighthawk, Flammulated Owl, Lewis's Woodpecker, Olive-sided Flycatcher,

Table 6 continued

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Priority species affected
use.		to minimize use of pesticides.		If available, use biological control for specific noxious species, rather than chemical control.		Vaux's Swift, White-throated Swift, Williamson's Sapsucker
Reduced survival of priority owl species due to Barred Owl competition and predation.	8.2 Problematic native species	Determine the impacts of Barred Owl on other owl populations as Barred Owls expand their range.	7.4 Improve understanding of causes of population declines.	Research is required to determine Barred Owl impacts on native owl populations (such as predation rates on priority species, degree of competition for prey, and extent of interbreeding between Barred and Spotted Owls) and identify potential mitigation strategies.	8.1 Research	Flammulated Owl, Spotted Owl
Decreased productivity and nest failure or abandonment due to disturbance from quarrying activity or rock climbing.	3.2 Mining & quarrying 6.1 Recreational activities 6.2 Work and other activities	Avoid disturbance of nesting priority species.	4.1 Reduce disturbance from human recreation. 4.2 Reduce disturbance from industrial or work activity.	Prevent rock climbing on or near occupied Canyon Wren, Rock Wren or White-throated Swift nesting habitat from May through July. Increase public awareness of the impacts of human disturbance on priority species, and methods to minimize such disturbance. Prevent removal of talus rock on or near these priority species' nesting and foraging habitats. Implement programs to monitor the use of cliffs by climbers and to evaluate spatial and temporal changes in number of birds, including changes in the number of invasive species.	4.3 Awareness and communica-tions 5.3 Private sector standards and codes 8.2 Monitoring	Canyon Wren, Rock Wren, White-throated Swift
Lowered productivity, nest abandonment and failure due to nest site disturbance from forestry operations.	6.3 Work & other activities	Avoid disturbance of nesting raptors.	4.2 Reduce disturbance from industrial or work activity.	Avoid loud noises or human activity near goshawk nest sites, particularly during their breeding period (March 1 to August 15). Allow no road construction, blasting, heli-logging, or fly-overs within a 200-m radius of any active goshawk nest trees. Minimize the use of existing roads within the nesting area.	5.3 Private sector standards and codes	Northern Goshawk
Decreased availability of nest cavities due to competition from European Starlings.	8.1 Invasive non-native/alien species	Ensure that nest site competition is not limiting Lewis's Woodpecker populations.	3.1 Reduce competition with invasive species.	Conduct research to understand conditions under which nest-site competition with European Starlings may be limiting Lewis's Woodpecker populations. In the interim, increase retention of cavity-bearing trees and snags as nesting habitat. In areas where cavities are limited, consider initiating a long-term, well-managed nest-box program.	5.3 Private sector standards and codes 8.1 Research	Lewis's Woodpecker

Mixed Wood

Mixed wood habitats (where coniferous tree basal area is <75% of total tree basal area) occur throughout BCR 9, typically dispersed within more extensive coniferous forest wherever disturbance or soils have allowed a substantial deciduous component to develop (Fig. 11). Mixed wood forests cover about 7.1% of the BC portion of BCR 9 (CIJV 2009). Nine (9) priority species have been identified as using mixed-wood habitats, including 8 landbirds and one waterbird (Table 7).

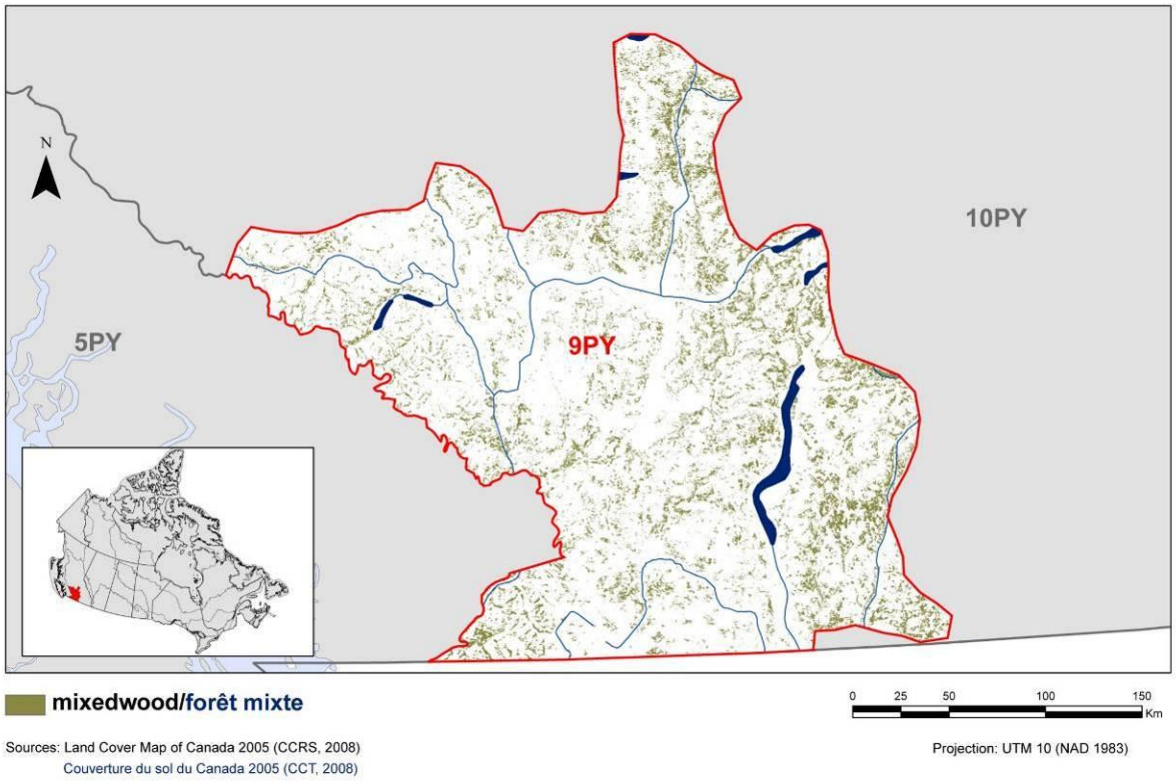

Figure 11. Map of mixed wood habitat in BCR 9 Pacific and Yukon Region: Great Basin.

Like coniferous forest, the primary threat to priority species in mixed wood habitats is loss of habitat and alteration of forest composition and structure through timber harvest (Fig. 12). Species are also threatened by loss or degradation of habitat due to urban/industrial development and agricultural expansion. The primary actions to address these threats include management of timber harvest for the protection and conservation of biodiversity, including maintenance of habitat features for priority species, and protection of key areas of habitat (Table 8).

Table 1. Priority species that use mixed wood habitat, regional habitat sub-class, important habitat features, population objectives and reason for priority status in BCR 9 Pacific and Yukon Region.

Priority Species	Regional habitat sub-class	Important habitat features	Population objective	Reason for priority status			
				At Risk	CC	S	NAWMP
Band-tailed Pigeon	Forest	mineral springs, openings/clearings, fruiting understory shrubs	Assess / Maintain	Y	Y		
Calliope Hummingbird	shrub, mature	openings/clearings	Assess / Maintain		Y	Y	
Great Blue Heron (*herodias*)	Mature	cottonwood riparian, veteran trees	Assess / Maintain	Y			
Mountain Chickadee	Mature	cavities, aspen groves	Increase 50%		Y		
Northern Saw-whet Owl	mature, old-growth	cavities, snags	Assess / Maintain		Y		
Olive-sided Flycatcher	Mature	recent burns, snags, openings/clearings	Increase 100%	Y	Y		
Purple Finch	Mature	openings/clearings	Increase 100%		Y		
Townsend's Warbler	mature/old growth		Increase 50%		Y		
Williamson's Sapsucker	mature, old-growth	snags, veteran trees, aspen groves, larch	Recovery objective	Y	Y		

Note: Reasons for inclusion in the priority species list are as follows. At Risk: the species is assessed as either Endangered, Threatened or Special Concern by COSEWIC, or the species is on the Red or Blue lists in BC; CC: the species meets Conservation Concern criteria for its bird group; S: the species meets Stewardship criteria for its bird group; NAWMP: the species has NAWMP priority of Moderate-High, High or Highest in the BCR.

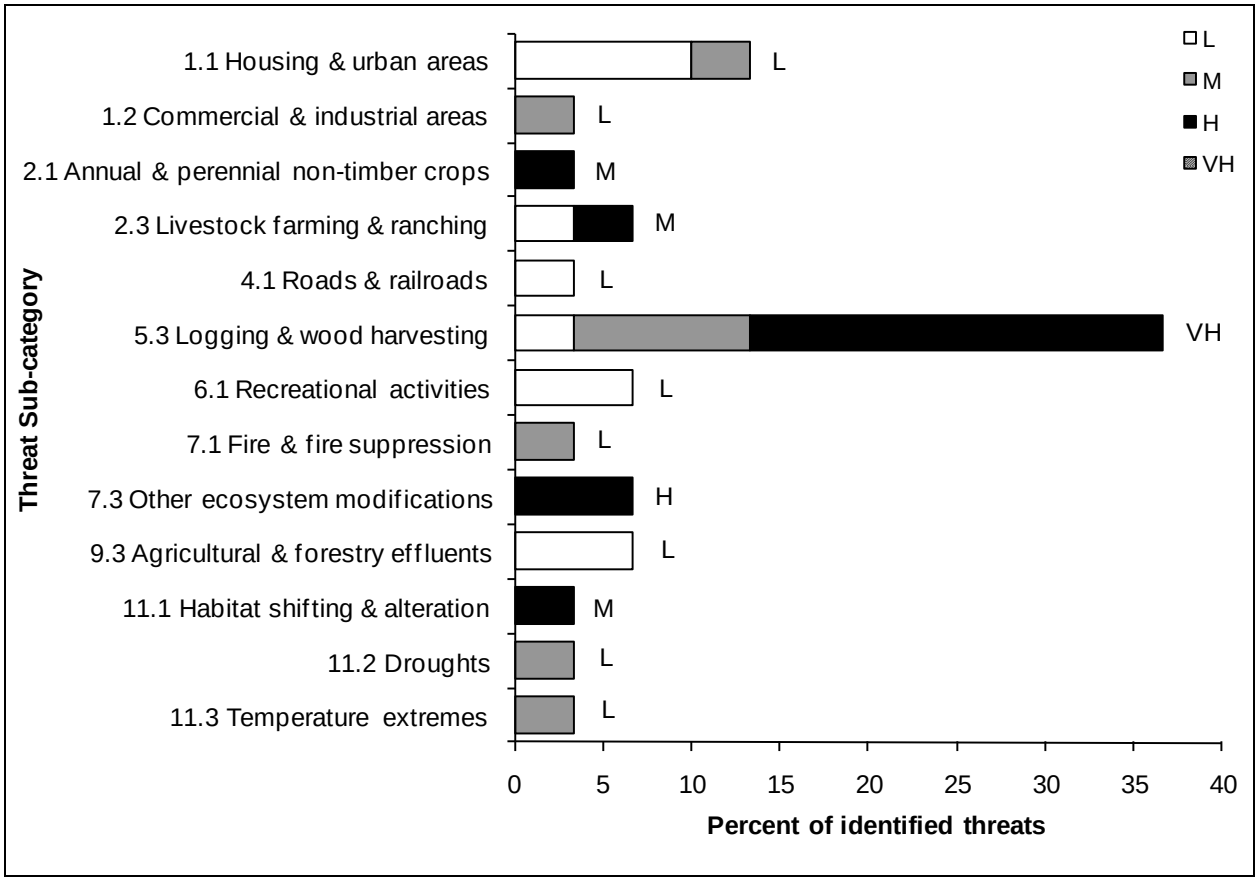

Figure 12. Percent of identified threats to priority species in mixed wood habitat in each threat sub-category.

Each bar represents the percent of the total number of threats identified in each sub-threat 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 9 Pacific and Yukon Region by threat category and broad habitat class).

Note: The overall rolled-up magnitude of the threats in each sub-category is shown at the end of each bar. Threats of all magnitudes are included, although low ranked threats affecting only a single species were not assigned conservation objectives or recommended actions. *7.3 Other ecosystem modifications* refers to changes in forest structure due to the current mountain pine beetle outbreak. *9.3 Agricultural and forestry effluents* refers to effects of pesticide use.

Table 2. Threats addressed, conservation objectives, recommended actions, and priority species affected for mixed wood habitat in BCR 9 Pacific and Yukon Region.

Threats addressed	Threat category	Objectives	Objective category	Recommended actions	Action category	Priority species affected
Loss of low elevation and old-growth/mature mixed woodland and important habitat features forest to logging.	5.3 Logging & wood harvesting	Maintain and enhance the quantity, quality and diversity of mixed woodland habitats.	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. 1.4 Maintain important habitat features on the landscape.	Protect all remaining old-growth stands and maintain large contiguous tracts of mature trees. Use harvest techniques such as selective cutting and partial retention that mimic natural disturbance regimes. Manage forests to maintain a diversity of structural stages and important habitat components, such as aspen of all size classes for Mountain Chickadee, fruiting understory layer for Band-tailed Pigeon, and snags and cavity-bearing trees for Northern Saw-whet Owl.	1.1 Site/area protection 5.3 Private sector standards and codes	Band-tailed Pigeon, Mountain Chickadee, Northern Saw-whet Owl, Purple Finch, Townsend's Warbler
Habitat loss and changes in forest structure due to the mountain pine beetle infestation.	7.3 Other ecosystem modifications	Maintain and enhance the quantity, quality and diversity of mixed woodland habitats.	1.2 Maintain the size, shape and configuration of habitat within the natural range of variation.	Avoid salvage operations in areas with high residual habitat value, such as areas with developed shrub layers and surviving non-pine trees. Where salvage logging occurs, use partial retention harvesting, and retain structural features such as deciduous trees, snags, veteran trees and cavity-bearing trees within retention patches to maintain habitat values for priority forest species. Focus restoration efforts on stands that are not already regenerating. Convert single-species stands by retaining live non-pine trees and planting a mix of species.	2.1 Site/area management 5.3 Private sector standards and codes	Olive-sided Flycatcher, Purple Finch
Loss of low-elevation mixed woodland and important habitat features to development and agricultural expansion.	1.1 Housing & urban areas 1.2 Commercial & industrial areas 2.1 Annual & perennial non-timber crops	Maintain and enhance the quantity, quality and diversity of mixed woodland habitats.	1.4 Maintain important habitat features on the landscape.	Secure and manage remaining low-elevation/bottomland deciduous forests through various methods such as creation of protected areas, private land acquisitions, conservation easements, community conservation plans and stewardship agreements. Establish protected areas around existing Great Blue Heron nesting colonies. Maintain key habitat features such as groups of large veteran trees for Great Blue Heron.	1.1 Site/area protection 2.1 Site/area management 5.3 Private sector standards and codes	Great Blue Heron (*herodias*)

Table 8 continued

Threats addressed	Threat category	Objectives	Objective category	Recommended actions	Action category	Priority species affected
Loss of important habitat features to logging.	5.3 Logging & wood harvesting	Maintain and enhance the quantity, quality and diversity of mixed woodland habitats.	1.4 Maintain important habitat features on the landscape.	Maintain natural forest openings and semi-open forest, especially in proximity to water or wetlands. Maintain residual trees in young regenerating forests (post-cutting or post-burn) to provide adequate nesting/perching habitat. Avoid salvage logging in burns, and/or retain tall live trees and snags for perching/nesting.	5.3 Private sector standards and codes	Olive-sided Flycatcher
Harvested areas may function as ecological traps.	5.3 Logging & wood harvesting	Maintain and enhance the quantity, quality and diversity of mixed woodland habitats.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat.	Research is needed to determine if and how clearcuts function as ecological traps for Olive-sided Flycatcher.	8.1 Research	Olive-sided Flycatcher
Loss of important habitat features to danger tree removal, and salvage or firewood cutting.	5.3 Logging & wood harvesting	Maintain key habitat features for Williamson's Sapsucker in mixed woodland habitats.	1.4 Maintain important habitat features on the landscape.	Manage forests to maintain key habitat features such as large veteran trees, snags, cavity-bearing trees, and decaying logs and stumps. Increase public awareness of the importance and rarity of wildlife trees, and alternatives to complete removal of danger trees. Use wildlife tree signs on wildlife trees to identify their importance and enhance their protection. Have potential danger trees properly assessed so that every effort can be made to retain (and if necessary, modify to remove dangerous portions) wildlife trees as an alternative to removal. Only standing dead trees (less than 40 cm in diameter) with limited wildlife value should be felled for salvage or firewood cutting.Support the use of and compliance with permits.	4.3 Awareness and communications 5.2 Policies and regulations 5.3 Private sector standards and codes 5.4 Compliance and enforcement	Williamson's Sapsucker

Table 8 continued

Threats addressed	Threat category	Objectives	Objective category	Recommended actions	Action category	Priority species affected
Habitat loss from urban and rangeland expansion, fire suppression and logging.	1.1 Housing & urban areas 2.3 Livestock farming & ranching 5.3 Logging & wood harvesting 7.1 Fire & fire suppression	Prevent further loss of amount and/or quality of currently known suitable Williamson's Sapsucker 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.	Secure and manage mixed woodland habitat for Williamson's Sapsucker through various methods including land acquisition, conservation easements, stewardship agreements or establishment of formal parks, protected areas, or management areas. Implement changes to land use practices such that stand and landscape-level functionality for Williamson's Sapsuckers is maintained.	2.1 Site/area management 5.3 Private sector standards and codes	Williamson's Sapsucker
Impaired regeneration of aspen stands (preferred Mountain Chickadee nesting habitat) due to grazing and forestry practices.	2.3 Livestock farming & ranching 5.3 Logging & wood harvesting	Maintain an adequate supply of nesting sites for priority species.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat.	Manage grazing to maintain aspen stands and allow aspen regeneration in managed forests. Reduce or remove grazing pressure where needed to allow regeneration of aspen stands. Where necessary, use fencing to control livestock access. Where needed, nest-boxes may be used to provide nesting habitat until natural cavities/cavity substrates are in sufficient supply.	3.2 Species recovery 5.3 Private sector standards and codes	Mountain Chickadee

Shrub/Early Successional

The shrub and early successional habitat class refers to areas dominated by early seral, shrubby vegetation. Early seral forest habitat occurs wherever wildfire, timber harvest or other disturbances have created successional openings within forests or riparian areas (Fig. 13). Four priority species in BCR 9, all landbirds, were associated with this habitat class (Table 9).

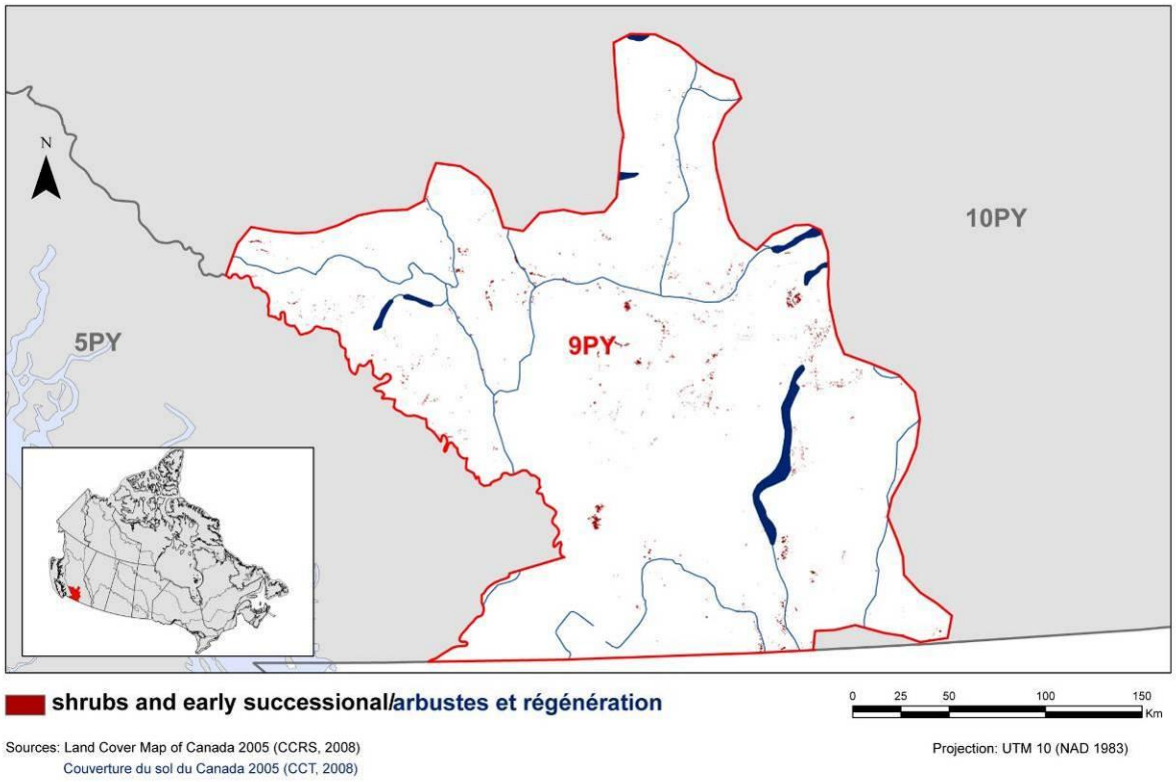

Figure 13. Map of shrub and early successional habitat in BCR 9 Pacific and Yukon Region: Great Basin.

There are relatively few threats to priority species in this habitat type, and these primarily stem from degradation of habitat due forestry practices (Fig. 14). While new patches of early seral habitat are created by timber harvest, they are typically managed for accelerated conifer regrowth, which may reduce their suitability for various priority species (Betts et al. 2010). Key actions include management of timber production and harvest to maintain suitable, high-quality habitat for species that use early successional habitats (Table 10).

Table 3. Priority species that use shrub and early successional habitat, regional habitat sub-class, important habitat features, population objectives and reason for priority status in BCR 9 Pacific and Yukon Region.

Priority species	Regional habitat sub-class	Important habitat features	Population objective	Reason for priority status			
				At Risk	CC	S	NAWMP
Dusky Flycatcher	early seral	openings/clearings, clearcuts, burns, young aspen copses	Increase 50%		Y		
Lazuli Bunting	early seral	aspen groves, cottonwood riparian, recent burns, wet draws in shrubsteppe	Assess / Maintain			Y	
MacGillivray's Warbler	early seral	cottonwood riparian, recent burns	Increase 50%		Y		
Willow Flycatcher	early seral	clearcuts, openings/clearings	Increase 100%		Y		

Note: Reasons for inclusion in the priority species list are as follows. At Risk: the species is assessed as either Endangered, Threatened or Special Concern by COSEWIC, or the species is on the Red or Blue lists in BC; CC: the species meets conservation concern criteria for its bird group; S: the species meets stewardship criteria for its bird group; NAWMP: the species has NAWMP priority of Moderate-High, High or Highest in the BCR.

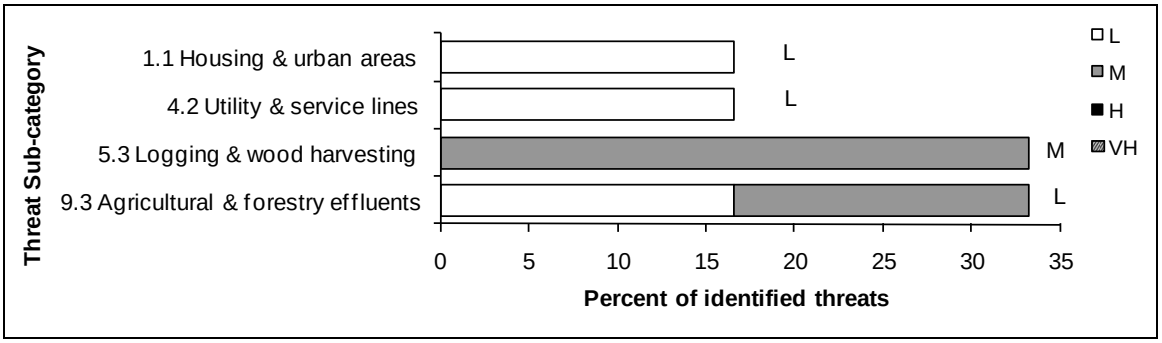

Figure 14. Percent of identified threats to priority species in shrub and early successional habitat in each threat subcategory.

Each bar represents the percent of the total number of threats identified in each sub-threat category in shrub and early successional habitat (for example, if 100 threats were identified in total for all priority species in shrub and early successional habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). 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 and 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 9 Pacific and Yukon Region by threat category and broad habitat class).

Note: The overall rolled-up magnitude of the threats in each sub-category is shown at the end of each bar. Threats of all magnitudes are included, although low ranked threats affecting only a single species were not assigned conservation objectives or recommended actions. *9.3 Agricultural and forestry effluents* includes effects of pesticide and herbicide use.

Table 4. Threats addressed, conservation objectives, recommended actions and priority species affected for shrub and early successional habitat in BCR 9 Pacific and Yukon Region.

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Priority species affected
Mechanical thinning and herbicides reduce deciduous cover in managed regenerating clearcuts.	5.3 Logging & wood harvesting 9.3 Agricultural & forestry effluents	Maintain key habitat features in forests, including deciduous shrub layers in successional openings.	1.4 Maintain important habitat features on the landscape.	Maintain a diversity of structural stages, including early seral stages, and important habitat components, such as deciduous shrub cover, within forests. Confine mechanical or herbicide control of shrubs competing with regenerating forest to the area immediately surrounding affected trees so some shrub cover is retained for birds and other wildlife.	5.3 Private sector standards and codes	Dusky Flycatcher, MacGillivray's Warbler

Herbaceous

Herbaceous habitat includes native grassland, shrubsteppe and agricultural land (cultivated and managed areas). Most of BCR 9's grasslands are found in the hottest and driest parts of main valleys and adjacent benches dissected by the Kettle, Okanagan, Similkameen, Thompson, Nicola and Fraser Rivers (Delesalle 2009; Fig. 15). Currently, undeveloped grassland and shrubsteppe habitat covers just over 5% of BCR 9 in Canada (Grasslands Conservation Council of BC 2004). While most of British Columbia is publicly owned Crown land, private ownership of grasslands is disproportionately high—50% of grasslands in the Okanagan Valley are privately owned, and a massive 70% of grasslands in the Southern Thompson Upland (Grasslands Conservation Council of BC 2004).

Approximately 17% of historic grasslands in BCR 9 have been lost to agriculture, and about 6% have been lost to urbanization (Grasslands Conservation Council of BC 2004). This is especially pronounced in the Okanagan valley where historical mapping indicates significant losses of big sagebrush shrubsteppe (33%), antelope brush—needle-and-thread grass (68%), and Idaho fescue—bluebunch wheat grass (77%) ecosystems to urban, rural and agricultural development since 1800 (Lea 2008). Grassland birds are one of the fastest and most consistently declining groups in North America (North American Bird Conservation Initiative, U.S. Committee 2009). According to the Breeding Bird Survey of Canada, grassland bird populations in BCR 9 have experienced a significant mean annual decline of 2.4% per year over the past 20 years (Collins and Downes 2009). Of the 37 priority species that use herbaceous habitats in BCR 9 (29 landbirds, 2 shorebirds, 6 waterfowl), 22 are considered at risk, either federally or provincially (Table 11).

The location of grassland and shrubsteppe habitat at or close to valley bottoms makes them particularly vulnerable to impacts by humans. Loss of native grassland and shrubsteppe to forest encroachment (due to fire suppression), urban, industrial, recreational and agricultural development, grazing practices which degrade grassland and shrubsteppe habitats and facilitate invasive plant species, and agricultural practices such as pesticide spraying and spring mowing, are the greatest threats to birds using herbaceous habitats in BCR 9 (Fig. 16). Key actions to conserve grassland birds include protection of remaining native grasslands to preserve habitat and maximize connectivity, and management of grazing to avoid degradation and to maintain habitat suitability for priority species (Table 12). Priority actions also include the use of beneficial management practices in agriculture and pest and non-native weed management to maintain bird biodiversity, and the reintroduction of historical fire regimes to control forest ingrowth (Fig. 16).

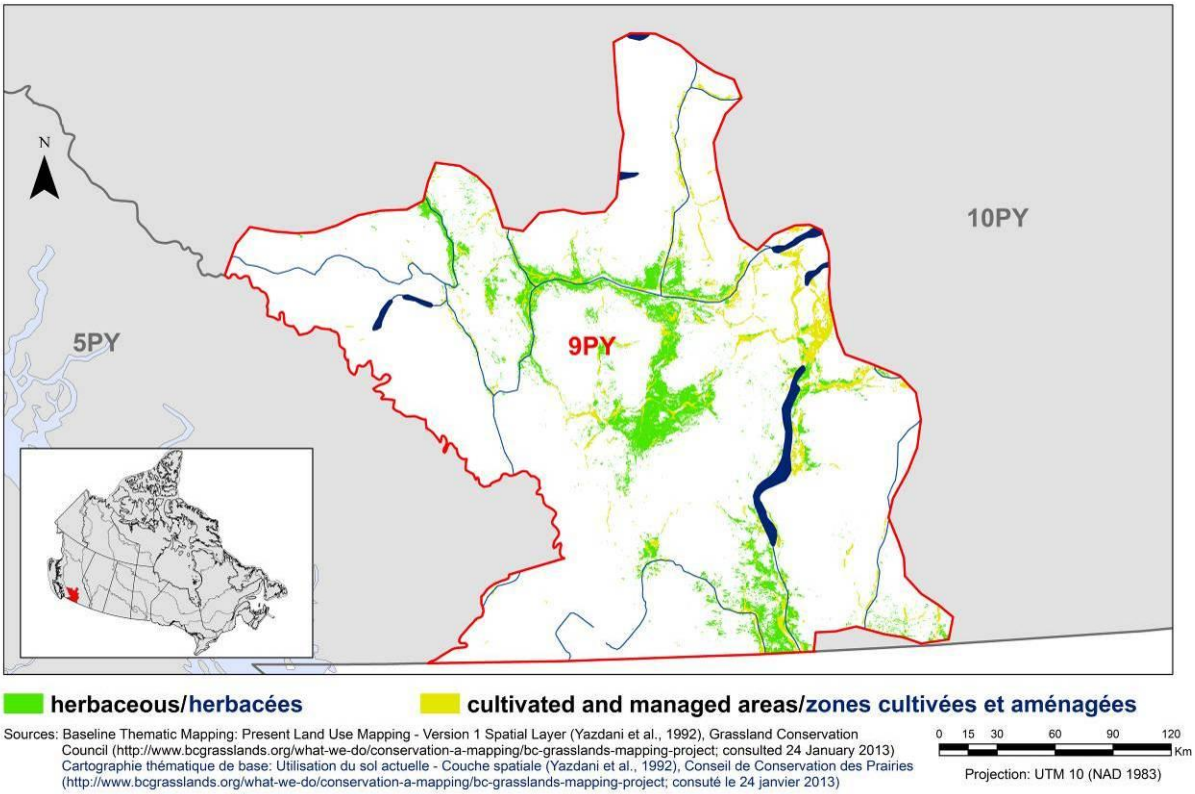

Figure 15. Map of herbaceous habitat and cultivated/managed areas in BCR 9 Pacific and Yukon Region: Great Basin.

Table 5. Priority species that use herbaceous habitat, regional habitat sub-class, important habitat features, population objectives and reason for priority status in BCR 9 Pacific and Yukon Region.

Priority species	Regional habitat sub-class	Important habitat features	Population objective	Reason for priority status			
				At Risk	CC	S	NAWMP
American Golden-Plover	hayfield/tame pasture		Migrant (no population objective)	Y	Y		
American Kestrel	native grassland, hayfield/tame pasture	cavities, openings/clearings, aspen groves	Increase 50%		Y	Y	
Bank Swallow	native grassland, shrubsteppe, hayfield/tame pasture	steep vertical banks	Assess / Maintain			Y	
Barn Owl	old field, hayfield/tame pasture	cavities, nest boxes	Assess / Maintain	Y			
Barn Swallow	native grassland, hayfield/tame pasture	openings/clearings, man-made ledges	Increase 100%	Y	Y		
Black-billed Magpie	shrub steppe		Assess / Maintain			Y	
Bobolink	native grasslands, hayfield/tame pasture		Increase 100%	Y			
Brewer's Sparrow (*breweri*)	shrub steppe		Increase 100%	Y	Y	Y	
Burrowing Owl	native grassland, hayfield/tame pasture	burrows	Recovery objective	Y	Y		
Canada Goose	hayfield/tame pasture, row crop, old field, native grassland		Maintain current				Y
Canyon Wren	shrub steppe	cliffs/canyons, outcrops/bluffs	Assess / Maintain	Y			
Common Nighthawk	old field, native grassland, hayfield/tame pasture, shrubsteppe	recent burns, clearcuts, rocky clearings, outcrops/bluffs	Assess / Maintain	Y			
Common Poorwill	shrub steppe, native grassland, hayfield/tame pasture	openings/clearings	Assess / Maintain			Y	
Dusky Grouse	native grassland, shrubsteppe	subalpine meadows, aspen groves, openings/clearings, burns	Increase 100%		Y		
Ferruginous Hawk	native grasslands, hayfield/tame pasture, shrubsteppe	nest trees on edge of/within grassland	Assess / Maintain	Y	Y	Y	
Golden Eagle	native grasslands, shrubsteppe	cliffs/canyons, outcrops/bluffs	Increase 50%		Y	Y	
Grasshopper Sparrow	native grasslands, hayfield/tame pasture, old field, shrubsteppe		Increase 100%	Y	Y		
Greater White-fronted Goose	hayfield/tame pasture, row crop		Migrant (no population objective)				Y
Gyrfalcon	hayfield/tame pasture	outcrops/bluffs	Assess / Maintain	Y			
Horned Lark (*merrilli*)	native grasslands, row crop, shrubsteppe		Increase 50%	Y			
Lark Sparrow	shrubsteppe, native grassland, pasture		Increase 50%	Y	Y		
Lesser Snow Goose	hayfield/tame pasture, row crop		Migrant (no population objective)				Y
Long-billed Curlew	native grassland, hayfield/tame pasture, row crop, oldfield		Assess / Maintain	Y	Y		
Long-eared Owl	old field, native grassland	forest adjacent to grassland/open areas	Assess / Maintain			Y	
Northern Harrier	old field, native grasslands		Assess / Maintain			Y	
Northern Pintail	native grassland, hayfield/tame pasture,		Maintain current				Y

Table 11 continued

Priority species	Regional habitat sub-class	Important habitat features	Population objective	Reason for priority status			
				At Risk	CC	S	NAWMP
	row crop, oldfield						
Northern Shoveler	native grassland, old field		Maintain current				Y
Prairie Falcon	native grasslands, old field, shrubsteppe	cliffs/canyons, outcrops/bluffs	Assess / Maintain	Y	Y	Y	
Rock Wren	shrub steppe	outcrops/bluffs	Increase 50%			Y	
Rough-legged Hawk	old field, native grasslands, hayfield/tame pasture		Assess / Maintain	Y			
Sage Thrasher	shrub steppe	mature sagebrush	Increase 50%	Y	Y	Y	
Sharp-tailed Grouse (*columbianus*)	native grasslands, shrubsteppe	dense shrub, riparian adjacent to open areas, lek sites, aspen copses	Increase by 100%	Y	Y		
Short-eared Owl	native grasslands, old field		Increase 50%	Y	Y		
Swainson's Hawk	native grasslands, hayfield/tame pasture, old field	nest trees on edge of or within grassland	Assess / Maintain	Y	Y		
Tundra Swan	hayfield/tame pasture, row crops		Maintain current	Y			Y
Western Meadowlark	native grasslands, hayfield/tame pasture		Increase 50%	Y	Y		
White-throated Swift	native grasslands	cliffs/canyons	Assess / Maintain		Y		

Note: Reasons for inclusion in the priority species list are as follows. At Risk: the species is assessed as either Endangered, Threatened or Special Concern by COSEWIC, or the species is on the Red or Blue lists in BC; CC: the species meets Conservation Concern criteria for its bird group; S: the species meets Stewardship criteria for its bird group; NAWMP: the species has NAWMP priority of Moderate-High, High or Highest in the BCR.

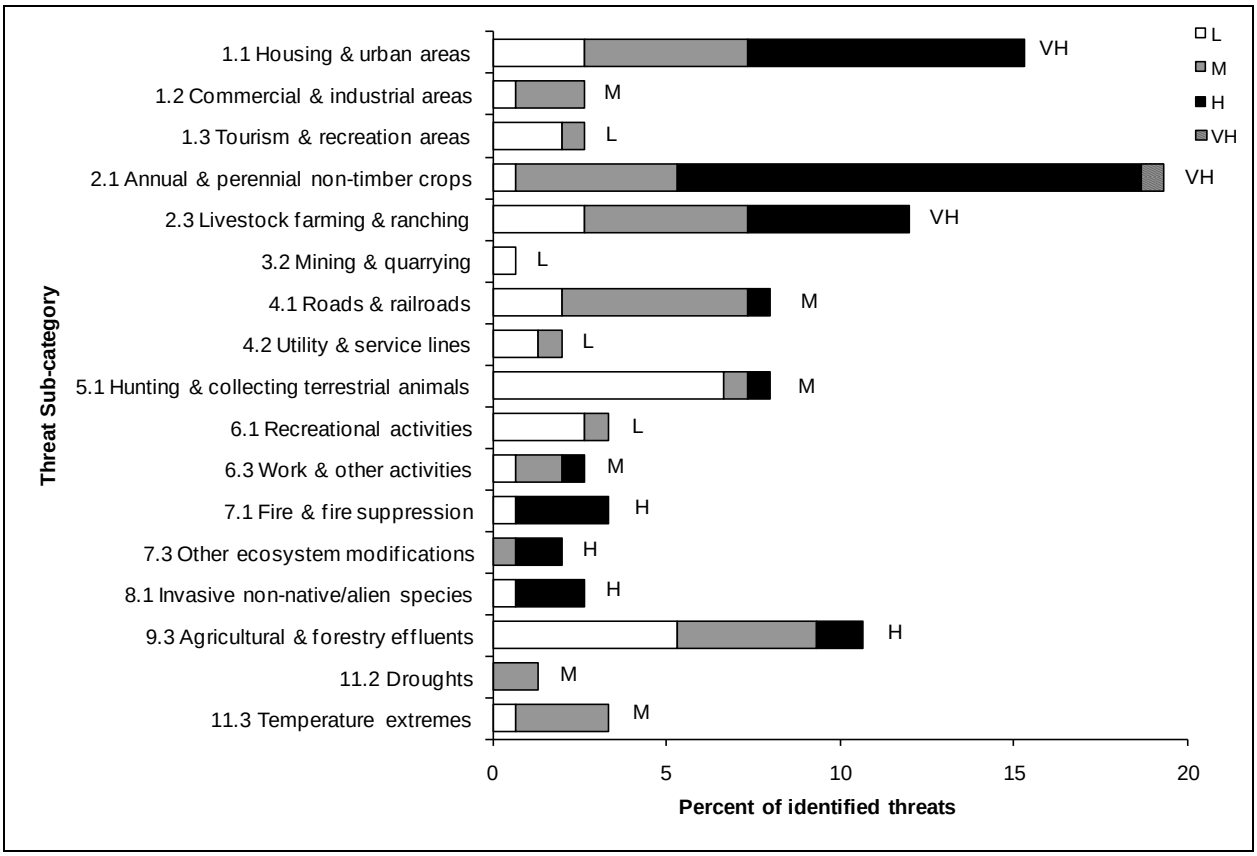

Figure 16. Percent of identified threats to priority species in herbaceous habitat in each threat sub-category.

Each bar represents the percent of the total number of threats identified in each sub-threat 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 9 Pacific and Yukon Region by threat category and broad habitat class).

Note: The overall rolled-up magnitude of the threats in each sub-category is shown at the end of each bar. Threats of all magnitudes are included, although low ranked threats affecting only a single species were not assigned conservation objectives or recommended actions. *5.1 Hunting and collecting terrestrial animals* refers primarily to lead poisoning due to ingestion of lead shot, but also includes illegal harvest and persecution. *8.1 Invasive non-native/alien species* refers primarily to habitat degradation due to invasive plant species. *9.3 Agricultural and forestry effluents* refers to the effects of pesticide use.

Table 6. Threats addressed, conservation objectives, recommended actions and priority species affected for herbaceous habitat in BCR 9.

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Priority species affected
Loss of habitat to urban, industrial and recreational development. Loss of habitat to agricultural activities.	1.1 Housing & urban areas 1.2 Commercial & industrial areas 1.3 Tourism & recreation areas 2.1 Annual & perennial non-timber crops	Maintain the quantity, quality and diversity of grassland and shrubsteppe habitats.	1.2 Maintain the size, shape and configuration of habitat within the natural range of variation.	Secure and manage herbaceous and shrubsteppe habitat for priority birds through various methods including land acquisition, conservation easements, stewardship agreements or establishment of formal parks, protected areas, or management areas. Avoid fragmenting existing grassland or shrubsteppe tracts. Reserves should be more or less circular or square shape to maximize the core area and minimize edge effects for edge sensitive species. Maximize connectivity of suitable habitats required for nesting, foraging and rearing young (e.g., sagebrush habitats, aspen-dominated ravines, adjacent wetlands).	1.1 Site/area protection 2.1 Site/area management	American Golden-Plover, Barn Owl, Barn Swallow, Bobolink, Burrowing Owl, Brewer's Sparrow, Common Nighthawk, Common Poorwill, Dusky Grouse, Ferruginous Hawk, Golden Eagle, Grasshopper Sparrow, Horned Lark (*merrilli*), Lark Sparrow, Long-billed Curlew, Long-eared Owl, Northern Harrier, Northern Pintail, Northern Shoveler, Prairie Falcon, Rough-legged Hawk, Sage Thrasher, Sharp-tailed Grouse, Short-eared Owl, Swainson's Hawk, Western Meadowlark
Degradation of grassland and shrubsteppe habitat from grazing activity.	2.3 Livestock farming & ranching	Maintain the quality and diversity of grassland and shrubsteppe habitats.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat.	Use grazing systems that contain rest, rotation, deferment and proscribed burning to produce a mosaic of habitat patches on the landscape which benefit a variety of grassland species. Plan livestock grazing to maintain the desired structure and density of the plant community for priority species. Grazing levels may not be the same for each of these species. Where necessary, use fencing to control livestock access.	2.3 Habitat and natural process restoration 5.3 Private sector standards and codes	Bobolink, Brewer's Sparrow (*breweri*), Dusky Grouse, Ferruginous Hawk, Grasshopper Sparrow, Northern Harrier, Northern Pintail, Northern Shoveler, Sage Thrasher, Sharp-tailed Grouse, Short-eared Owl

Table 12 continued

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Priority species affected
Loss of nests due to livestock trampling.	2.3 Livestock farming & ranching	Avoid disturbance of nesting priority birds and destruction of nests due to livestock activity.	2.9 Reduce nest destruction.	Do not concentrate livestock in priority grassland and shrubsteppe habitats during the breeding season (1 May - 1 August) to minimize disturbance and trampling by livestock. Allow longer rest periods (6 weeks or more) during the breeding season in rotationally-grazed systems. Maintain some pastures as "refuge areas" that are completely undisturbed during the breeding season. Where necessary, use fencing to control livestock access.	5.3 Private sector standards and codes	Grasshopper Sparrow, Horned Lark (*merrilli*) Lark Sparrow, Northern Harrier
Forest encroachment due to fire suppression.	7.1 Fire & fire suppression	Maintain and enhance fire-dependent ecosystems in grassland and shrubsteppe habitats.	1.3 Ensure the continuation of natural processes that maintain bird habitat.	Wherever possible, re-introduce or mimic historic fire regimes to maintain fire-dependent ecosystems. Conduct prescribed burning in early spring, fall or winter.	2.3 Habitat and natural process restoration	Lark Sparrow, Long-Billed Curlew, Sage Thrasher, Sharp-tailed Grouse, Swainson's Hawk
Habitat fragmentation may lead to increased predation.	2.3 Livestock farming & ranching	Maintain and enhance the quality, configuration and connectivity of grassland and shrubsteppe habitats.	1.2 Maintain the size, shape and configuration of habitat within the natural range of variation.	Research is needed to clarify relationships between habitat fragmentation and predation of Burrowing Owls. Avoid further fragmenting existing grassland tracts where Burrowing Owls breed.	5.3 Private sector standards and codes 8.1 Research	Burrowing Owl
Reduction in prey availability due to pesticide use.	9.3 Agricultural & forestry effluents	Adopt integrated pest management to minimize use of pesticides.	5.1 Maintain natural food webs and prey sources.	Avoid use of pesticides. When necessary, use only as part of an integrated pest management system to minimize destruction of non-target invertebrate species. If available, use biological control for specific noxious species, rather than chemical control. If available, use biological control for specific noxious species, rather than chemical control.	5.3 Private sector standards and codes	Barn Swallow, Bobolink, Burrowing Owl, Common Nighthawk, Ferruginous Hawk, Lark Sparrow, Northern Harrier, Swainson's Hawk, White-throated Swift
Invasive species alter grassland and shrubsteppe structure and	8.1 Invasive non-native/alien species	Eliminate or control invasive species while preventing	3.5 Prevent and control the spread of invasive and	Eliminate or control non-native weeds through mechanical control, biological control, grazing or herbicides (as a last resort). In some sites, prescribed burning may enhance native plant growth and reduce	2.2 Invasive/problematic species control	Brewer's Sparrow (*breweri*), Long-billed Curlew, Sharp-tailed Grouse

Table 12 continued

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Priority species affected
suitability.		further introductions.	exotic species.	non-native, invasive weeds. Increase public awareness of invasive plant species and measures to control their spread (such as regular cleaning of boats, vehicles and equipment, and using only native species for gardening, landscaping and re-vegetation purposes), to prevent establishment of additional invasive species.	4.3 Awareness and communications	
Illegal harvest and malicious shooting.	5.1 Hunting & collecting terrestrial animals	Prevent killing of protected priority species in accordance with British Columbia's *Wildlife Act.*	2.8 Reduce mortality from legal or illegal hunting, and persecution.	Increase public awareness of the legal protection of priority species under the *Migratory Birds Convention Act* and British Columbia's *Wildlife Act.* Support compliance with existing legal protection of species.	4.3 Awareness and communications 5.4 Compliance and enforcement	Golden Eagle, Prairie Falcon
Nests destroyed by haying, mowing and harvesting practices.	2.1 Annual & perennial non-timber crops	Prevent destruction of bird nests in accordance with the *Migratory Birds Convention Act*.	2.9 Reduce nest destruction.	Avoid use of heavy equipment in fields supporting breeding grassland birds during the breeding season. Delay spring mowing of hayfields until mid or late July. To minimize risk of affecting any late nesters, mow or plow from the center of the field outwards and slow equipment if birds are flushed to give adults and flightless/newly fledged young time to escape.	5.3 Private sector standards and codes	Bobolink, Long-billed Curlew, Northern Harrier, Short-eared Owl, Western Meadowlark
Removal of nests by landowners. Loss of nesting sites (building modification, building removal).	5.1 Hunting & collecting terrestrial animals 7.3 Other ecosystem modifications	Prevent destruction of bird nests in accordance with the *Migratory Birds Convention Act*.	1.4 Maintain important habitat features on the landscape. 2.9 Reduce nest destruction.	Research is needed to quantify the distribution and intensity of nest removal and assess the threat this behaviour poses to Barn Swallow populations. Increase public awareness of the species, its benefits, and current legal protection to increase stewardship and eliminate destruction of nests. Encourage landowners to incorporate nesting ledges on out-buildings in habitat suitable for Barn Swallows.	4.3 Awareness and communications 8.1 Research	Barn Swallow

Table 12 continued

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Priority species affected
Decreased productivity and nest failure or abandonment due to disturbance from quarrying activity or rock climbing.	3.2 Mining & quarrying 6.1 Recreational activities 6.2 Work and other activities	Avoid disturbance of nesting priority species.	4.1 Reduce disturbance from human recreation. 4.2 Reduce disturbance from industrial or work activity.	Prevent rock climbing on or near occupied Canyon Wren, Rock Wren or White-throated Swift nesting habitat from May through July. Increase public awareness of the impacts of human disturbance on priority species, and methods to minimize such disturbance. Prevent removal of talus rock on or near these priority species' nesting and foraging habitats. Implement programs to monitor the use of cliffs by climbers and to evaluate spatial and temporal changes in number of birds, including changes in the number of invasive species.	4.3 Awareness and communications 5.3 Private sector standards and codes 8.2 Monitoring	Canyon Wren, Rock Wren, White-throated Swift
Disturbance of nesting raptors may cause abandonment.	6.1 Recreational activities 6.3 Work & other activities	Avoid disturbance of nesting raptors.	4.1 Reduce disturbance from human recreation. 4.2 Reduce disturbance from industrial or work activity.	Keep a 200 m, naturally-vegetated buffer free of loud noises and disturbance around occupied raptor nests and other important habitats (brood rearing, roosting and foraging areas) during the entire breeding period. Locate new trails, buildings, and roads away from raptor nesting, roosting and foraging areas.	5.3 Private sector standards and codes	Ferruginous Hawk, Golden Eagle, Long-eared Owl, Prairie Falcon
Reductions in burrowing mammal populations leads to lack of suitable nesting sites for Burrowing Owls.	2.3 Livestock farming & ranching	Ensure an adequate supply of nesting sites for Burrowing Owls.	1.4 Maintain important habitat features on the landscape.	Discourage the extermination of burrowing mammals such as ground squirrels and badgers. Reintroduce burrowing mammals to areas where they previously resided and suitable habitat remains. Where burrowing animal populations are not yet re-established, install artificial nest burrows as a temporary measure.	3.2 Species recovery 3.3 Species reintroduction 4.3 Awareness and communications	Burrowing Owl
Loss of Barn Owl nesting sites with agricultural modernization and intensification.	7.3 Other ecosystem modifications	Ensure an adequate supply of nesting sites for Barn Owls.	1.4 Maintain important habitat features on the landscape.	Increase public awareness of the Barn Owl and encourage landowners to install nest boxes when renovating, removing old, or building new farm out-buildings in habitat suitable for Barn Owls. Encourage and support well planned nest box projects and monitoring programs.	3.2 Species recovery 4.3 Awareness and communications	Barn Owl

Table 12 continued

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Priority species affected
Removal or damage of Sage Thrasher nest sites from highway construction/maintenance activities.	4.1 Roads & railroads	Maintain existing roadside Sage Thrasher nesting habitat.	2.9 Reduce nest destruction.	Minimize brushing and mowing of big sage in ditches in areas where Sage Thrasher is known or suspected to nest in the South Okanagan.	4.2 Training 5.3 Private sector standards and codes	Sage Thrasher
Loss of winter forage to urban development and agricultural intensification.	1.1 Housing & urban areas 2.1 Annual and perennial non-timber crops	Maintain the quantity of foraging habitat for wintering swans.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat.	Establish and maintain winter cover crop programs to provide foraging habitat for migrating and wintering swans near key staging and wintering areas.	6.4 Conservation payments	Tundra Swan

Urban

The urban habitat class consists of urban, suburban and industrial areas where developments such as buildings, roads, parking lots and other impervious surfaces are common. Urban habitats comprise 0.4% of the landscape in BCR 9 (CIJV 2009; Fig. 17). BCR 9 contains two major urban areas (Kelowna, population 162,000; and Kamloops, pop. 93,000), along with numerous smaller towns (e.g., Penticton, pop. 43,000; Vernon, pop. 55,000; and Merritt, pop. 7,000; Statistics Canada 2008). Only three priority species (Barn Owl, Barn Swallow and Thayer's Gull) were identified as using urban habitat in BCR 9 (Table 13).

Primary threats include the loss of Barn Owl foraging habitat to development and agricultural intensification, loss of Barn Swallow nesting sites and the removal of swallow nests from buildings, and effects of pesticides (Fig. 18). No threats to Thayer's Gull ranked greater than Low concern. Key actions to address these threats include reducing the use of pesticides, managing landscapes to provide nesting and foraging habitat for Barn Owls, and increasing public awareness of Barn Swallows, their needs, and legal protection to reduce persecution (Table 14).

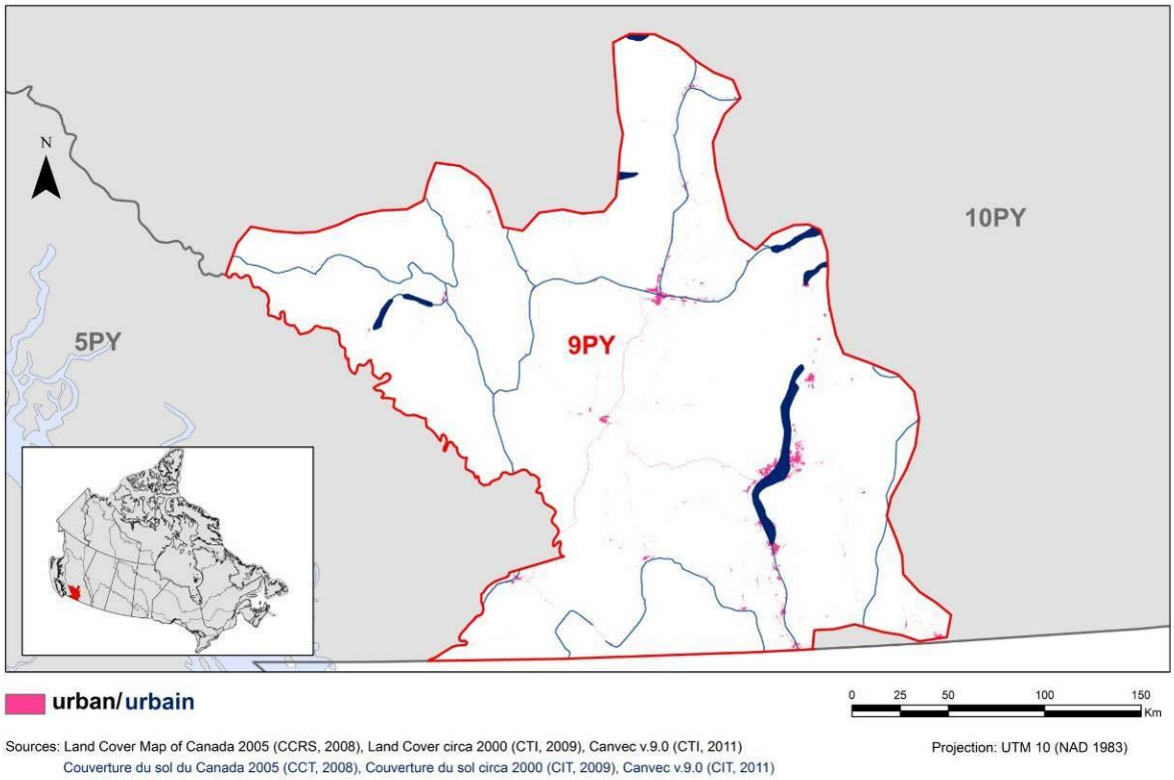

Figure 17. Map of urban habitat in BCR 9 Pacific and Yukon Region: Great Basin.

Table 7. Priority species that use urban habitat, regional habitat sub-class, important habitat features, population objectives and reason for priority status in BCR 9 Pacific and Yukon Region.

Priority species	Regional habitat sub-class	Important habitat features	Population objective	Reason for priority status			
				At Risk	CC	S	NAWMP
Barn Owl		cavities, nest boxes	Assess / Maintain	Y			
Barn Swallow		openings/clearings, man-made ledges	Increase 100%	Y	Y		
Thayer's Gull			Assess / Maintain			Y	

Note: Reasons for inclusion in the priority species list are as follows. At Risk: the species is assessed as either Endangered, Threatened or Special Concern by COSEWIC, or the species is on the Red or Blue lists in BC; CC: the species meets Conservation Concern criteria for its bird group; S: the species meets Stewardship criteria for its bird group; NAWMP: the species has NAWMP priority of Moderate-High, High or Highest in the BCR.

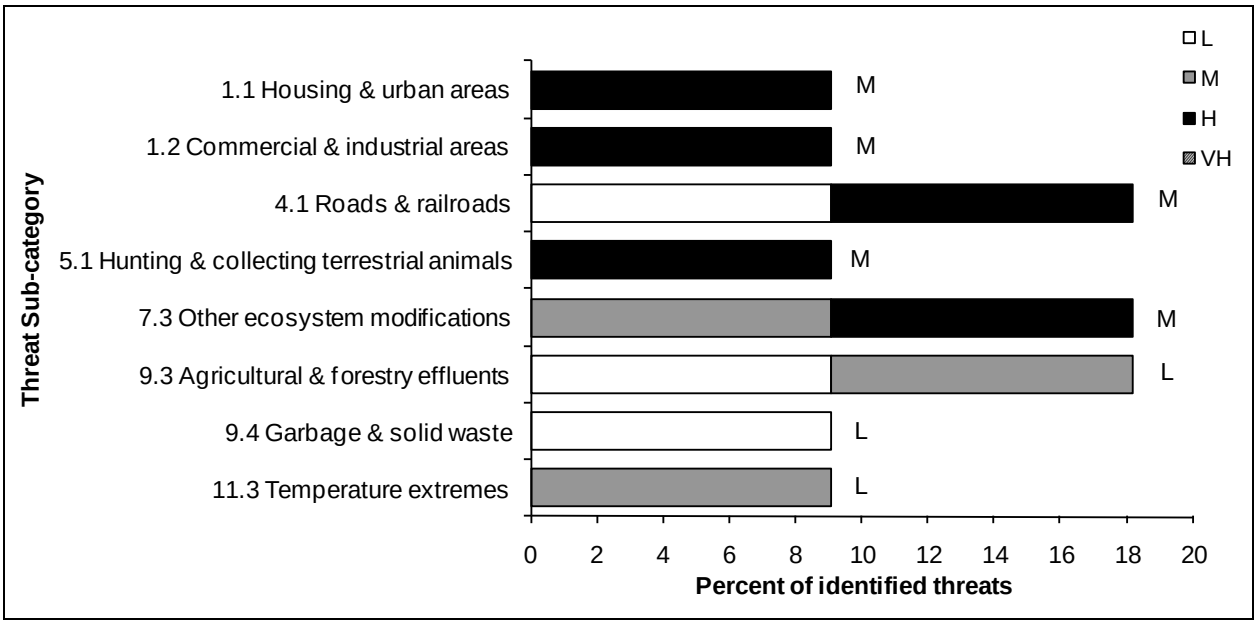

Figure 1. Percent of identified threats to priority species in urban habitat in each threat sub-category.
Each bar represents the percent of the total number of threats identified in each sub-threat category in urban habitat (for example, if 100 threats were identified in total for all priority species in urban habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%).
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 urban habitat is shown at the end of each bar (also presented in Table 4. Relative magnitude of identified threats to priority species within BCR 9 Pacific and Yukon Region by threat category and broad habitat class).
Note: The overall rolled-up magnitude of the threats in each sub-category is shown at the end of each bar. Threats of all magnitudes are included, although low ranked threats affecting only a single species were not assigned conservation objectives or recommended actions. *5.1 Hunting and collecting terrestrial animals* refers to removal of Barn Swallow nests from buildings, and *7.3 Other ecosystem modifications* refers to loss of suitable nesting sites for Barn Owls and Barn Swallows. *9.3 Agricultural and forestry effluents* refers to secondary poisoning and loss of prey due to pesticide use, and *9.4 Garbage and solid waste* refers to plastic ingestion in Thayer's Gulls.

Table 8. Threats addressed, conservation objectives, recommended actions and priority species affected for urban habitat in BCR 9.

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Priority species affected
Loss of nesting and foraging habitat to urban, industrial and agricultural conversion.	1.1 Housing & urban areas 1.2 Commercial & industrial areas 7.3 Other ecosystem modifications	Protect, maintain and enhance high quality nesting and foraging habitat for Barn Owls.	1.4 Maintain important habitat features on the landscape.	Secure and manage large tracts of suitable Barn Owl nesting and foraging habitat through various methods including land acquisition, conservation easements, stewardship agreements or establishment of formal parks, protected areas, or management areas. Encourage landowners to maintain or create land cover that supports small mammal populations, such as hayfields, old pasture and hedgerows. Increase public awareness of the Barn Owl and encourage landowners to install nest boxes when renovating, removing old, or building new farm out-buildings in habitat suitable for Barn Owls. Encourage and support well planned nest box projects and monitoring programs.	1.1 Site/area protection 3.2 Species recovery 4.3 Awareness and communications 8.1 Research	Barn Owl
Removal of nests by landowners. Loss of nesting sites (building modification, building removal).	5.1 Hunting & collecting terrestrial animals 7.3 Other ecosystem modifications	Prevent destruction of bird nests, in accordance with the *Migratory Birds Convention Act.*	1.4 Maintain important habitat features on the landscape. 2.9 Reduce nest destruction.	Research is needed to quantify the distribution and intensity of nest removal and assess the threat this behaviour poses to Barn Swallow populations. Increase public awareness of the species, its benefits, and current legal protection to increase stewardship and eliminate destruction of nests. Encourage landowners to incorporate nesting ledges on out-buildings in habitat suitable for Barn Swallows.	4.3 Awareness and communications 8.1 Research	Barn Swallow
Reduction in prey availability due to pesticide use.	9.3 Agricultural & forestry effluents	Adopt integrated pest management to minimize use of pesticides.	5.1 Maintain natural food webs and prey sources.	Avoid use of pesticides. When necessary, use only as part of an integrated pest management system to minimize destruction of non-target invertebrate species. If available, use biological control for specific noxious species, rather than chemical control	5.3 Private sector standards and codes	Barn Swallow

Wetlands

The wetlands habitat class includes bogs, swamps, marshes, fens, and shallow open water (largely non-vegetated surface, but <2 m deep; Fig. 19). Wetlands common to the drier Bunchgrass and Interior Douglas Fir biogeoclimatic zones and, to a more limited extent, in the Ponderosa Pine zone are represented by cattail or bulrush marshes, willow-dominated fens and saline meadows or ponds dominated by alkali saltgrass (CIJV 2003). Wetlands in BCR 9 cover only 0.9% of the region (CIJV 2009). Their rarity belies their significance to birds and other taxa in British Columbia's southern interior. In BCR 9, 26 priority species were identified as using wetland habitat, including 9 waterbirds, 12 waterfowl, and 5 landbird species. Of these, 11 species are considered at risk federally or provincially (Table 15).

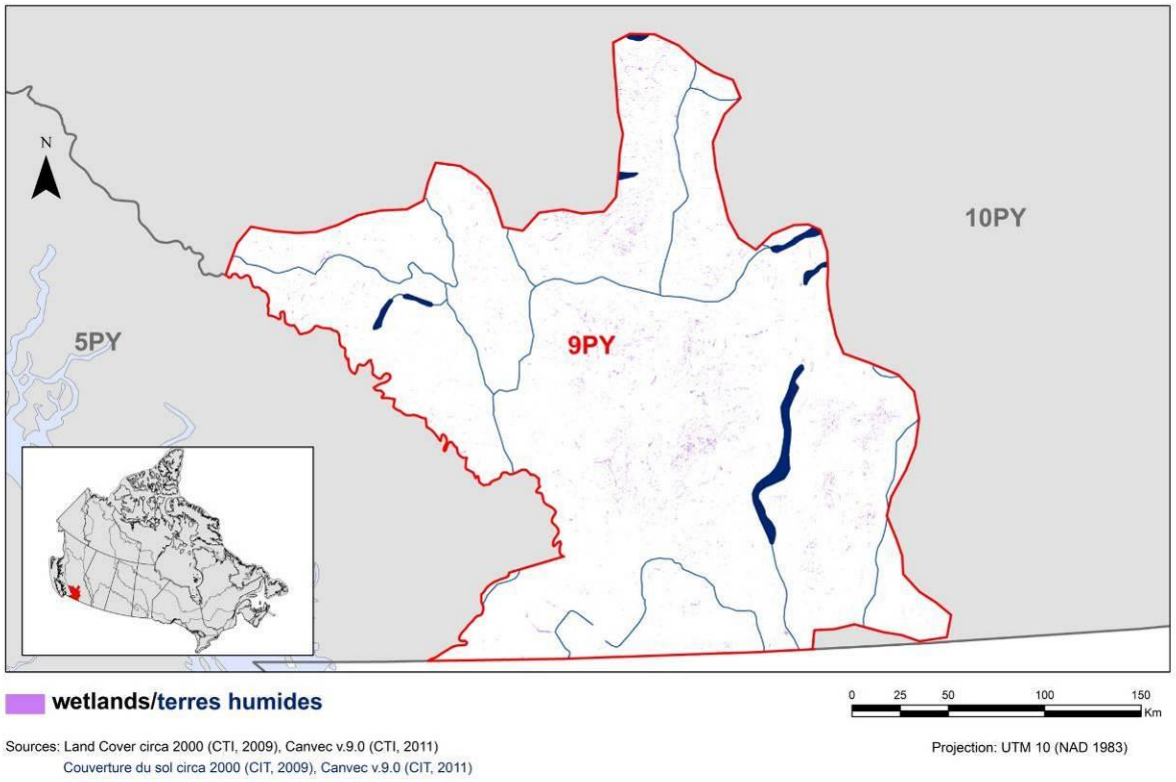

Figure 19. Map of wetland habitat in BCR 9 Pacific and Yukon Region: Great Basin.

Many wetlands in BCR 9 occur within 10 kilometers of existing urban centres, making them particularly vulnerable to the drainage and deterioration that coincides with urban and agricultural development (CIJV 2003; Fig. 20). In some areas, particularly along valley-bottoms, extensive areas of wetland habitat have been lost in the past to drainage and conversion to agriculture. These losses continue, though at a lower rate today than historically (CIJV Technical Committee 2010). Currently, wetlands in BCR 9 are threatened by ongoing urban, industrial and agricultural development. Heavy livestock grazing removes riparian and wetland vegetation, and along with agricultural runoff, degrades water quality. Climate projections predict

considerable drying in BCR 9, which will lead to degradation and loss of habitat, particularly shallow or small wetlands, which can be some of the most productive areas (Bunnell et al. 2010). Priority species are also threatened by exposure to contaminants such as heavy metals and pesticides. Key actions to address these threats include avoiding further loss of wetland habitat to development, reducing the exposure of birds to toxic contaminants, and increasing the use of beneficial management practices for biodiversity and bird conservation in ranching and agriculture, including establishment and maintenance of suitable vegetated buffers to maintain water quality (Table 16). See the Widespread Issues section for additional information on the effects of climate change in BCR 9, and objectives associated with climate change.

Table 9. Priority species that use wetlands, regional habitat sub-class, important habitat features, population objectives and reason for priority status in BCR 9 Pacific and Yukon Region.

Priority species	Regional habitat sub-class	Important habitat features	Population objective	Reason for priority status			
				At Risk	CC	S	NAWMP
American Avocet	Marsh		Assess / Maintain	Y			
American Bittern	marsh, swamp		Assess / Maintain	Y			
American Wigeon	Marsh		Maintain current				Y
Black Tern	Marsh		Increase 50%		Y	Y	
Canvasback	Marsh		Maintain current				Y
Cinnamon Teal	Marsh		Maintain current				Y
Clark's Grebe	Marsh		Assess / Maintain	Y		Y	
Gadwall	Marsh		Maintain current				Y
Great Blue Heron (*herodias*)	Marsh	cottonwood riparian, veteran trees	Maintain current	Y			
Greater White-fronted Goose	Marsh		Migrant (no population objective)				Y
Green-winged Teal	Marsh		Maintain current				Y
Horned Grebe	Marsh		Assess / Maintain	Y			
Lesser Snow Goose	Marsh		Migrant (no population objective)				Y
Mallard	Marsh		Maintain current				Y
Northern Harrier	Marsh		Assess / Maintain			Y	
Northern Pintail	Marsh		Maintain current				Y
Northern Shoveler	Marsh		Maintain current				Y
Peregrine Falcon (*anatum/tundrius*)	Marsh	cliffs/canyons, outcrops/bluffs	Assess / Maintain	Y			
Redhead	Marsh		Maintain current				Y
Red-necked Phalarope	Marsh		Migrant (no population objective)	Y			
Rough-legged Hawk	Marsh		Assess / Maintain	Y			
Rusty Blackbird	marsh, bog, fen, swamp	forested wetlands, bogs, openings	Assess / Maintain	Y			
Short-eared Owl	Marsh		Increase 50%	Y	Y		
Trumpeter Swan	Marsh		Maintain current	Y			Y
Virginia Rail	Marsh		Assess / Maintain			Y[1]	
Wilson's Phalarope	Marsh		Assess / Maintain		Y		

Note: Reasons for inclusion in the priority species list are as follows. At Risk: the species is assessed as either Endangered, Threatened or Special Concern by COSEWIC, or the species is on the Red or Blue lists in BC; CC: the species meets Conservation Concern criteria for its bird group; S: the species meets Stewardship criteria for its bird group; NAWMP: the species has NAWMP priority of Moderate-High, High or Highest in the BCR.

[1]Virginia rail was assessed using PIF methods.

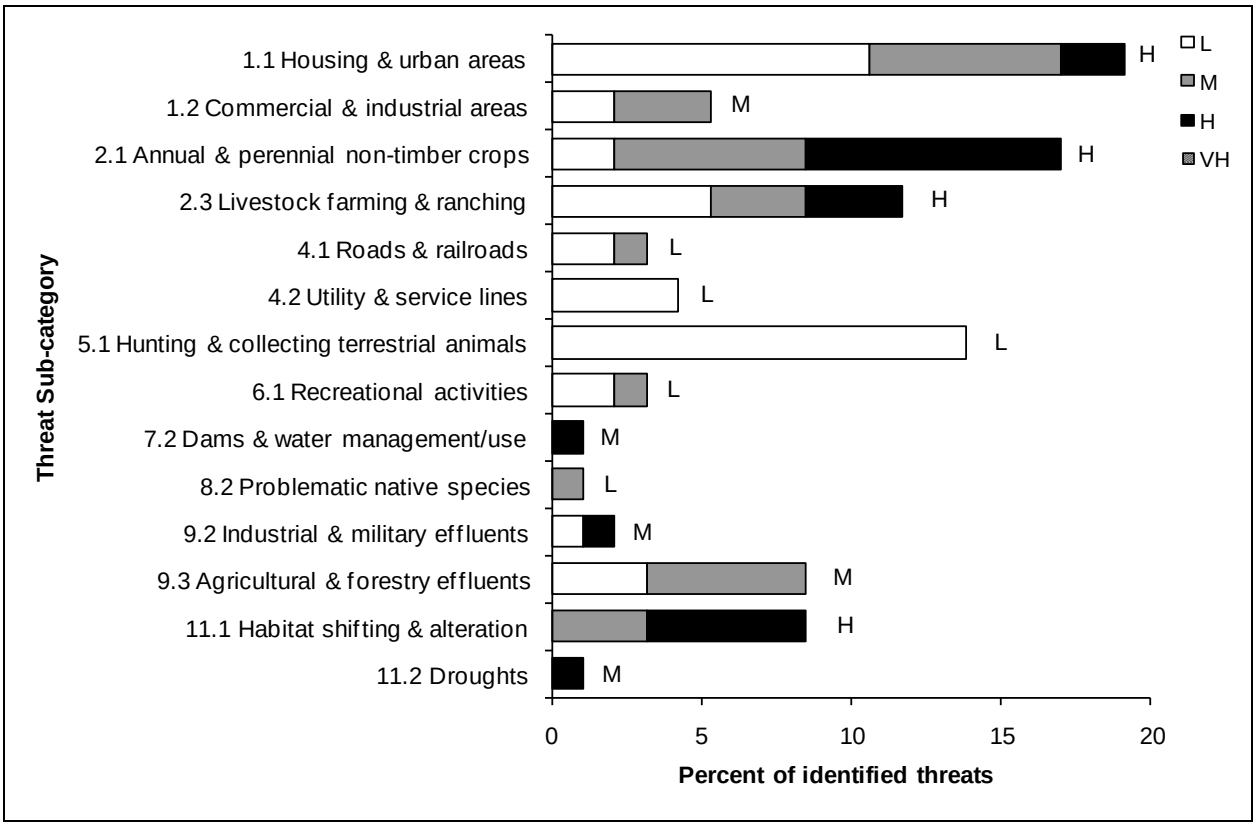

Figure 20. Percent of identified threats to priority species in wetlands in each threat sub-category. Each bar represents the percent of the total number of threats identified in each sub-threat category in wetland habitat (for example, if 100 threats were identified in total for all priority species 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 9 Pacific and Yukon Region by threat category and broad habitat class).

Note: The overall rolled-up magnitude of the threats in each sub-category is shown at the end of each bar. Threats of all magnitudes are included, although low ranked threats affecting only a single species were not assigned conservation objectives or recommended actions. *5.1 Hunting and collecting terrestrial animals* refers primarily to lead poisoning of waterfowl (due to ingestion of lead shot), but also includes illegal harvest. *9.3 Agricultural and forestry effluents* refers to effects of pesticide use.

Table 10. Threats addressed, conservation objectives, recommended actions and priority species affected for wetlands in BCR 9.

Threats Addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Priority species affected
Wetland loss and degradation due to urban development and agricultural activities.	1.1 Housing & urban areas 1.2 Commercial & industrial areas 2.1 Annual and perennial non-timber crops	Maintain and enhance the quantity and diversity of wetland habitats, in support of the Federal Policy on Wetland Conservation.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat.	Secure and manage wetlands for priority birds through various methods including land acquisition, conservation easements, stewardship agreements or establishment of formal parks, protected areas, or management areas. Maintain/restore undisturbed riparian buffers around wetland habitat to reduce runoff and provide bird habitat. Allow natural flooding and restore or maintain historical hydrological cycles. Employ British Columbia's *Riparian Areas Regulation* for fish habitat where applicable.	1.1 Site/area protection 2.3 Habitat and natural process restoration 5.3 Private sector standards and codes	American Avocet, American Bittern, American Wigeon, Black Tern, Canvasback, Cinnamon Teal, Great Blue Heron (*herodias*), Green-winged Teal, Horned Grebe, Mallard, Northern Harrier, Northern Pintail, Northern Shoveler, Peregrine Falcon (*anatum/tundrius*), Redhead, Rough-legged Hawk, Short-eared Owl, Trumpeter Swan, Virginia Rail, Wilson's Phalarope
Degradation of wetlands due to grazing and livestock activity.	2.3 Livestock farming & ranching	Maintain and enhance the quantity and diversity of wetland habitats, in support of the Federal Policy on Wetland Conservation.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat.	Maintain/restore suitable riparian buffers around wetlands to reduce erosion and runoff, and provide foraging and nesting habitat for birds. Manage livestock distribution to prevent cattle from lingering in wetland/riparian areas. Control livestock access to surface water by using offsite water sources or fencing with controlled access points. Where wetlands have been degraded by livestock activity, restore and enhance habitat through fencing, grazing management, and planting of native wetland and riparian vegetation.	2.1 Site/area management 2.3 Habitat and natural process restoration 5.3 Private sector standards and codes	American Wigeon, Canvasback, Cinnamon Teal, Green-winged Teal, Mallard, Northern Pintail, Northern Shoveler, Redhead, Rough-legged Hawk, Rusty Blackbird
Eutrophication of wetlands.	9.3 Agricultural & forestry effluents	Maintain and enhance the quantity and diversity of wetland habitats, in support of the Federal Policy on Wetland Conservation.	1.5 Reduce habitat degradation from contaminants.	Maintain unfertilized buffer areas around wetlands and riparian areas. Manage runoff to avoid contamination of surface water by silage, manure or fertilizer. Use pesticide and nutrient application practices that reduce the risk of direct drift into water courses or contamination of runoff that enters aquatic habitats.	2.1 Site/area management 5.3 Private sector standards and codes	American Bittern, Black Tern, Horned Grebe
Water control measures alter or eliminate natural	7.2 Dams & water management/use	Maintain natural hydrologic regimes.	1.3 Ensure the continuation of natural	Maintain natural range of variation in water flow, water levels and flood frequency in rivers, streams and wetlands.	2.3 Habitat and natural process	American Avocet

Table 16 continued

Threats Addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Priority species affected
flooding cycles, leading to loss of alkaline lakes/sloughs and areas with vernal flooding.			processes that maintain bird habitat.	Limit water diversions to maintain features such as shallow, seasonally-flooded wetlands and alkaline lakes and sloughs for American Avocet.	restoration 5.3 Private sector standards and codes	
Illegal harvest and malicious shooting.	5.1 Hunting & collecting terrestrial animals	Prevent killing of protected priority species in accordance with the *Migratory Birds Convention Act* and British Columbia's *Wildlife Act*.	2.8 Reduce mortality from legal or illegal hunting, and persecution.	Increase public awareness of the legal protection of priority species under *the Migratory Birds Convention Act* and British Columbia's *Wildlife Act*. Support compliance with existing legal protection of species.	5.4 Compliance and enforcement	Peregrine Falcon (*anatum/tundrius*), Trumpeter Swan
Human disturbance may cause increased reproductive failure or nest/colony abandonment. Boat wakes overwhelm nests.	6.1 Recreational activities	Avoid human disturbance of nesting priority species.	4.1 Reduce disturbance from human recreation.	Ensure commercial tourism operators are following backcountry tourism/commercial recreation wildlife guidelines and encourage members of the public to do so as well. Use a combination of buffer zones and seasonal closures around known Black Tern breeding colonies to prevent disturbance of breeding birds. Limit watercraft speeds and establish no-wake zones around nesting colonies. Increase public awareness of the impacts of human disturbance on priority species, and methods to minimize such disturbance.	2.1 Site/area management 4.3 Awareness and communica-tions 5.3 Private sector standards and codes	Black Tern
Forestry practices encourage spread of Red-winged Blackbird into Rusty Blackbird habitat.	8.2 Problematic native species	Ensure that competition is not limiting Rusty Blackbird populations.	3.2 Reduce competition with problematic native species.	Research is required to determine if competition with Red-winged Blackbirds is limiting Rusty Blackbird populations and identify possible mitigation measures. In the interim, maintain unharvested buffers of contiguous forest around bogs used by breeding Rusty Blackbird.	2.1 Site/area management 8.1 Research	Rusty Blackbird

Waterbodies, Snow and Ice

The waterbodies, snow and ice habitat class includes standing and flowing water such as reservoirs, lakes, ponds, rivers and streams, as well as areas where snow and/or ice covers the ground for the majority of the year. However, permanent snow and ice are not considered bird habitat *per se* in BCR 9, so the following discussion focuses on reservoirs, lakes, ponds, streams and rivers.

Waterbodies cover 2.4% of BCR 9 (CIJV 2009; Fig. 21). As well as providing breeding and foraging habitat, large lakes in the southern interior of British Columbia provide important stopover and wintering habitat for many waterfowl (CIJV Technical Committee 2010). Thirty priority species were identified as using these habitats in BCR 9, including 14 waterfowl, 11 waterbirds, 1 shorebird, and 4 landbirds (Table 17).

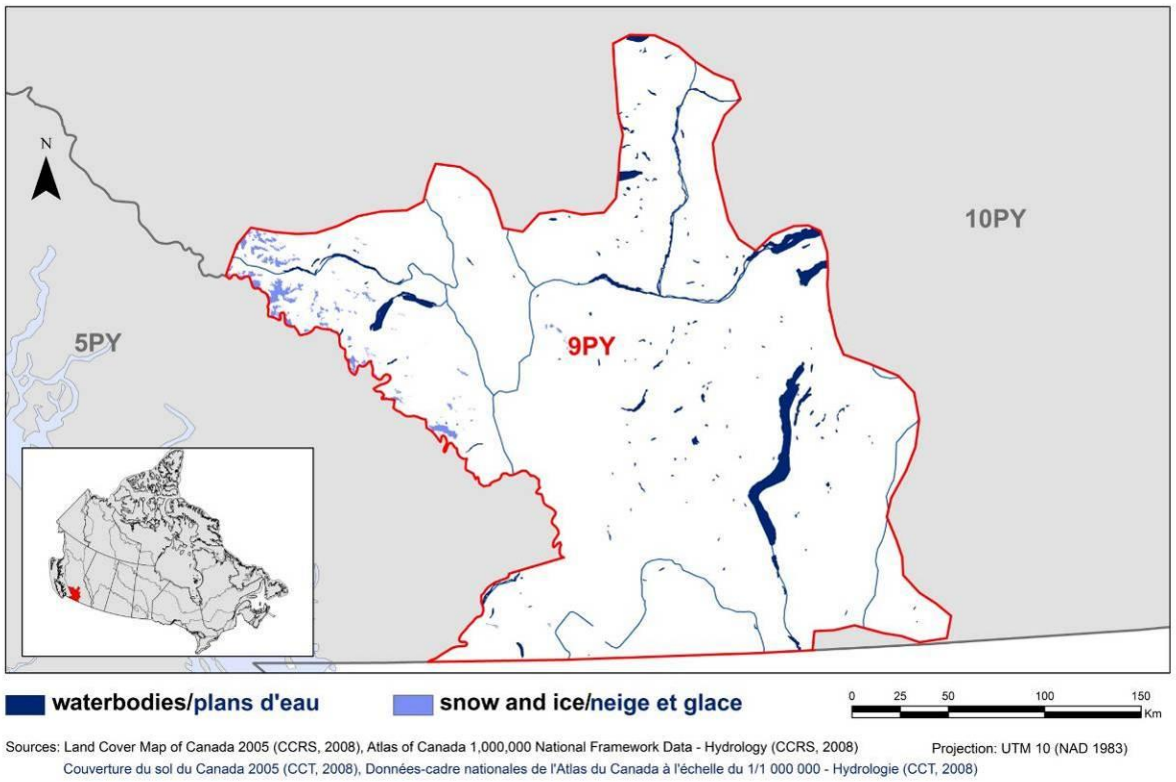

Figure 21. Map of waterbodies, snow and ice in BCR 9 Pacific and Yukon Region: Great Basin.
Note: permanent snow and ice are not considered bird habitat *per se* in BCR 9

Priority species in these habitats are threatened by loss and degradation of habitat due to urban and agricultural shoreline development, reduced water quality, altered hydrologic regimes, and exposure to contaminants such as lead (primarily from ingestion of lead shot) and pesticides (Fig. 22). Human disturbance on breeding, roosting and foraging areas also poses a serious threat to many waterfowl and waterbirds. Key actions to address threats facing priority species in this habitat type include maintaining or restoring natural riparian/shoreline

vegetation, managing industrial, agricultural, and forestry activities to maintain water quality, and maintaining natural hydrologic regimes on controlled streams, rivers, and reservoirs (Table 18). Creation of disturbance-free buffer areas around important breeding and foraging areas and increasing public awareness of the effects of disturbance on priority species would also be beneficial.

Table 11. Priority species that use waterbodies, regional habitat sub-class, important habitat features, population objectives and reason for priority status in BCR 9 Pacific and Yukon Region.

Priority Species	Regional habitat sub-class	Important habitat features	Population objective	Reason for priority status			
				At Risk	CC	S	NAWMP
American Avocet	lake, pond		Assess / Maintain	Y			
American White Pelican	Lake		Assess / Maintain	Y			
American Wigeon	lake, river, pond		Maintain current				Y
Bank Swallow	River	steep vertical banks	Assess / Maintain			Y	
Barrow's Goldeneye	lake, pond	cavities	Maintain current				Y
Black Swift	river, stream	waterfalls, cliffs/canyons	Assess / Maintain		Y		
Bufflehead	lake, pond	cavities	Maintain current				Y
California Gull	lake, river		Assess / Maintain	Y		Y	
Canada Goose	lake, river, pond		Maintain current				Y
Canvasback	lake, pond		Maintain current				Y
Caspian Tern	lake, river		Assess / Maintain	Y			
Clark's Grebe	Lake		Assess / Maintain	Y		Y	
Common Tern	Lake		Migrant (no population objective)			Y	
Double-crested Cormorant	Lake		Assess / Maintain	Y			
Gadwall	lake, pond		Maintain current				Y
Greater Scaup	lake, pond		Maintain current				Y
Green-winged Teal	lake, pond		Maintain current				Y
Gyrfalcon	river, pond	outcrops/bluffs	Assess / Maintain	Y			
Harlequin Duck	stream, river	cavities	Maintain current	Y			Y
Horned Grebe	Lake		Assess / Maintain	Y			
Mallard	lake, pond, stream		Maintain current				Y
Peregrine Falcon (*anatum/tundrius*)	river, lake	cliffs/canyons, outcrops/bluffs	Assess / Maintain	Y			
Redhead	Lake		Maintain current				Y
Red-necked Phalarope	lake, pond		Migrant (no population objective)	Y			
Sanderling	lake, pond		Migrant (no population objective)		Y		
Surf Scoter	Lake		Migrant (no population objective)	Y			Y
Thayer's Gull	Lake		Assess / Maintain			Y	
Trumpeter Swan	lake, river		Maintain current	Y			Y
Tundra Swan	lake, river		Maintain current	Y			Y
Western Grebe	Lake		Increase 100%	Y		Y	

Note: Reasons for inclusion in the priority species list are as follows. At Risk: the species is assessed as either Endangered, Threatened or Special Concern by COSEWIC, or the species is on the Red or Blue lists in BC; CC: the species meets Conservation Concern criteria for its bird group; S: the species meets Stewardship criteria for its bird group; NAWMP: the species has NAWMP priority of Moderate-High, High or Highest in the BCR.

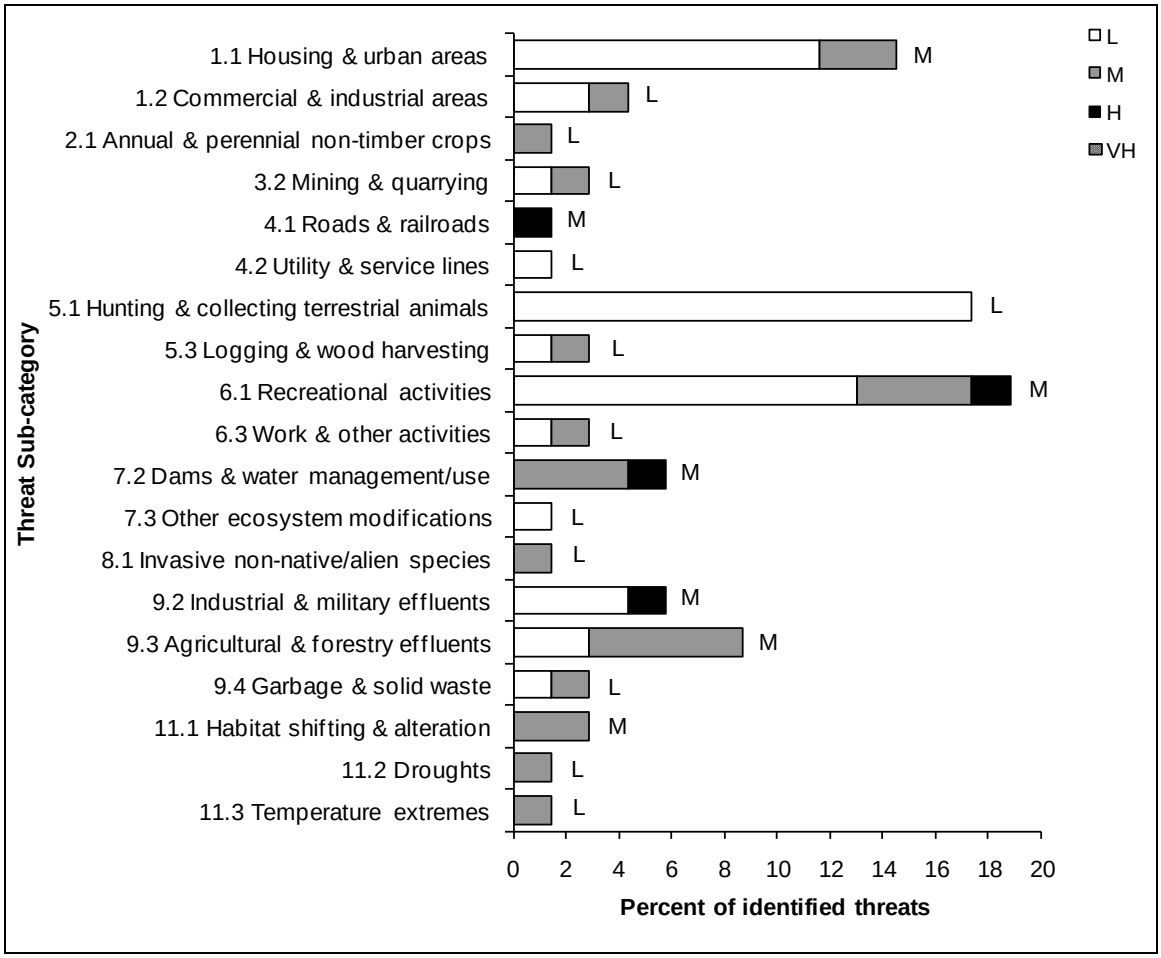

Figure 22. Percent of identified threats to priority species in waterbodies in each threat sub-category.

Each bar represents the percent of the total number of threats identified in each sub-threat category in waterbodies (for example, if 100 threats were identified in total for all priority species in waterbodies, 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 is shown at the end of each bar (also presented in Table 4. Relative magnitude of identified threats to priority species within BCR 9 Pacific and Yukon Region by threat category and broad habitat class).

Note: The overall rolled-up magnitude of the threats in each sub-category is shown at the end of each bar. Threats of all magnitudes are included, although low ranked threats affecting only a single species were not assigned conservation objectives or recommended actions. 5*.1 Hunting and collecting terrestrial animals* refers primarily to lead poisoning of waterfowl (due to ingestion of lead shot), but also includes illegal harvest. *9.2 Industrial and military effluents* refers to PCB exposure, *9.3 Agricultural and forestry effluents* refers to exposure to pesticides, and *9.4 Garbage and solid waste* includes ingestion of and entanglement in plastics.

Table 12. Threats addressed, conservation objectives, recommended actions and priority species affected for waterbodies in BCR 9.

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Priority species affected
Loss of lake/pond habitat and associated emergent vegetation due to urban and commercial development, agricultural conversion, and water management/use.	1.1 Housing & urban areas 1.2 Commercial & industrial areas 2.1 Annual & perennial non-timber crops 7.2 Dams & water management/ use	Maintain the quantity, quality and diversity of lake and pond habitats.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat. 1.3 Ensure the continuation of natural processes that maintain bird habitat.	Avoid draining waterbodies of any size. Maintain undisturbed and undeveloped buffer zones around waterbodies of all types (minimum 30m in urban areas, 100m in rural areas and 150m in undeveloped areas). Retain natural vegetation in these buffer zones. Maintain natural shoreline vegetation and emergent vegetation in the water, and minimize water access points. Place buildings well away from floodplains and allow natural flooding cycles to occur. Ensure that natural hydrological cycles will be maintained. Support compliance with British Columbia's *Water Act*.	1.2 Resource and habitat protection 5.3 Private sector standards and codes 5.4 Compliance and enforcement	American Avocet, Canada Goose, Canvasback, Green-winged Teal, Horned Grebe, Redhead, Sanderling, Trumpeter Swan, Tundra Swan, Western Grebe
Eutrophication of ponds and lakes.	9.3 Agricultural & forestry effluents	Maintain and enhance the quality and diversity of lake and pond habitats.	1.5 Reduce habitat degradation from contaminants.	Maintain unfertilized buffer areas around wetlands and riparian areas. Manage runoff to avoid contamination of surface water by silage, manure or fertilizer. Use pesticide and nutrient application practices that reduce the risk of direct drift into water courses or indirect drift into runoff flows that enter aquatic habitats.	2.3 Habitat and natural process restoration 5.3 Private sector standards and codes	Horned Grebe
Habitat loss due to altered hydrologic regimes and/or decreased water quality from mining, logging and renewable energy projects.	3.2 Mining & quarrying 5.3 Logging & wood harvesting 7.2 Dams & water management/ use	Maintain natural hydrologic regimes.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat. 1.3 Ensure the continuation of natural processes that maintain bird habitat.	In watersheds suitable for Harlequin Ducks, maintain the natural range of variation in water flow, water levels and flood frequency in rivers and streams. On controlled streams, mimic historical hydrological regimes as closely as possible. At a minimum, maintain recommended instream flow thresholds. Manage the timing and location of activities (road/trail construction, felling, etc) to minimize sediment runoff into surface waters. Route roads through upland areas rather than through streamside zones and wet areas. Install and maintain appropriate erosion control measures and follow beneficial management practices for instream works to avoid runoff into watercourses. Initiate research to determine the impacts of altered streamflow on nesting density and success of Harlequin Ducks.	1.2 Resource and habitat protection 5.3 Private sector standards and codes 8.1 Research	Harlequin Duck

Table 18 continued

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Priority species affected
Altered hydrologic regimes due to large-scale timber harvest or hydroelectric development reduce the suitability of waterfall nesting sites.	5.3 Logging & wood harvesting 7.2 Dams & water management/ use	Maintain natural hydrologic regimes.	1.3 Ensure the continuation of natural processes that maintain bird habitat.	Conduct inventories of Black Swift nest sites in BCR 9. Develop and implement monitoring programs to determine population trends. Locate hydroelectric developments to minimize reduction of flow at waterfalls. Manage timber harvest to ensure that natural hydrological cycles are maintained at known Black Swift nest sites. Initiate research to determine the impacts of altered streamflow on nesting density and success of Black Swift.	5.3 Private sector standards and codes 8.1 Research 8.2 Monitoring	Black Swift
Invasive species (e.g., water milfoil) alter habitat structure and suitability.	8.1 Invasive non-native/alien species	Eliminate or control invasive species while preventing further introductions.	3.5 Prevent and control the spread of invasive and exotic species.	Eliminate or control non-native weeds through mechanical control, biological control, or herbicides (as a last resort). Increase public awareness of invasive plant species and measures to control their spread (such as regular cleaning of boats, vehicles and equipment, and using only native species for gardening, landscaping and re-vegetation purposes), to prevent establishment of additional invasive species.	2.2 Invasive/ problematic species control 4.3 Awareness and communications	Western Grebe
Human disturbance may disrupt territorial behaviour, or cause increased reproductive failure or nest/colony abandonment. Human disturbance at roosting and foraging areas of staging birds during migration.	6.1 Recreational activities 6.3 Work and other activities	Avoid human disturbance of nesting priority species and prevent changes in habitat use due to disturbance.	4.1 Reduce disturbance from human recreation. 4.2 Reduce disturbance from industrial or work activity.	Ensure commercial tourism operators are following backcountry tourism/commercial recreation wildlife guidelines and encourage members of the public to do so as well. Use a combination of buffer zones and seasonal closures around breeding colonies, key lake/pond breeding habitats, and key staging areas to prevent disturbance of breeding and/or migrating birds. Increase public awareness of the impacts of human disturbance on priority species, and methods to minimize such disturbance. Reduce or avoid activities such as rafting, boating or fishing on stream reaches used by breeding Harlequin Ducks, particularly narrower streams.	2.1 Site/area management 4.3 Awareness and communications 5.3 Private sector standards and codes	American White Pelican, Barrow's Goldeneye, California Gull, Caspian Tern, Clark's Grebe, Common Tern, Harlequin Duck, Surf Scoter, Trumpeter Swan, Western Grebe

Table 18 continued

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Priority species affected
Nest abandonment due to human disturbance from urban development encroaching on nesting sites.	6.1 Recreational activities 6.3 Work & other activities	Avoid disturbance of nesting raptors.	4.1 Reduce disturbance from human recreation. 4.2 Reduce disturbance from industrial or work activity.	Maintain an undisturbed, naturally vegetated buffer of at least 50m (urban), 200m (rural) or 500m (undeveloped areas) from the base of Peregrine Falcon nesting cliffs or around other Peregrine Falcon nest sites. Raise public awareness of raptors and their habitat and nesting needs. Support compliance with British Columbia's *Wildlife Act* regulations around disturbance at Peregrine Falcon nests.	5.3 Private sector standards and codes 5.4 Compliance and enforcement	Peregrine Falcon (*anatum/tundrius*)
Changing water levels can flood or strand nests. Boat wakes can tip or flood nests.	7.2 Dams & water management/ use	Prevent destruction of bird nests, in accordance with the *Migratory Birds Convention Act*.	2.9 Reduce nest destruction.	Maintain stable water levels during the nesting season on reservoirs where Western Grebes breed. Limit watercraft speeds and establish no-wake zones around grebe nesting colonies.	2.1 Site/area management	Western Grebe
Nest destruction from road-building and sand/gravel quarry development and use.	3.2 Mining quarrying 4.1 Roads & railroads	Prevent destruction of bird nests, in accordance with the *Migratory Birds Convention Act*.	2.9 Reduce nest destruction.	Conduct site surveys for Bank Swallow nests prior to construction activity. Locate developments away from Bank Swallow colonies and establish no-activity buffer zones around occupied colonies. Support compliance with existing legal protection of species.	5.3 Private sector standards and codes 5.4 Compliance and enforcement	Bank Swallow
Illegal harvest and malicious shooting.	5.1 Hunting & collecting terrestrial animals	Prevent killing of protected priority species in accordance with the *Migratory Birds Convention Act* and British Columbia's *Wildlife Act.*	2.8 Reduce mortality from legal or illegal hunting, and persecution.	Increase public awareness of the legal protection of priority species under the *Migratory Birds Convention Act* and British Columbia's *Wildlife Act*. Support compliance with existing legal protection of species.	5.4 Compliance and enforcement	Peregrine Falcon (*anatum/tundrius*), Trumpeter Swan
Ingestion of plastics. Entanglement in plastics.	9.4 Garbage & solid waste	Reduce the amount of plastic available for ingestion. Reduce the number of entangled birds.	2.2 Reduce mortality and/or sub-lethal effects from exposure to contaminants. 2.4 Reduce incidental mortality.	Encourage recycling programs, roadside and shoreline cleanups, and educate the public on the effects of plastic ingestion on birds to reduce the amount of plastic in the environment. Educate the public on safe disposal of items that commonly entangle birds.	4.3 Awareness and communications	California Gull, Thayer's Gull

Riparian

Riparian areas occur adjacent to standing or flowing water where the vegetation is influenced by the presence of water and is distinct from adjacent uplands. Riparian areas may be treed, shrubby, or herbaceous, depending on site conditions. In BCR 9, black cottonwood, trembling aspen, paper birch and willows typically characterize treed lowland riparian areas (Partners in Flight British Columbia and Yukon 2003). While there are no available estimates of the total area of riparian habitats in BCR 9, riparian areas are geographically restricted and form only a small part of the overall landscape (there is no available map of riparian habitat). Despite their small extent, riparian areas are highly important in terms of biodiversity and landscape connectivity. Riparian habitats are particularly important to wildlife in arid regions such as the southern interior of British Columbia (Partners in Flight British Columbia and Yukon 2003). Riparian habitats face a wide variety of pressures, and in some areas, much of the original riparian habitat has been degraded or lost. For example, in the southern Okanagan Valley, 85% of valley-bottom riparian habitat has been lost due to development and flood control (Partners in Flight British Columbia and Yukon 2003). Of the 14 priority species that have been identified as using riparian habitats in BCR 9, three are waterfowl, and the remaining 11 are landbirds (Table 19).

Due to their location on flatter and more accessible valley bottoms, proximity to water, and soil characteristics, riparian areas (and the birds that use them) are highly threatened by urban and agricultural development (Fig. 23). Several priority species that use riparian areas are also particularly threatened by the loss of large, cavity-bearing trees or snags required for nesting or roosting. Poorly managed cattle grazing and altered hydrologic regimes can alter vegetative structure and degrade riparian habitats. Competition with invasive species (European Starling) and nest parasitism by Brown-headed Cowbirds also pose threats to priority species. Key conservation actions to support birds in riparian habitats include protection and restoration of important riparian areas, management of timber harvest and other tree-cutting activities for the protection and conservation of bird habitat, maintenance or restoration of natural hydrologic regimes, and management of grazing pressure to avoid degradation of riparian habitats (Table 20).

Table 13. Priority species that use riparian habitat, regional habitat sub-class, important habitat features, population objectives and reason for priority status in BCR 9 Pacific and Yukon Region.

Priority Species	Regional habitat sub-class	Important habitat features	Population objective	Reason for priority status			
				At Risk	CC	S	NAWMP
Barrow's Goldeneye	forest	Cavities	Maintain current				Y
Black-billed Magpie	shrub		Assess / Maintain			Y	
Bufflehead	forest	cavities, aspen groves	Maintain current				Y
Harlequin Duck	shrub, forest	Cavities	Maintain current	Y			Y
Lazuli Bunting	shrub	aspen groves, cottonwood riparian, recent burns, wet draws in shrubsteppe	Assess / Maintain			Y	
Lewis's Woodpecker	forest	snags, recent burns, openings/clearings, low stem density, cottonwood	Increase 100%	Y	Y	Y	
Long-eared Owl	forest	forest adjacent to grassland/open areas	Assess / Maintain			Y	
MacGillivray's Warbler	shrub	cottonwood riparian, recent burns, clearcuts	Increase 50%		Y		
Rufous Hummingbird	shrub, forest	openings/clearings	Assess / Maintain		Y		
Vaux's Swift	forest	cavities, snags, cottonwood riparian, chimneys	Assess / Maintain		Y		
Western Screech-Owl (*macfarlanei*)	forest	cavities, openings/clearings, cottonwood riparian, aspen groves	Recovery objective	Y	Y		
Willow Flycatcher	shrub	openings/clearings	Increase 100%		Y		
Yellow-breasted Chat	shrub	dense shrub thickets	Recovery objective	Y			

Note: Reasons for inclusion in the priority species list are as follows. At Risk: the species is assessed as either Endangered, Threatened or Special Concern by COSEWIC, or the species is on the Red or Blue lists in BC; CC: the species meets Conservation Concern criteria for its bird group; S: the species meets Stewardship criteria for its bird group; NAWMP: the species has NAWMP priority of Moderate-High, High or Highest in the BCR.

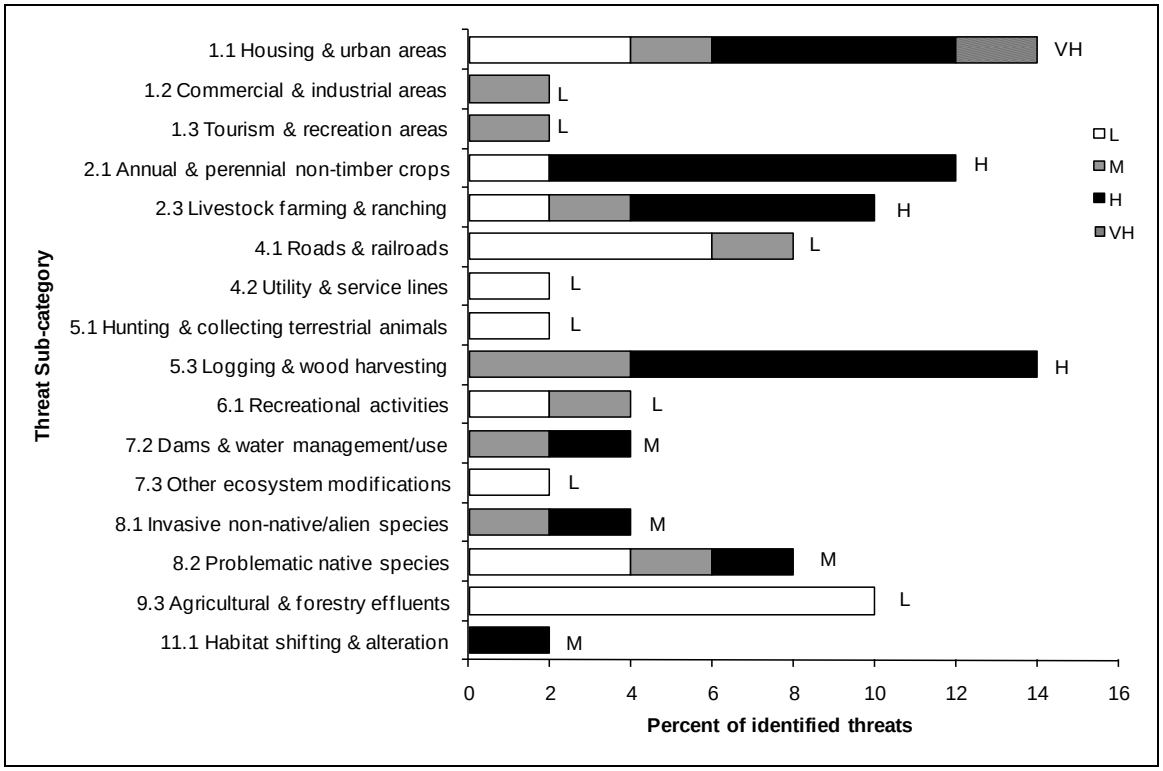

Figure 23. Percent of identified threats to priority species in riparian habitat in each threat sub-category.

Each bar represents the percent of the total number of threats identified in each sub-threat category in riparian habitat (for example, if 100 threats were identified in total for all priority species in riparian habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). 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 riparian habitat is shown at the end of each bar (also presented in Table 4. Relative magnitude of identified threats to priority species within BCR 9 Pacific and Yukon Region by threat category and broad habitat class).

Note: The overall rolled-up magnitude of the threats in each sub-category is shown at the end of each bar. Threats of all magnitudes are included, although low ranked threats affecting only a single species were not assigned conservation objectives or recommended actions. *8.1 Invasive non-native/alien species* refers to predation by domestic cats and competition from European Starlings, while *8.2 Problematic native species* refers to nest parasitism by the Brown-headed Cowbird. *9.3 Agricultural and forestry effluents* refers to the effects of pesticide use.

Table 14. Threats addressed, conservation objectives, recommended actions and priority species affected for riparian habitat in BCR 9.

Threats addressed	Threat category	Objective	Objective category	Recommended action	Action category	Priority species affected
Loss of riparian habitat and key habitat features to urban, industrial and agricultural development, logging, and danger tree removal.	1.1 Housing & urban areas 1.2 Commercial & industrial areas 1.3 Tourism & recreation areas 2.1 Annual and perennial non-timber crops 5.3 Logging & wood harvesting	Maintain and enhance the quantity, quality and diversity of riparian habitats.	1.2 Maintain the size, shape and configuration of habitat within the natural range of variation. 1.4 Maintain important habitat features on the landscape.	Maintain, restore, and where possible, expand existing riparian buffers in agricultural and developed areas. At a minimum, maintain natural riparian vegetation in buffer strips >30m wide on either wide of the watercourse, with riparian and upland vegetation >300m wide for at least 10% of stream length. Secure and manage existing stands of mature riparian forests (especially cottonwood) to maintain key habitat features for priority species, particularly large veteran trees and snags, and all cavity-bearing trees. Restore cottonwoods in lowland riparian floodplains. Use a variety of methods such as land acquisition, conservation easements, stewardship agreements or establishment of formal parks, protected areas, or management areas to secure any currently unprotected breeding habitat around known Lewis's Woodpecker or Yellow-breasted Chat nesting locations. Support compliance with British Columbia's *Riparian Areas Regulation* for fish habitat where applicable.	1.1 Site/area protection 2.1 Site/area management 5.4 Compliance and enforcement	Barrow's Goldeneye, Bufflehead, Harlequin Duck, Lewis's Woodpecker, Long-eared Owl, Vaux's Swift, Western Screech-Owl (*macfarlanei*), Willow Flycatcher, Yellow-breasted Chat
Degradation of riparian habitat due to livestock activity.	2.3 Livestock farming & ranching	Prevent livestock from degrading riparian habitat and restore and enhance degraded areas.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat.	Manage livestock distribution to prevent cattle lingering in and over-using riparian areas, by providing offsite water and placing feed, salt blocks and shelter away from riparian areas. Use extra (or longer) rest periods on riparian areas in rotational grazing systems. Where riparian areas have been degraded by livestock activity, restore and enhance habitat through fencing, livestock management, and planting native riparian vegetation.	2.1 Site/area management 2.3 Habitat and natural process restoration 5.3 Private sector standards and codes	Lewis's Woodpecker, MacGillivray's Warbler, Willow Flycatcher, Western Screech-Owl (*macfarlanei*), Yellow-breasted Chat
Habitat loss or degradation due to altered hydrologic regimes from dams and renewable energy projects.	7.2 Dams & water management/use	Maintain natural hydrologic regimes.	1.3 Ensure the continuation of natural processes that maintain bird habitat.	Maintain the natural range of variation in water flow, water levels and flood frequency in rivers, streams, and wetlands, and restore meanders to channelized streams to maintain healthy riparian habitats. On controlled streams, mimic historical hydrological regimes as closely as possible. At a minimum, maintain recommended instream flow thresholds. Initiate research to determine the impacts of altered streamflow on nesting density and success of Harlequin Duck.	1.2 Resource and habitat protection 2.1 Site/area management 5.3 Private sector standards and codes 8.1 Research	Harlequin Duck, Willow Flycatcher

Table 20 continued

Threats addressed	Threat category	Objective	Objective category	Recommended action	Action category	Priority species affected
Degradation of habitat (loss of shrub layer) due to forestry activities.	5.3 Logging & wood harvesting	Maintain key habitat features in riparian habitats, including thick undergrowth for McGillivray's Warbler.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat.	Manage forests to maintain a diversity of structural stages and important habitat components, such as a well-developed shrub layer. Strive to mimic, retain, or restore pre-settlement proportions and distribution of forest types, successional stages, and habitat components.	5.3 Private sector standards and codes	MacGillivray's Warbler
Nest failure or abandonment due to disturbance.	6.1 Recreational activities	Avoid disturbance of nesting raptors.	4.1 Reduce disturbance from human recreation.	Maintain natural, undisturbed vegetation around all raptor nest sites. Avoid human disturbance within 200m (minimum) from active Long-eared Owl nest sites during the breeding season. Increase public awareness of the impacts of human disturbance on priority species, and methods to minimize such disturbance.	2.1 Site/area management 4.3 Awareness and communications	Long-eared Owl
Decreased availability of nest cavities due to competition from European Starlings.	8.1 Invasive non-native/alien species	Ensure that nest site competition is not limiting Lewis's Woodpecker populations.	3.1 Reduce competition with invasive species.	Conduct research to understand conditions under which nest-site competition with European Starlings may be limiting Lewis's Woodpecker populations. In the interim, increase retention of cavity-bearing trees and snags as nesting habitat. In areas where cavities are limited, consider initiating a long-term, well-managed nest-box program.	3.2 Species recovery 8.1 Research	Lewis's Woodpecker
Reduced nest productivity due to Brown-headed Cowbird nest parasitism.	8.2 Problematic native species	Ensure that brood parasitism is not limiting priority species' populations.	3.3 Reduce parasitism/predation.	Avoid further fragmentation of existing riparian habitat, and restore fragmented or degraded habitat. This includes reducing trails and roads through these habitats. Keep feedlots, livestock staging areas, and other cowbird attractants as far away from riparian areas as possible. Avoid grazing in riparian areas during the breeding season.	2.2 Invasive/problematic species control 5.3 Private sector standards and codes	Lazuli Bunting, MacGillivray's Warbler, Willow Flycatcher, Yellow-breasted Chat
Reduction in prey availability due to pesticide use.	9.3 Agricultural & forestry effluents	Adopt integrated pest management to minimize use of pesticides.	5.1 Maintain natural food webs and prey sources.	Avoid use of pesticides. When necessary, use only as part of an integrated pest management system to minimize destruction of non-target invertebrate species. If available, use biological control for specific noxious species, rather than chemical control.	5.3 Private sector standards and codes	Lewis's Woodpecker, Vaux's Swift

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 21 for conservation objectives and actions.

Wind Turbines

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

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

At the 43 wind farms in Canada for which data are available, total habitat loss per turbine is 1.23 ha on average. Based on this average, the predicted total habitat loss for wind farms nationwide is 3,635 ha. Using published estimates of nest densities, the total number of affected nests, not accounting for construction that might occur outside the breeding season, is approximately 5,700 (Zimmerling et al. 2013). See Table 21 for conservation objectives and actions.

Communication Towers

There are currently almost 8,000 communication towers in Canada >60m 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. However, BCR 9 is estimated to contribute relatively little to the total avian collision mortality in Canada (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 21 for conservation objectives and actions.

Power Lines

Birds may be killed by colliding with power lines, or they may be electrocuted. Species with high wing-loading and thus low maneuverability, such as waterfowl, appear particularly at risk for collisions (Bevanger 1998). Electrocutions are most likely for large birds such as raptors and herons, whose bodies are large enough to span the distances between wires and create a short-circuit. Raptors' habit of using power poles as perches further increases their risk. However, estimates of total mortality due to collisions and electrocutions can vary widely (Manville 2005) and population-level impacts are difficult to determine. Canadian estimates are that 161,000 – 802,000 birds are killed annually by electrocution and another 5.3–20.6 million birds are killed each year by colliding with electrical transmission lines (Calvert et al. 2013). See Table 21 for conservation objectives and actions.

Fences

Birds can be killed by colliding with and/or becoming entangled in barbed-wire fences. Large, low-flying birds are particularly vulnerable, though a wide range of waterbirds, waterfowl, raptors, passerines and game birds can be affected (Paige 2008, Allen and Ramirez 1990). While there are few quantitative data on the impacts of fence collisions, it can be a major source of mortality for some species (e.g., Lesser Prairie-Chicken; Wolfe et al. 2007). See Table 21 for conservation objectives and actions.

Vehicles

There are over 1.4 million km of roads and hundreds of airports in Canada (World Bank Indicators 2012) that are often bordered by fences and vegetation 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 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 21 for conservation objectives and actions.

Predation by Domestic Cats

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

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

Without detailed study of the individual species affected, it is difficult to assess whether mortality caused by cat predation impacts population trends of birds in Canada. Nevertheless, it is likely that many species of birds are potentially vulnerable to population effects at the local scale in southern Canada. See Table 21 for conservation objectives and actions.

Pollution

Pollution caused by industrial chemicals, pesticides and heavy metals can have both direct and indirect effects on survival and reproduction in birds. Sometimes the effects of exposure to pollutants are unexpected and do not result in immediate, measurable impacts on bird populations (Eeva and Lehikoinen 2000, Franceschini et al. 2008, North American Bird Conservation Initiative, U.S. Committee 2009, Mineau 2010). However, persistent exposure can result in sharp declines in bird populations as happened with Peregrine Falcons in eastern Canada prior to the ban of DDT. See Table 21 for conservation objectives and actions.

Pesticides

The most recent estimate suggests that 0.96–4.4 million birds are killed by pesticides annually in Canada (Mineau 2010). Provinces such as Saskatchewan, which have a large agricultural land base, account for the majority of the estimated kill, and pesticides are thought to be an important contributor to the decline in grassland bird species in Canada (Mineau 2010). Pesticides can kill birds rapidly following contact or may have sub-lethal impacts such as suppressed immune function and reduced stress response. There may also be indirect effects of pesticides such as reduction in prey and changes in vegetation that reduce habitat quality. While the use of the many toxic pesticides has been eliminated in Canada, migratory birds are still exposed while on wintering grounds in countries where their use is still permitted (Mineau 2010). See Table 21 for conservation objectives and actions.

Toxic Chemicals and Heavy Metals

Toxic organic chemicals and heavy metals released into the environment can also negatively impact bird populations. While some industrial chemicals such as PCBs are regulated, there is concern about new chemicals such as flame retardants (PBDE) that are used in computers, car parts and upholstery and whose effects on wildlife are largely unknown (Environment Canada 2003). Scavengers experience toxic effects when they ingest lead shotgun pellets or bullet fragments embedded in carcasses of game animals, and loons and other waterbirds are exposed to lead from shotgun pellets, sinkers and jigs that they ingest either while collecting grit for their gizzards or by eating bait fish with line and sinker still attached (Scheuhammer and Norris 1996, Scheuhammer et al. 2003). In some areas lead poisoning from sinkers and jigs can account for approximately half of the mortality of adult Common Loons on their breeding grounds (Scheuhammer and Norris 1996). Birds are also susceptible to bioaccumulation of other toxic metals such as methylmercury, selenium, and others when they consume prey that has been exposed to these substances. See Table 21 for conservation objectives and actions.

Table 21. 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	All species
Collisions with wind turbines cause bird mortality.	3.3 Renewable energy	Reduce incidental mortality from collisions with wind turbines	2.7 Reduce incidental mortality from collisions.	Follow beneficial management practices for reducing bird mortality when designing and locating wind turbines. Ensure that offshore wind energy developments will not present significant migration barriers. Locate offshore wind energy developments away from seabird breeding colonies and important waterbird foraging areas. Utilize techniques such as radar monitoring to determine pre-construction flight paths and assess the degree to which wind farms present migration barriers, and infrared camera systems to quantify strike rates.	2.1 Site/area management 5.3 Private sector standards and codes 1.2 Resource and habitat protection 8.2 Monitoring	All species

Table 21 continued

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Example priority species affected
Collisions with communications towers cause bird mortality, particularly during migration.	1.2 Commercial and industrial areas	Reduce incidental mortality from collisions with man-made structures	2.7 Reduce incidental mortality from collisions.	Follow beneficial management practices for reducing mortality to birds when constructing new communications towers. Switch off solid lights on existing towers and ensure that remaining lights have a synchronized, complete dark phase. Take steps to ensure that new towers avoid guy wires and minimize height, and avoid topographic locations where migrating birds are likely to be found in abundance. Retrofit existing towers to adhere to as many guidelines as possible.	2.1 Site/area management 5.3 Private sector standards and codes	All species
Collisions with power lines and accidental electrocution cause bird mortality.	4.2 Utility and service lines	Reduce mortality from collisions with utility lines / transmission towers	2.7 Reduce incidental mortality from collisions.	In high-risk areas, retrofit power lines so that the risk of electrocution of raptors is minimized. In new developments, locate transmission lines underground. Use markers or paint to increase visibility of power lines in high-strike areas. Avoid siting lines over or near wetlands.	2.1 Site/area management	Golden Eagle, Northern Pintail, Short-eared Owl, Trumpeter Swan, Virginia Rail
Collisions and entanglement in barbed-wire fences cause bird mortality.	2.3 Livestock farming & ranching	Reduce mortality from collisions with fences	2.7 Reduce incidental mortality from collisions.	Remove unneeded or unused wire fences. Install markers or high-visibility top wire on remaining wire fences, particularly near creeks or wetlands.	2.1 Site/area management	Prairie Falcon, Short-eared Owl
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.	2.1 Site/area management	American Kestrel, Barn Owl, Barn Swallow, Black-billed Magpie, Burrowing Owl, Common Nighthawk, Common Poorwill, Golden Eagle, Lewis's Woodpecker, Northern Saw-whet Owl, Red Crossbill, Rough-legged Hawk, Short-eared Owl,

Table 21 continued

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Example priority species affected
				Encourage the use of salt management plans to avoid unnecessary use of particulate salt (a bird attractant) on roads. Avoid locating roads in valuable bird habitat.	1.1 Site/area protection	Swainson's Hawk, Virginia Rail, Western Screech-Owl (*macfarlanei*), Yellow-breasted Chat
Population effects of collisions are unknown.	12.1 Information lacking	Improve understanding of population effects of mortality from collisions	7.4 Improve understanding of causes of population declines.	Assess the biological importance of bird kills from all sources of collisions.	8.1 Research	All species
Predation by domestic cats						
Predation by domestic and feral cats.	8.1 Invasive non-native/ alien species	Reduce mortality from domestic and feral cats	2.4 Reduce incidental mortality.	Implement a "Cats Indoors!" Campaign following the guidelines of the American Bird Conservancy. 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
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						

Table 21 continued

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Example priority species affected
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	**Direct or indirect poisoning:** American Wigeon, Band-tailed Pigeon, Barn Owl, Black-billed Magpie, Canada Goose, Common Tern, Double-crested Cormorant, Ferruginous Hawk, Horned Grebe, Horned Lark (*merrilli*), Lewis's Woodpecker, MacGillivray's Warbler, Peregrine Falcon (*anatum/tundrius*), Prairie Falcon, Rough-legged Hawk, Williamson's Sapsucker, Yellow-breasted Chat **Reductions in insect/rodent prey:** Barn Swallow, Black Tern, Bobolink, Burrowing Owl, Common Nighthawk, Ferruginous Hawk, Flammulated Owl, Lark Sparrow, Lewis's Woodpecker, Olive-sided Flycatcher, Swainson's Hawk, Vaux's Swift, White-throated Swift, Williamson's Sapsucker
Mortality from ingestion of lead shot or tackle.	5.1 Hunting & collecting terrestrial animals 5.4 Fishing & harvesting aquatic resources	Reduce mortality and sub-lethal effects of lead shot and fishing tackle on birds	2.2 Reduce mortality and/or sub-lethal effects from exposure to contaminants.	Work with hunters, anglers and industry to eliminate the exposure of birds to shot, sinkers and jigs made of lead. Enforce the use of non-toxic shot in waterfowl hunting, and encourage adoption of non-toxic alternatives in target shooting, upland game bird hunting, and fishing.	4.3 Awareness and communications 5.4 Compliance and enforcement	American Wigeon, Bufflehead, Canada Goose, Canvasback, Cinnamon Teal, Golden Eagle, Greater Scaup, Greater White-fronted Goose, Green-winged Teal, Lesser Snow Goose, Mallard, Northern Pintail, Northern Shoveler, Redhead, 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	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:** Northern Harrier, Virginia Rail **PCBs:** Barrow's Goldeneye, Common Tern, Double-crested Cormorant,

Table 21 continued

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Example priority species affected
			contaminants.			Greater Scaup
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 understand the effects of contaminant concentrations in birds. Continue to acquire information on oiling of waterbirds through programs like Birds Oiled at Sea.	8.1 Research 8.2 Monitoring	**PBDE exposure; effects unknown:** Peregrine Falcon (*anatum/tundrius*)

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 22 and 23 for a summary of impacts of climate change and conservation objectives.

A recent exercise used bioclimatic modeling to predict changes in bird species ranges based on anticipated climate change for different time periods and under different emissions scenarios (Lawler et al. unpublished; Lawler et al. 2009). Bioclimatic models use statistical associations between the current range of a species and a suite of climate variables to predict future ranges under new climate conditions. The study focused on bird species currently found within Bird Conservation Regions in Canada. The results suggest that bird species turnover in Canada will be highest in northern Bird Conservation Regions as species ranges continue to shift northward in the coming decades. In BCR 9, the model predicts a gain of 14 species, a loss of 13 species for a total turnover (species gains + species losses) of 14% by the period 2071–2100.

In BCR 9, effects of climate change are already apparent. Temperatures have increased and more precipitation is falling as rain and less as snow. These changes have resulted in shorter winters and earlier and stronger winter/spring runoff and reduced summer/fall flows. Across British Columbia, average annual temperatures are expected to continue to rise, increasing 3–5°C by 2100 (Pojar 2010), and it is estimated that 20–30% of animal species currently assessed are likely to experience high risk of extinction with 2–3°C of warming (Austin et al. 2008). Geographical shifts in vegetation are expected for many species as climatic envelopes shift markedly upslope and northward, and will result in the redistribution of ecosystems on the landscape (Pojar 2010). Research on birds in British Columbia already indicates shifts in arrival and departure dates, increased overwintering by many species, and northward shifts in range and relative abundance with increasing temperature (Bunnell et al. 2008). In BCR 9, grassland, shrubsteppe, and dry forest are expected to expand upslope and northwards (Austin et al. 2008, Pojar 2010). Wetlands appear particularly vulnerable, as climate change modeling predicts that wetlands in BCR 9 will be subject to considerable drying. The smallest lakes and wetlands, which can be the most productive for waterfowl, are also the most at risk (Bunnell et al. 2010). Increases in the number and variety of forest pests are also expected. Warmer winters and earlier springs have already contributed to the scale of the current mountain pine beetle outbreak in BCR 9 (Austin et al 2008, Pojar 2010).

To maintain healthy bird populations in the face of a changing climate, conservation must be carefully planned and must be implemented so as to buffer birds from the negative impacts of climate change wherever possible (Faaborg et al. 2010).

Table 22. 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.

Climate change risk	Threat category	Example priority species affected
Direct bird mortality due to temperature extremes.	11.3 Temperature extremes	Bank Swallow, Barn Swallow, Canyon Wren, Common Nighthawk, Common Poorwill, Olive-sided Flycatcher
Reductions in food availability (e.g., nectar, invertebrates) and/or mismatches in the timing of breeding and peak food abundance due to phenological shifts, droughts, or temperature extremes.	11.1 Habitat shifting & alteration 11.2 Droughts 11.3 Temperature extremes	Bank Swallow, Barn Swallow, Black Swift, Calliope Hummingbird, Common Nighthawk, Common Poorwill, Olive-sided Flycatcher, Rufous Hummingbird
Loss or alteration of habitat due to changes in climate (e.g., altered hydrology, drying/shrinking of wetlands).	11.1 Habitat shifting & alteration 11.2 Droughts	**Waterbodies (rivers, streams):** Black Swift, Harlequin Duck **Wetlands:** American Avocet, American Bittern, Bufflehead, Cinnamon Teal, Horned Grebe, Mallard, Rusty Blackbird, Trumpeter Swan, Wilson's Phalarope

Table 23. Proposed conservation objectives and actions to address climate change.

Threats addressed	Threat sub-category	Objective	Objective category	Recommended Actions	Action category	Priority species affected
Climate change impacts habitat and negatively affects survival and productivity of birds	11.1 Habitat shifting and alteration	Reduce greenhouse gas emissions	6.1 Support efforts to reduce greenhouse gas emissions	Support efforts to reduce greenhouse gas emissions.	5.2 Policies and regulations	All
		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. 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.	8.1 Research	All

Table 23 continued

Threats addressed	Threat sub-category	Objective	Objective category	Recommended Actions	Action category	Priority species affected
				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 at the BCR scale. 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.

For example, the PIF species assessment database (Rocky Mountain Bird Observatory 2005) and local re-analysis of BBS data yield a PT of 3 for many priority waterfowl (10 of 19 species) in BCR 9. However, waterfowl are subject to widespread and intense monitoring on their breeding grounds, and population trends are typically well-understood at the flyway scale. It is for this reason we set population objectives for waterfowl from the Canadian Intermountain Joint Venture's Biological Foundation and Prospectus (CIJV 2003) and Implementation Plan (CIJV Technical Committee, 2010) rather than directly from local PT scores.

Similarly, the PIF species assessment database and local re-analysis of BBS data yielded PT scores of 3 for all priority shorebirds (6 of 6 species) and most waterbirds (11 of 13 waterbird species). Both shorebirds and waterbirds are poorly sampled by the BBS. However, for many of these species (5 of 6 shorebirds, and 7 of 13 waterbirds), population trends are better understood at a national scale (see Table 1 for PT scores from national assessments in Wings Over Water: Canada's Waterbird Conservation Plan (Milko et al. 2003) and the Canadian Shorebird Conservation Plan (Donaldson et al. 2000)). In addition, for some colonial waterbirds (e.g., Double-crested Cormorant, Western Grebe, Clark's Grebe) are relatively easily monitored via colony counts, though this information does not always scale up to the entire BCR.

BBS data yield much better information for landbirds, though population trends remain uncertain at the BCR scale for some landbird species. Our inability to more accurately assess population trends for these species may result from a lack of monitoring in remote or difficult-to-access areas. Many of the landbird species with a PT of 3 are also from groups known to be poorly sampled by BBS methods (e.g., raptors, owls, woodpeckers). Despite some shortcomings, ongoing monitoring activities such as BBS and Christmas Bird Counts provide much of the population trend data that exist, and maintaining these programs is critical. Supporting the expansion of these programs into under-sampled habitats and remote areas will improve their utility in the future.

Specific recommendations for some priority species with unknown or uncertain population trends are presented below (Table 24).

Table 24. Categories of poorly monitored species, possible monitoring approaches, and example priority species in BCR 9 Pacific and Yukon for which there are currently insufficient data to reliably estimate population trend at the BCR scale.

Category	Example priority species	Possible monitoring approaches
Aerial insectivores	Bank Swallow, Black Swift, Common Nighthawk, Common Poorwill, Vaux's Swift, White-throated Swift	Conduct regular colony counts where applicable (e.g., White-throated Swift, Bank Swallow). Surveys are required to identify Black Swift nesting locations. Implement or expand focused crepuscular surveys for Common Nighthawk and Common Poorwill. These surveys could be modeled after the United States Nightjar Survey Network (ccb-wm.org/nightjars.htm).
Diurnal raptors	Ferruginous Hawk, Gyrfalcon, Northern Harrier, Peregrine Falcon (*anatum/tundrius*), Prairie Falcon, Rough-legged Hawk, Swainson's Hawk	Support and expand Christmas Bird Counts to capture wintering raptors such as Gyrfalcon and Rough-legged Hawk. 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 such as periodic surveys of known/suspected aeries (e.g., Peregrine Falcon [*anatum/tundrius*], Prairie Falcon, Swainson's Hawk, Ferruginous Hawk).
Nocturnal raptors	Barn Owl, Flammulated Owl, Great Gray Owl, Long-eared Owl, Western Screech-Owl (*macfarlanei*)	Support and expand Nocturnal Owl Surveys. Species-specific surveys may be required for some species, such as later (e.g., May/June) surveys for Flammulated Owl.
Woodpeckers	Black-backed Woodpecker	Conduct targeted woodpecker surveys in early spring. Other poorly-monitored woodpeckers (including non-priority species) would benefit.
Hummingbirds	Calliope Hummingbird, Rufous Hummingbird	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.
Colonial waterbirds	California Gull, Caspian Tern, Clark's Grebe, Western Grebe	Conduct regular counts of principal colonies within the BCR (e.g., Okanagan Lake: California Gull, Western Grebe; Shuswap Lake: California Gull, Caspian Tern, Western Grebe). Periodically survey historical Western Grebe breeding sites for current breeding activity. Survey known Western Grebe colonies for Clark's Grebe.
Non-colonial waterbirds and wetland-associated birds	American Bittern, Horned Grebe, Rusty Blackbird, Virginia Rail, Wilson's Phalarope	Implement, support and expand Marsh Monitoring Programs similar to those in the Great Lakes Basin.
Other species captured by the Breeding Bird Survey, but currently lacking enough data for trend analysis in the BCR	Band-tailed Pigeon, Canyon Wren, Cassin's Finch, Gray Flycatcher, Lazuli Bunting, Long-billed Curlew, Red Crossbill, Townsend's Solitaire	Increase Breeding Bird Survey coverage in all habitats (both density of routes and geographic coverage), particularly grasslands, to increase data and improve trend information on undersampled 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 4 main species groups:

Landbirds

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

Shorebirds

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

Waterbirds

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

Waterfowl

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

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, and not necessarily a schedule of studies, that are needed to determine the needs of individual species (Table 25). Undertaking research will allow us to improve future iterations of BCR strategies and to focus future implementation, and will also enable the development of new tools for conservation.

Table 25. General research objectives in BCR 9 Pacific and Yukon region.

Objective	Example priority species affected
For all priority bird species exhibiting declines in BCR 9, or those that are known to be declining nationally or continentally: Determine the primary drivers of population decline (e.g., productivity, juvenile survival, adult breeding season survival, overwinter survival) to identify when and where species are being limited. Assess threats identified for these species (both within and outside Canada for migratory species) to determine the degree to which they are driving population trends.	**Species exhibiting declines in BCR 9:** American Kestrel, Barn Swallow, Black Tern, Bobolink, Brewer's Sparrow (*breweri*), Cinnamon Teal, Dusky Flycatcher, Dusky Grouse, Golden Eagle, Grasshopper Sparrow, Horned Lark (*merrilli*), Lark Sparrow, Lewis's Woodpecker, MacGillivray's Warbler, Mountain Chickadee, Northern Goshawk, Northern Pintail, Northern Saw-whet Owl, Olive-sided Flycatcher, Purple Finch, Rock Wren, Sage Thrasher, Sharp-tailed Grouse, Short-eared Owl, Spotted Owl, Townsend's Warbler, Trumpeter Swan, Western Meadowlark, White-headed Woodpecker, Williamson's Sapsucker, Willow Flycatcher **Additional species exhibiting declining trends nationally or continentally:** American Bittern, American Golden-Plover, Band-tailed Pigeon, Black Swift, Burrowing Owl, Canyon Wren, Cassin's Finch, Common Nighthawk, Common Tern, Horned Grebe, Long-billed Curlew, Long-eared Owl, Northern Harrier, Red-necked Phalarope, Rufous Hummingbird, Rusty Blackbird, Sanderling, Surf Scoter, White-throated Swift**,** Wilson's Phalarope
Conduct, support, and continue research addressing widespread declines in aerial insectivores.	Bank Swallow, Barn Swallow, Black Swift, Common Nighthawk, Common Poorwill, Dusky Flycatcher, Gray Flycatcher, Olive-sided Flycatcher, Vaux's Swift, White-throated Swift, Willow Flycatcher
Conduct, support, and continue research addressing widespread declines in grassland species.	Bobolink, Brewer's Sparrow, Dusky Grouse, Grasshopper Sparrow, Horned Lark (*merrilli*), Lark Sparrow, Long-Billed Curlew, Sage Thrasher, Sharp-tailed Grouse, Western Meadowlark
Map land cover changes that have occurred across the BCR	All species for which habitat-related declines

Table 25 continued

Objective	Example priority species affected
between the baseline time periods established in BCR plans and current day in order to correlate habitat loss with species declines and assess the main types of habitat transitions that have occurred (e.g., agriculture to forest, wetland to urban development).	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 plans.	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 non-resident 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. Monitor adherence to these BMPs and assess their effectiveness at preserving and/or increasing priority bird populations.	All priority species.
Evaluate the importance (quantity and quality) of BCR 9 wetlands as breeding and non-breeding habitats for waterfowl, waterbirds, and other wetland-associated species.	All wetland-associated species.
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.
Continue to engage in and support climate change research with respect to: -impacts to wetlands and other waterbodies resulting from changing patterns of precipitation. -habitat alteration and loss, particularly changing forest types, the shifting grassland/forest interface, and potential desertification of grassland/shrubsteppe. -potential increases in insect/disease outbreak frequency and intensity (e.g., mountain pine beetle). -range expansion or contraction of priority bird species. -identification of vulnerable species.	All priority species.

Threats Outside Canada

Many bird species found in Canada spend a large portion of their lifecycle outside of the country (Fig. 24). These species face threats while they are outside Canada; in fact, threats to some migratory species may be most severe outside of the breeding season (Calvert et al. 2009). Of the 98 priority species in BCR 9, 84 (86%) are migratory and spend part of their annual cycle—up to half the year or more—outside Canada.

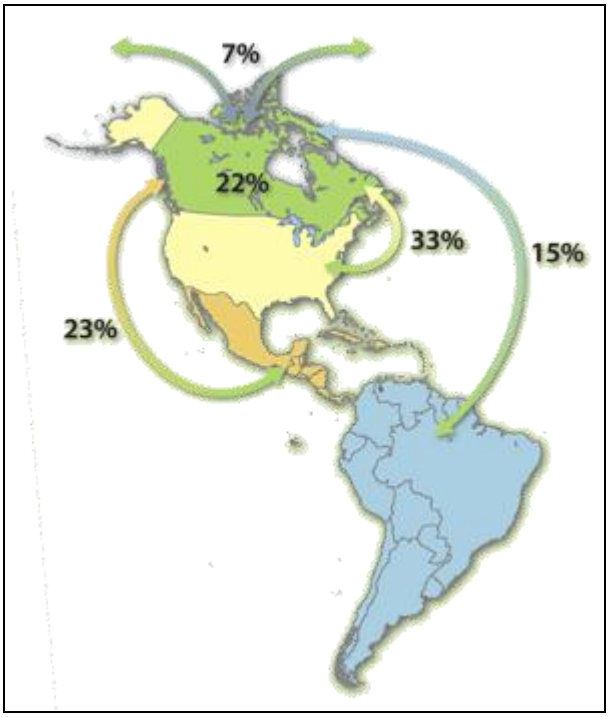

Figure 24. Percent of Canadian breeding birds that migrate to regions outside of Canada for part of their life cycle (NABCI 2012).

Birds are some of the most mobile species on the planet, and some species are true global wanderers. Priority birds from BCR 9 range widely throughout North, Central and South America. Many of our waterfowl winter in the southern parts of the United States and Mexico. Migrant songbirds from BCR 9 are particularly reliant on the southwestern United States and central and western Mexico, with many species, including the Brewer's Sparrow, Grasshopper Sparrow, MacGillivray's Warbler, Rock Wren, Townsend's Warbler, and Willow Flycatcher wintering in those areas. Some species travel much further, such as the American Golden-Plover, Bobolink, and Swainson's Hawk; all of which migrate to the pampas grasslands of Argentina, Uruguay and southern Brazil.

Our migratory species face threats throughout their life cycles, both within and outside Canada (Fig. 25). Outside Canada, key migration, wintering and breeding habitats can be lost or degraded through development, agriculture, forestry, resource extraction or other human activities. Some species, such as Calliope Hummingbird and Flammulated Owl, have relatively

small and concentrated wintering ranges where any habitat degradation or loss could have major impacts on the species population. Others can be particularly vulnerable if large proportions of the species' population concentrate at just a handful of key migratory stopover sites; degradation or loss of these sites could have devastating impacts. Birds may be incidentally killed by colliding with man-made structures; lit communications towers and tall buildings can pose a major hazard to night-migrating birds. Birds can be exposed to toxic pollutants, including chemicals which may be banned or tightly regulated in Canada and the United States but are more freely available elsewhere. While the United States and Mexico have passed laws similar to Canada's *Migratory Birds Convention Act, 1994*, which provide legal protection to many birds, other countries have not and migratory birds can be threatened by unsustainable or illegal hunting and persecution.

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

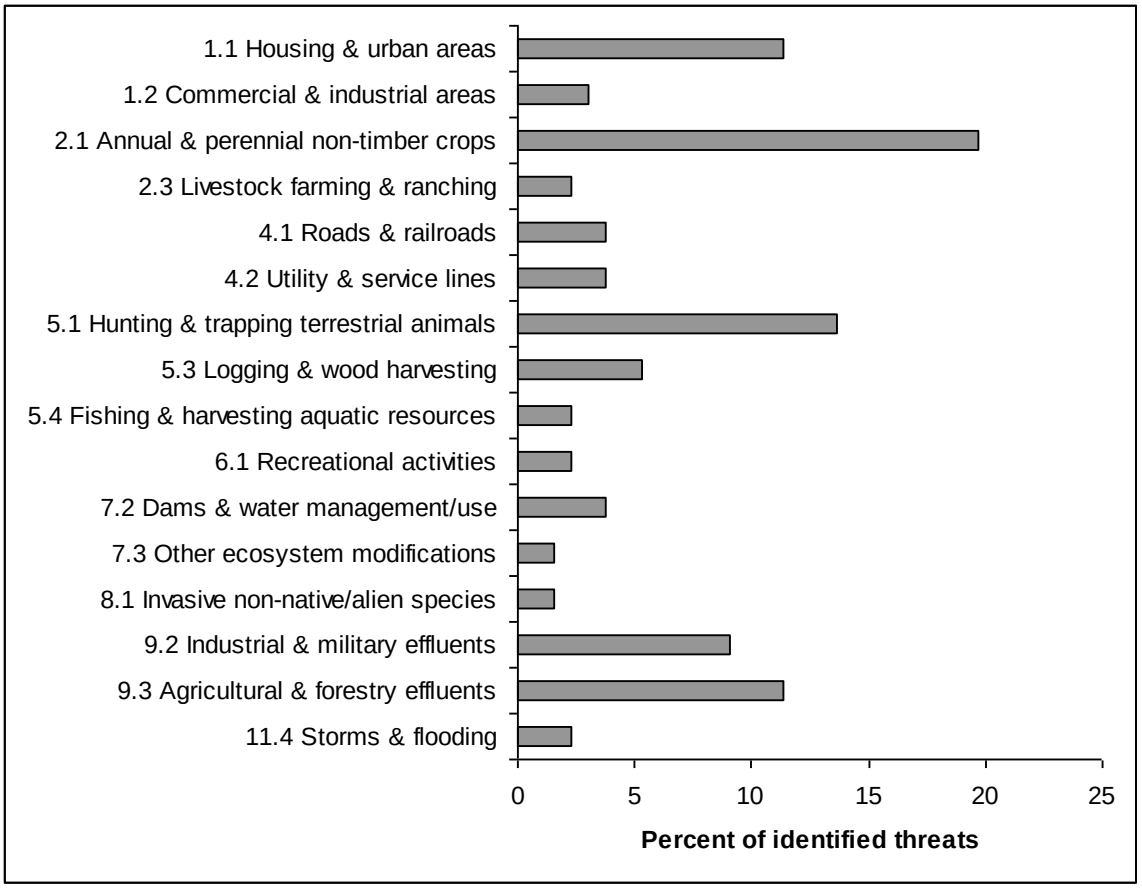

Figure 25. Percent of identified threats to priority species (by threat sub-category) in BCR 9 when they are outside Canada.

Note: Magnitudes could not be assigned for threats outside Canada due to lack of information on scope and severity. Categories representing ≤1% of all identified threats are omitted for clarity. 5.1 Hunting and trapping terrestrial animals includes hunting, lead poisoning from ingestion of spent shot, and accidental mortality of non-target species in pest bird control programs. *5.4 Fishing and harvesting aquatic resources* refers primarily to bycatch of birds in fisheries. *7.3 Other ecosystem modifications* refers to loss of roosting sites through human activity. *9.2 Industrial and military effluents* refers to the effects of oil, heavy metals and other contaminants such as PCBs, while *9.3 Agricultural and forestry effluents* refers to pesticides.

Loss of stopover, migration, and/or wintering habitat (particularly grasslands and wetlands) to urbanization and agricultural conversion and intensification were frequently identified as threats to BCR 9's migratory priority species. Additional sources of habitat loss include timber harvest and water management/use. In addition, priority species face incidental mortality from a variety of sources such as exposure to oil, pesticides and other contaminants, collisions with man-made structures while migrating, and hunting/persecution. Many threats to birds on migration and the wintering grounds are poorly documented and we were unable to accurately assess their scope and severity; consequently we were unable to assign magnitudes to individual threats facing BCR 9's priority species while they are outside Canada.

Next Steps

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

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

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Appendix 1

List of All Bird Species in BCR 9 Pacific and Yukon Region

Table A1. Complete list of species in BCR 9 Pacific and Yukon Region, when they are in the BCR (breeding, migrant, winter) and their priority status.

Scientific Name	English Name	French Name	Bird group	Breeding	Migrant	Wintering	Priority
Empidonax alnorum	Alder Flycatcher	Moucherolle des aulnes	Landbird	Y			
Corvus brachyrhynchos	American Crow	Corneille d'Amérique	Landbird	Y		Y	
Cinclus mexicanus	American Dipper	Cincle d'Amérique	Landbird	Y		Y	
Carduelis tristis	American Goldfinch	Chardonneret jaune	Landbird	Y		Y	
Falco sparverius	American Kestrel	Crécerelle d'Amérique	Landbird	Y		Y	Y
Anthus rubescens	American Pipit	Pipit d'Amérique	Landbird	Y			
Setophaga ruticilla	American Redstart	Paruline flamboyante	Landbird	Y			
Turdus migratorius	American Robin	Merle d'Amérique	Landbird	Y		Y	
Picoides dorsalis	American Three-toed Woodpecker	Pic à dos rayé	Landbird	Y		Y	
Spizella arborea	American Tree Sparrow	Bruant hudsonien	Landbird			Y	
Calypte anna	Anna's Hummingbird	Colibri d'Anna	Landbird	Y		Y	
Haliaeetus leucocephalus	Bald Eagle	Pygargue à tête blanche	Landbird	Y		Y	
Columba fasciata	Band-tailed Pigeon	Pigeon à queue barrée	Landbird	Y			Y
Riparia riparia	Bank Swallow	Hirondelle de rivage	Landbird	Y			Y
Tyto alba	Barn Owl	Effraie des clochers	Landbird	Y		Y	Y
Hirundo rustica	Barn Swallow	Hirondelle rustique	Landbird	Y			Y
Strix varia	Barred Owl	Chouette rayée	Landbird	Y		Y	
Megaceryle alcyon	Belted Kingfisher	Martin-pêcheur d'Amérique	Landbird	Y		Y	
Cypseloides niger	Black Swift	Martinet sombre	Landbird	Y			Y
Picoides arcticus	Black-backed Woodpecker	Pic à dos noir	Landbird	Y		Y	Y
Pica hudsonia	Black-billed Magpie	Pie d'Amérique	Landbird	Y		Y	Y
Poecile atricapillus	Black-capped Chickadee	Mésange à tête noire	Landbird	Y		Y	
Archilochus alexandri	Black-chinned Hummingbird	Colibri à gorge noire	Landbird	Y			
Pheucticus melanocephalus	Black-headed Grosbeak	Cardinal à tête noire	Landbird	Y			
Cyanocitta cristata	Blue Jay	Geai bleu	Landbird			Y	
Dolichonyx oryzivorus	Bobolink	Goglu des prés	Landbird	Y			Y

Table A1 continued

Scientific Name	English Name	French Name	Bird group	Breeding	Migrant	Wintering	Priority
Bombycilla garrulus	Bohemian Waxwing	Jaseur boréal	Landbird	Y		Y	
Poecile hudsonica	Boreal Chickadee	Mésange à tête brune	Landbird	Y		Y	
Aegolius funereus	Boreal Owl	Nyctale de Tengmalm	Landbird	Y		Y	
Euphagus cyanocephalus	Brewer's Blackbird	Quiscale de Brewer	Landbird	Y		Y	
Spizella breweri breweri	Brewer's Sparrow (*breweri*)	Bruant de Brewer (*breweri*)	Landbird	Y			Y
Certhia americana	Brown Creeper	Grimpereau brun	Landbird	Y		Y	
Molothrus ater	Brown-headed Cowbird	Vacher à tête brune	Landbird	Y			
Icterus bullockii	Bullock's Oriole	Oriole de Bullock	Landbird	Y			
Athene cunicularia	Burrowing Owl	Chevêche des terriers	Landbird	Y			Y
Stellula calliope	Calliope Hummingbird	Colibri calliope	Landbird	Y			Y
Catherpes mexicanus	Canyon Wren	Troglodyte des canyons	Landbird	Y		Y	Y
Carpodacus cassinii	Cassin's Finch	Roselin de Cassin	Landbird	Y		Y	Y
Vireo cassinii	Cassin's Vireo	Viréo de Cassin	Landbird	Y			
Bombycilla cedrorum	Cedar Waxwing	Jaseur d'Amérique	Landbird	Y		Y	
Poecile rufescens	Chestnut-backed Chickadee	Mésange à dos marron	Landbird	Y		Y	
Spizella passerina	Chipping Sparrow	Bruant familier	Landbird	Y			
Nucifraga columbiana	Clark's Nutcracker	Cassenoix d'Amérique	Landbird	Y		Y	
Spizella pallida	Clay-colored Sparrow	Bruant des plaines	Landbird	Y			
Petrochelidon pyrrhonota	Cliff Swallow	Hirondelle à front blanc	Landbird	Y			
Chordeiles minor	Common Nighthawk	Engoulevent d'Amérique	Landbird	Y			Y
Phalaenoptilus nuttallii	Common Poorwill	Engoulevent de Nuttall	Landbird	Y			Y
Corvus corax	Common Raven	Grand Corbeau	Landbird	Y		Y	
Carduelis flammea	Common Redpoll	Sizerin flammé	Landbird			Y	
Geothlypis trichas	Common Yellowthroat	Paruline masquée	Landbird	Y			
Accipiter cooperii	Cooper's Hawk	Épervier de Cooper	Landbird	Y		Y	
Junco hyemalis	Dark-eyed Junco	Junco ardoisé	Landbird	Y		Y	
Picoides pubescens	Downy Woodpecker	Pic mineur	Landbird	Y		Y	
Empidonax oberholseri	Dusky Flycatcher	Moucherolle sombre	Landbird	Y			Y
Dendragapus obscurus	Dusky Grouse	Tétras sombre	Landbird	Y		Y	Y
Tyrannus tyrannus	Eastern Kingbird	Tyran tritri	Landbird	Y			
Coccothraustes vespertinus	Evening Grosbeak	Gros-bec errant	Landbird	Y		Y	

Table A1 continued

Scientific Name	English Name	French Name	Bird group	Breeding	Migrant	Wintering	Priority
Buteo regalis	Ferruginous Hawk	Buse rouilleuse	Landbird	Y			Y
Otus flammeolus	Flammulated Owl	Petit-duc nain	Landbird	Y			Y
Passerella iliaca	Fox Sparrow	Bruant fauve	Landbird	Y		Y	
Aquila chrysaetos	Golden Eagle	Aigle royal	Landbird	Y		Y	Y
Regulus satrapa	Golden-crowned Kinglet	Roitelet à couronne dorée	Landbird	Y		Y	
Zonotrichia atricapilla	Golden-crowned Sparrow	Bruant à couronne dorée	Landbird			Y	
Ammodramus savannarum	Grasshopper Sparrow	Bruant sauterelle	Landbird	Y			Y
Dumetella carolinensis	Gray Catbird	Moqueur chat	Landbird	Y			
Empidonax wrightii	Gray Flycatcher	Moucherolle gris	Landbird	Y			Y
Perisoreus canadensis	Gray Jay	Mésangeai du Canada	Landbird	Y		Y	
Leucosticte tephrocotis	Gray-crowned Rosy-Finch	Roselin à tête grise	Landbird	Y		Y	
Strix nebulosa	Great Gray Owl	Chouette lapone	Landbird	Y		Y	Y
Bubo virginianus	Great Horned Owl	Grand-duc d'Amérique	Landbird	Y		Y	
Falco rusticolus	Gyrfalcon	Faucon gerfaut	Landbird			Y	Y
Picoides villosus	Hairy Woodpecker	Pic chevelu	Landbird	Y		Y	
Empidonax hammondii	Hammond's Flycatcher	Moucherolle de Hammond	Landbird	Y			
Zonotrichia querula	Harris's Sparrow	Bruant à face noire	Landbird			Y	
Catharus guttatus	Hermit Thrush	Grive solitaire	Landbird	Y			
Eremophila alpestris merrilli	Horned Lark (*merrilli*)	Alouette hausse-col (*merrilli*)	Landbird	Y		Y	Y
Carpodacus mexicanus	House Finch	Roselin familier	Landbird	Y		Y	
Troglodytes aedon	House Wren	Troglodyte familier	Landbird	Y			
Calcarius lapponicus	Lapland Longspur	Bruant lapon	Landbird			Y	
Chondestes grammacus	Lark Sparrow	Bruant à joues marron	Landbird	Y			Y
Passerina amoena	Lazuli Bunting	Passerin azuré	Landbird	Y			Y
Empidonax minimus	Least Flycatcher	Moucherolle tchébec	Landbird	Y			
Melanerpes lewis	Lewis's Woodpecker	Pic de Lewis	Landbird	Y		Y	Y
Melospiza lincolnii	Lincoln's Sparrow	Bruant de Lincoln	Landbird	Y			
Asio otus	Long-eared Owl	Hibou moyen-duc	Landbird	Y		Y	Y
Oporornis tolmiei	MacGillivray's Warbler	Paruline des buissons	Landbird	Y			Y
Cistothorus palustris	Marsh Wren	Troglodyte des marais	Landbird	Y		Y	
Falco columbarius	Merlin	Faucon émerillon	Landbird	Y		Y	

Table A1 continued

Scientific Name	English Name	French Name	Bird group	Breeding	Migrant	Wintering	Priority
Sialia currucoides	Mountain Bluebird	Merlebleu azuré	Landbird	Y			
Poecile gambeli	Mountain Chickadee	Mésange de Gambel	Landbird	Y		Y	Y
Zenaida macroura	Mourning Dove	Tourterelle triste	Landbird	Y		Y	
Oreothlypis ruficapilla	Nashville Warbler	Paruline à joues grises	Landbird	Y			
Colaptes auratus	Northern Flicker	Pic flamboyant	Landbird	Y		Y	
Accipiter gentilis	Northern Goshawk	Autour des palombes	Landbird	Y		Y	Y
Circus cyaneus	Northern Harrier	Busard Saint-Martin	Landbird	Y		Y	Y
Glaucidium gnoma	Northern Pygmy-Owl	Chevêchette naine	Landbird	Y		Y	
Stelgidopteryx serripennis	Northern Rough-winged Swallow	Hirondelle à ailes hérissées	Landbird	Y			
Aegolius acadicus	Northern Saw-whet Owl	Petite Nyctale	Landbird	Y		Y	Y
Lanius excubitor	Northern Shrike	Pie-grièche grise	Landbird			Y	
Parkesia noveboracensis	Northern Waterthrush	Paruline des ruisseaux	Landbird	Y			
Contopus cooperi	Olive-sided Flycatcher	Moucherolle à côtés olive	Landbird	Y			Y
Oreothlypis celata	Orange-crowned Warbler	Paruline verdâtre	Landbird	Y			
Pandion haliaetus	Osprey	Balbuzard pêcheur	Landbird	Y			
Troglodytes pacifica	Pacific Wren	Troglodyte mignon	Landbird	Y		Y	
Empidonax difficilis	Pacific-slope Flycatcher	Moucherolle côtier	Landbird	Y			
Falco peregrinus anatum tundrius	Peregrine Falcon (*anatum/tundrius*)	Faucon pèlerin (*anatum/tundrius*)	Landbird	Y		Y	Y
Dryocopus pileatus	Pileated Woodpecker	Grand Pic	Landbird	Y		Y	
Pinicola enucleator	Pine Grosbeak	Durbec des sapins	Landbird	Y		Y	
Carduelis pinus	Pine Siskin	Tarin des pins	Landbird	Y		Y	
Falco mexicanus	Prairie Falcon	Faucon des prairies	Landbird	Y		Y	Y
Carpodacus purpureus	Purple Finch	Roselin pourpré	Landbird	Y			Y
Sitta pygmaea	Pygmy Nuthatch	Sittelle pygmée	Landbird	Y		Y	Y
Loxia curvirostra	Red Crossbill	Bec-croisé des sapins	Landbird	Y		Y	Y
Sitta canadensis	Red-breasted Nuthatch	Sittelle à poitrine rousse	Landbird	Y		Y	
Sphyrapicus ruber	Red-breasted Sapsucker	Pic à poitrine rouge	Landbird	Y			
Vireo olivaceus	Red-eyed Vireo	Viréo aux yeux rouges	Landbird	Y			
Sphyrapicus nuchalis	Red-naped Sapsucker	Pic à nuque rouge	Landbird	Y			
Buteo jamaicensis	Red-tailed Hawk	Buse à queue rousse	Landbird	Y		Y	
Agelaius phoeniceus	Red-winged Blackbird	Carouge à épaulettes	Landbird	Y		Y	

Table A1 continued

Scientific Name	English Name	French Name	Bird group	Breeding	Migrant	Wintering	Priority
Salpinctes obsoletus	Rock Wren	Troglodyte des rochers	Landbird	Y			Y
Buteo lagopus	Rough-legged Hawk	Buse pattue	Landbird			Y	Y
Regulus calendula	Ruby-crowned Kinglet	Roitelet à couronne rubis	Landbird	Y		Y	
Bonasa umbellus	Ruffed Grouse	Gélinotte huppée	Landbird	Y		Y	
Selasphorus rufus	Rufous Hummingbird	Colibri roux	Landbird	Y			Y
Euphagus carolinus	Rusty Blackbird	Quiscale rouilleux	Landbird	Y			Y
Oreoscoptes montanus	Sage Thrasher	Moqueur des armoises	Landbird	Y			Y
Passerculus sandwichensis	Savannah Sparrow	Bruant des prés	Landbird	Y			
Sayornis saya	Say's Phoebe	Moucherolle à ventre roux	Landbird	Y			
Accipiter striatus	Sharp-shinned Hawk	Épervier brun	Landbird	Y		Y	
Tympanuchus phasianellus columbianus	Sharp-tailed Grouse (*columbianus*)	Tétras à queue fine (*columbianus*)	Landbird	Y		Y	Y
Asio flammeus	Short-eared Owl	Hibou des marais	Landbird	Y		Y	Y
Plectrophenax nivalis	Snow Bunting	Bruant des neiges	Landbird			Y	
Melospiza melodia	Song Sparrow	Bruant chanteur	Landbird	Y		Y	
Strix occidentalis	Spotted Owl	Chouette tachetée	Landbird	Y		Y	Y
Pipilo maculatus	Spotted Towhee	Tohi tacheté	Landbird	Y		Y	
Falcipennis canadensis	Spruce Grouse	Tétras du Canada	Landbird	Y		Y	
Cyanocitta stelleri	Steller's Jay	Geai de Steller	Landbird	Y		Y	
Buteo swainsoni	Swainson's Hawk	Buse de Swainson	Landbird	Y			Y
Catharus ustulatus	Swainson's Thrush	Grive à dos olive	Landbird	Y			
Myadestes townsendi	Townsend's Solitaire	Solitaire de Townsend	Landbird	Y		Y	Y
Dendroica townsendi	Townsend's Warbler	Paruline de Townsend	Landbird	Y			Y
Tachycineta bicolor	Tree Swallow	Hirondelle bicolore	Landbird	Y			
Cathartes aura	Turkey Vulture	Urubu à tête rouge	Landbird	Y			
Ixoreus naevius	Varied Thrush	Grive à collier	Landbird	Y		Y	
Chaetura vauxi	Vaux's Swift	Martinet de Vaux	Landbird	Y			Y
Catharus fuscescens	Veery	Grive fauve	Landbird	Y			
Pooecetes gramineus	Vesper Sparrow	Bruant vespéral	Landbird	Y			
Tachycineta thalassina	Violet-green Swallow	Hirondelle à face blanche	Landbird	Y			
Vireo gilvus	Warbling Vireo	Viréo mélodieux	Landbird	Y			
Sialia mexicana	Western Bluebird	Merlebleu de l'Ouest	Landbird	Y		Y	

Table A1 continued

Scientific Name	English Name	French Name	Bird group	Breeding	Migrant	Wintering	Priority
Tyrannus verticalis	Western Kingbird	Tyran de l'Ouest	Landbird	Y			
Sturnella neglecta	Western Meadowlark	Sturnelle de l'Ouest	Landbird	Y		Y	Y
Megascops kennicottii macfarlanei	Western Screech-Owl (*macfarlanei*)	Petit-duc des montagnes (*macfarlanei*)	Landbird	Y		Y	Y
Piranga ludoviciana	Western Tanager	Tangara à tête rouge	Landbird	Y			
Contopus sordidulus	Western Wood-Pewee	Pioui de l'Ouest	Landbird	Y			
Sitta carolinensis	White-breasted Nuthatch	Sittelle à poitrine blanche	Landbird	Y		Y	
Zonotrichia leucophrys	White-crowned Sparrow	Bruant à couronne blanche	Landbird	Y		Y	
Picoides albolarvatus	White-headed Woodpecker	Pic à tête blanche	Landbird	Y		Y	Y
Lagopus leucurus	White-tailed Ptarmigan	Lagopède à queue blanche	Landbird	Y		Y	
Zonotrichia albicollis	White-throated Sparrow	Bruant à gorge blanche	Landbird			Y	
Aeronautes saxatalis	White-throated Swift	Martinet à gorge blanche	Landbird	Y			Y
Loxia leucoptera	White-winged Crossbill	Bec-croisé bifascié	Landbird	Y		Y	
Meleagris gallopavo	Wild Turkey	Dindon sauvage	Landbird	Y		Y	
Sphyrapicus thyroideus	Williamson's Sapsucker	Pic de Williamson	Landbird	Y			Y
Empidonax traillii	Willow Flycatcher	Moucherolle des saules	Landbird	Y			Y
Wilsonia pusilla	Wilson's Warbler	Paruline à calotte noire	Landbird	Y			
Dendroica petechia	Yellow Warbler	Paruline jaune	Landbird	Y			
Icteria virens	Yellow-breasted Chat	Paruline polyglotte	Landbird	Y			Y
Xanthocephalus xanthocephalus	Yellow-headed Blackbird	Carouge à tête jaune	Landbird	Y			
Dendroica coronata	Yellow-rumped Warbler	Paruline à croupion jaune	Landbird	Y			
Recurvirostra americana	American Avocet	Avocette d'Amérique	Shorebird	Y			Y
Pluvialis dominica	American Golden-Plover	Pluvier bronzé	Shorebird		Y		Y
Calidris bairdii	Baird's Sandpiper	Bécasseau de Baird	Shorebird		Y		
Pluvialis squatarola	Black-bellied Plover	Pluvier argenté	Shorebird		Y		
Himantopus mexicanus	Black-necked Stilt	Échasse d'Amérique	Shorebird		Y		
Calidris alpina	Dunlin	Bécasseau variable	Shorebird		Y		
Tringa melanoleuca	Greater Yellowlegs	Grand Chevalier	Shorebird		Y		
Charadrius vociferus	Killdeer	Pluvier kildir	Shorebird	Y		Y	
Calidris minutilla	Least Sandpiper	Bécasseau minuscule	Shorebird		Y		
Tringa flavipes	Lesser Yellowlegs	Petit Chevalier	Shorebird		Y		

Table A1 continued

Scientific Name	English Name	French Name	Bird group	Breeding	Migrant	Wintering	Priority
Numenius americanus	Long-billed Curlew	Courlis à long bec	Shorebird	Y			Y
Limnodromus scolopaceus	Long-billed Dowitcher	Bécassin à long bec	Shorebird		Y		
Calidris melanotos	Pectoral Sandpiper	Bécasseau à poitrine cendrée	Shorebird		Y		
Phalaropus lobatus	Red-necked Phalarope	Phalarope à bec étroit	Shorebird		Y		Y
Calidris alba	Sanderling	Bécasseau sanderling	Shorebird		Y		Y
Charadrius semipalmatus	Semipalmated Plover	Pluvier semipalmé	Shorebird		Y		
Calidris pusilla	Semipalmated Sandpiper	Bécasseau semipalmé	Shorebird		Y		
Tringa solitaria	Solitary Sandpiper	Chevalier solitaire	Shorebird	Y			
Actitis macularius	Spotted Sandpiper	Chevalier grivelé	Shorebird	Y			
Calidris himantopus	Stilt Sandpiper	Bécasseau à échasses	Shorebird		Y		
Calidris mauri	Western Sandpiper	Bécasseau d'Alaska	Shorebird		Y		
Calidris fuscicollis	White-rumped Sandpiper	Bécasseau à croupion blanc	Shorebird		Y		
Tringa semipalmata	Willet	Chevalier semipalmé	Shorebird		Y		
Phalaropus tricolor	Wilson's Phalarope	Phalarope de Wilson	Shorebird	Y			Y
Gallinago delicata	Wilson's Snipe	Bécassine de Wilson	Shorebird	Y		Y	
Botaurus lentiginosus	American Bittern	Butor d'Amérique	Waterbird	Y			Y
Fulica americana	American Coot	Foulque d'Amérique	Waterbird	Y			
Pelecanus erythrorhynchos	American White Pelican	Pélican d'Amérique	Waterbird	Y			Y
Chlidonias niger	Black Tern	Guifette noire	Waterbird	Y			Y
Chroicocephalus philadelphia	Bonaparte's Gull	Mouette de Bonaparte	Waterbird		Y		
Larus californicus	California Gull	Goéland de Californie	Waterbird	Y		Y	Y
Hydroprogne caspia	Caspian Tern	Sterne caspienne	Waterbird		Y		Y
Aechmophorus clarkii	Clark's Grebe	Grèbe à face blanche	Waterbird	Y			Y
Gavia immer	Common Loon	Plongeon huard	Waterbird	Y		Y	
Sterna hirundo	Common Tern	Sterne pierregarin	Waterbird		Y		Y
Phalacrocorax auritus	Double-crested Cormorant	Cormoran à aigrettes	Waterbird			Y	Y
Podiceps nigricollis	Eared Grebe	Grèbe à cou noir	Waterbird	Y		Y	
Larus pipixcan	Franklin's Gull	Mouette de Franklin	Waterbird		Y		
Larus hyperboreus	Glaucous Gull	Goéland bourgmestre	Waterbird			Y	
Larus glaucescens	Glaucous-winged Gull	Goéland à ailes grises	Waterbird			Y	
Ardea herodias herodias	Great Blue Heron (*herodias*)	Grand Héron (*herodias*)	Waterbird	Y		Y	Y

Table A1 continued

Scientific Name	English Name	French Name	Bird group	Breeding	Migrant	Wintering	Priority
Ardea alba	Great Egret	Grande Aigrette	Waterbird		Y		
Larus argentatus	Herring Gull	Goéland argenté	Waterbird	Y		Y	
Podiceps auritus	Horned Grebe	Grèbe esclavon	Waterbird	Y		Y	Y
Larus canus	Mew Gull	Goéland cendré	Waterbird			Y	
Stercorarius parasiticus	Parasitic Jaeger	Labbe parasite	Waterbird		Y		
Podilymbus podiceps	Pied-billed Grebe	Grèbe à bec bigarré	Waterbird	Y		Y	
Podiceps grisegena	Red-necked Grebe	Grèbe jougris	Waterbird	Y		Y	
Gavia stellata	Red-throated Loon	Plongeon catmarin	Waterbird			Y	
Larus delawarensis	Ring-billed Gull	Goéland à bec cerclé	Waterbird	Y		Y	
Xema sabini	Sabine's Gull	Mouette de Sabine	Waterbird		Y		
Grus canadensis	Sandhill Crane	Grue du Canada	Waterbird	Y		Y	
Porzana carolina	Sora	Marouette de Caroline	Waterbird	Y			
Larus thayeri	Thayer's Gull	Goéland de Thayer	Waterbird			Y	Y
Rallus limicola	Virginia Rail	Râle de Virginie	Waterbird	Y		Y	Y
Aechmophorus occidentalis	Western Grebe	Grèbe élégant	Waterbird	Y		Y	Y
Anas americana	American Wigeon	Canard d'Amérique	Waterfowl	Y		Y	Y
Bucephala islandica	Barrow's Goldeneye	Garrot d'Islande	Waterfowl	Y		Y	Y
Anas discors	Blue-winged Teal	Sarcelle à ailes bleues	Waterfowl	Y			
Bucephala albeola	Bufflehead	Petit Garrot	Waterfowl	Y		Y	Y
Branta canadensis	Canada Goose	Bernache du Canada	Waterfowl	Y		Y	Y
Aythya valisineria	Canvasback	Fuligule à dos blanc	Waterfowl	Y		Y	Y
Anas cyanoptera	Cinnamon Teal	Sarcelle cannelle	Waterfowl	Y			Y
Bucephala clangula	Common Goldeneye	Garrot à oeil d'or	Waterfowl	Y		Y	
Mergus merganser	Common Merganser	Grand Harle	Waterfowl	Y		Y	
Anas penelope	Eurasian Wigeon	Canard siffleur	Waterfowl		Y	Y	
Anas strepera	Gadwall	Canard chipeau	Waterfowl	Y		Y	Y
Aythya marila	Greater Scaup	Fuligule milouinan	Waterfowl		Y	Y	Y
Anser albifrons	Greater White-fronted Goose	Oie rieuse	Waterfowl		Y		Y
Anas crecca	Green-winged Teal	Sarcelle d'hiver	Waterfowl	Y		Y	Y
Histrionicus histrionicus	Harlequin Duck	Arlequin plongeur	Waterfowl	Y		Y	Y
Lophodytes cucullatus	Hooded Merganser	Harle couronné	Waterfowl	Y		Y	

Table A1 continued

Scientific Name	English Name	French Name	Bird group	Breeding	Migrant	Wintering	Priority
Aythya affinis	Lesser Scaup	Petit Fuligule	Waterfowl	Y		Y	
Chen caerulescens caerulescens	Lesser Snow Goose	Petite Oie des neiges	Waterfowl		Y		Y
Clangula hyemalis	Long-tailed Duck	Harelde kakawi	Waterfowl		Y	Y	
Anas platyrhynchos	Mallard	Canard colvert	Waterfowl	Y		Y	Y
Cygnus olor	Mute Swan	Cygne tuberculé	Waterfowl	Y		Y	
Anas acuta	Northern Pintail	Canard pilet	Waterfowl	Y		Y	Y
Anas clypeata	Northern Shoveler	Canard souchet	Waterfowl	Y		Y	Y
Mergus serrator	Red-breasted Merganser	Harle huppé	Waterfowl			Y	
Aythya americana	Redhead	Fuligule à tête rouge	Waterfowl	Y		Y	Y
Aythya collaris	Ring-necked Duck	Fuligule à collier	Waterfowl	Y		Y	
Chen rossii	Ross's Goose	Oie de Ross	Waterfowl		Y		
Oxyura jamaicensis	Ruddy Duck	Érismature rousse	Waterfowl	Y		Y	
Melanitta perspicillata	Surf Scoter	Macreuse à front blanc	Waterfowl		Y		Y
Cygnus buccinator	Trumpeter Swan	Cygne trompette	Waterfowl	Y		Y	Y
Cygnus columbianus	Tundra Swan	Cygne siffleur	Waterfowl		Y	Y	Y
Melanitta fusca	White-winged Scoter	Macreuse brune	Waterfowl	Y		Y	
Aix sponsa	Wood Duck	Canard branchu	Waterfowl	Y		Y	

Appendix 2

General Methodology for Compiling the Six Standard Elements

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

1) identifying priority species – to focus conservation attention on species of conservation concern and those most representative of the region
2) attributing priority species to habitat classes – a tool for identifying habitats of conservation interest and a means of organizing and presenting information
3) setting population objectives for priority species – an assessment of current population status compared to the desired status, and a means of measuring conservation success
4) assessing and ranking threats – identifies the relative importance of issues affecting populations of priority species within the planning area as well as outside Canada (i.e., throughout their 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 needs among birds.

In BCR 9, a species was considered as "regularly occurring" within the BCR and assessed for priority status if there are 10 or more records in the past 10 years, occurring every year or almost every year. Records were obtained from *The Birds of British Columbia* (Campbell et al. 1990, 1997, 2001), *Birds of the Okanagan Valley, British Columbia* (Cannings et al. 1987) the BC BIRDS database (Wendy Easton, CWS-PYR), preliminary data from the British Columbia Atlas of Breeding Birds (http://birdatlas.bc.ca), eBird Canada (http://ebird.org/content/canada), and Christmas Bird Count (CBC) data (www.audubon.org/bird/cbc/index.html). Federally or provincially listed species were also considered, even if there were fewer than 10 records.

Priority species were initially identified based on the following two criteria: (a) whether they were listed by the pillar plans for the species group (landbirds, waterbirds, shorebirds, waterfowl) or (b) whether they were designated "At Risk" by provincial or federal processes. Landbirds, waterbirds and shorebirds were also added to the list as species of regional concern or stewardship based on the criteria outlined below. The resulting initial list of priority species was then screened by local experts, and additional species of conservation concern were added to the list.

Partners in Flight criteria for landbirds

Landbird species identified as being of Continental Concern or Stewardship in BCR 9 by the PIF species assessment database (Rocky Mountain Bird Observatory 2005) were added to the priority list in the Canadian portion of BCR 9.

The process for identifying Regional Concern and Regional Stewardship landbird species in the Canadian portion of BCR 9 included a reassessment of the BCR 9 Threats to Breeding (TB), Threats to Non-breeding (TN), and Population Trend (PT) scores appearing in the 2005 PIF species assessment database to reflect data specific to the planning area. TB and TN scores were reassessed by local experts, and PT scores were reassessed based on 1968-2008 Breeding Bird Survey trend data for the Canadian portion of BCR 9 and the PT scores criteria described in The Partners in Flight Handbook on Species Assessment (Panjabi et al. 2005). Where a change in score was made, the highest of the BCR-wide and sub-BCR scores was retained. New Regional Combined Scores for the breeding (RCS-b) and non-breeding (RCS-n) seasons were calculated using Breeding Distribution (BD), Non-Breeding Distribution (ND), Population Size (PS), Breeding Relative Density (RD-b) and global PT scores from the PIF species assessment database, Non-breeding Relative Density (RD-n) scores provided by Peter Blancher (CWS-National), and TB, TN, and regional PT scores from the regional reassessment (see formulas below).

Birds that occur in the Canadian portion of BCR 9 only during the breeding season:

$$RCS\text{-}b = BD_{global} + PS_{global} + PT_{BCR\ 9} + TB_{BCR\ 9} + RD\text{-}b_{BCR\ 9}$$

Birds that occur in the Canadian portion of BCR 9 only during the non-breeding season:

$$RCS\text{-}n = ND_{global} + PS_{global} + PT_{global} + TN_{BCR\ 9} + RD\text{-}n_{BCR\ 9}$$

Birds that occur in the Canadian portion of BCR 9 during both the breeding and non-breeding seasons (residents):

$$RCS\text{-}n = ND_{global} + PS_{global} + PT_{BCR\ 9} + TN_{BCR\ 9} + RD\text{-}b_{BCR\ 9}$$

The criteria used by Panjabi et al. 2005 for identifying Regional Concern and Regional Stewardship species were then applied to prioritize species in the Canadian portion of BCR 9 (see below).

Regional Concern: Species must meet all criteria in the season(s) for which it is listed:

- Regional Combined Score > 13
- High Regional Threats (> 3) or Moderate Regional Threat (3) combined with significant population decline (PT > 3)
- Occurs regularly in significant numbers in the BCR, i.e., RD > 1

Regional Stewardship: Species must meet all criteria in the season(s) for which it is listed:

- Regional Combined Score > 13
- High importance of the BCR to the species; % of Western Hemisphere Breeding Population in BCR 9 ≥ 25 OR (RD=5 and % of Western Hemisphere Breeding Population in BCR 9 ≥ 5). **Note:** The % of Western Hemisphere Breeding Population was used here as opposed to the % of Global Breeding Population because Global Population data were not available for most non-landbirds.
- Future conditions are not enhanced by human activities, i.e., Threat Score > 1

Waterfowl

For waterfowl, the prioritization by the 2004 Strategic Guidance to the North American Waterfowl Management Plan: Strengthening the Biological Foundation (North American Waterfowl Management Plan, Plan Committee 2004) was used as a criterion for identifying waterfowl priority species in the Canadian portion of BCR 9. Species that scored Moderate High, High or Highest for either Breeding or Non-breeding Need in WCR 9 in the NAWMP prioritization were selected as priority species.

Waterbirds and Shorebirds

Unlike waterfowl, the pillar plans for waterbirds and shorebirds reflect a national scope and do not list priority species by region and unlike landbirds, no standardized methods exist to adjust species lists to reflect species of regional concern or stewardship. We have therefore developed a technique to allow for the assessment of waterbirds and shorebirds at a regional scale. These methods are loosely based on those developed by Schonewille et al. (2007) but were somewhat modified to reflect the data available in our region.

For Waterbirds:

PT, PS, TB, TN, BD and ND scores are taken directly from Wings Over Water Canada's Waterbird Conservation Plan (Milko et al. 2003; WOW). Species in categories 1 (highly imperiled) and 2 (high concern) in WOW are automatically added to the priority species list. To regionalize we used the percent of the species range that occurs within the BCR. The percent range scores were calculated using range data from NatureServe (www.natureserve.org/getData/birdMaps.jsp) and included the portions of the range where each species is listed as Extant and/or Possibly Present. The categories of data used from NatureServe include:

- Native (year-round)
- Native (breeding season only)
- Native (non-breeding season only)
- Native (as a passage migrant or wanderer)

The highest of the 4 scores were used to assign the species to one of 5 categories that reflected the percent of the species' range in the BCR.

- 1–<1%
- 2–1-9%
- 3–10–24%
- 4–25–49%
- 5–≥50%

The regional combined score (RCS_BCR) is:

RCS_BCR = PT + PS + TB + TN+ BD + ND + % Range in BCR

If RCS_BCR ≥18 then the species is added to the priority species list. Species that have a RCS_BCR ≥18 are considered to be regional stewardship species.

There are a number of species of waterbirds that are Information Lacking and do not have scores for PT, PS, TB, TN, BD and ND. In order to assess those species we deferred to the PIF approach for landbirds as described above. For BCR 9, Pied-billed Grebe, Sora and Virginia Rail fell into this category. Virginia Rail was added to the list of priority species based on the PIF data and assessment methods.

For Shorebirds:

Species in categories 4 (species of high concern) and 5 (highly imperiled) in the Canadian Shorebird Conservation Plan (Donaldson et al. 2000) were automatically added to the priority species list. As above, to regionalize we used the percent of the species' range that occurs within the BCR. If the percent of the species' range in the BCR falls into categories 4 or 5 (above) then the overall score given to the species in the Canadian Shorebird Conservation Plan was increased by one.

If the new score is ≥4 then the species is added to the priority species list. Species that have ≥25% of their range in the BCR are considered to be regional stewardship species.

Species at risk

Among the species occurring in the Canadian portion of BCR 9, those that were Red- or Blue-listed in British Columbia or had a COSEWIC status of Endangered, Threatened or Special Concern were identified as priority species.

Screening by experts

The list resulting from the assessment described above was screened by experts. No additional species of conservation interest in the planning area were added.

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 BCR 9, a maximum of two habitat associations were identified for each priority 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 (FAO 2000). Some modifications were made to the LCCS scheme to reflect habitat types that are important to birds that are not included in the classification (e.g., marine habitats). Species often are assigned to more than one of these coarse habitat classes. To retain the link to regional spatial data (e.g., provincial forest inventories, etc.), or to group species into regionally relevant habitat classes, individual BCR strategies may identify finer scale habitat classes. Finer-scale habitat attributes and the surrounding landscape context were also captured when possible to better guide the development of specific conservation objectives and actions.

Element 3: Population Objectives for Priority Species

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

Population objectives for all bird groups are based on a quantitative or qualitative assessment of species' population trends. If the population trend for a species is unknown, the objective is usually "assess and maintain," and a monitoring objective is set. Harvested waterfowl and stewardship species that are already at desired population levels are given an objective of "maintain." For any species listed under the *Species at Risk Act* (SARA) or under provincial/territorial endangered species legislation, Bird Conservation Strategies defer to population objectives in available Recovery Strategies and Management Plans. If recovery documents are not available, objectives are set using the same approach as for other species within that bird group. Once recovery objectives are available, they will replace interim objectives.

For BCR 9, population objectives for waterfowl were taken from the Canadian Intermountain Joint Venture's Biological Foundation and Prospectus (CIJV 2003) and Implementation Plan (CIJV Technical Committee 2010). Population objectives for landbirds, waterbirds and shorebirds were assigned based on the species' population trend (PT) score. For each priority species, the PT score for the entire BCR was provided by Partners in Flight, and the PT score for the Canadian portion of the BCR was calculated from BBS data following PIF protocols (Panjabi et al. 2005). Conservatively, the higher of the two PT scores was used to assign a population objective. Priority species exhibiting declines (PT = 4) were set an objective of "increase population by 50%," while strongly declining species (PT = 5) had an objective identified as "increase population by 100%." For species with PT = 3 (uncertain or unknown trend), objectives were set as "maintain and assess." Finally, species with stable or increasing populations (PT = 1 or 2) had an objective set to "maintain current." Population objectives were not set for priority species which only occur in the BCR on migration and do not breed or winter in the region.

Element 4: Threat Assessment for Priority Species

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

The threats assessment exercise included three main steps:

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

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

Element 5: Conservation Objectives

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

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

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

Conservation objectives generally fall into one of two broad categories:

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

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

Element 6: Recommended Actions

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

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

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

Appendix 3

Recommendations for the Silvicultural Management of Mountain Pine Beetle-Affected Forests

Adapted from: Harrison, M. 2009. *Birds in Mountain Pine Beetle-Infested Forests: Summary and Recommendations*. Prepared for Pacific Wildlife Research Centre, Environment Canada. Unpublished report. 25pp.

When and Where to Conduct Salvage Logging

- Do not conduct salvage logging in the short term (3–5 years) while the mountain pine beetle (MPB) is providing an ephemeral food subsidy and the residual habitat structure remains intact.
- Do not conduct salvage harvesting in the non–contributing land base.
- Do not conduct salvage logging in selected areas where intermixed pine represents <40% of the species mix (to maintain habitat for late-seral associated species and maintain stands with lower susceptibility to MPB).
- Limit salvage operations in areas with high residual habitat value:
  - uneven aged stands (i.e. surviving younger trees).
  - stands with surviving non-pine trees (dominant and codominant).
  - stands with well-developed shrub layers.
  - ecosystems were where biodiversity was high prior to MPB attack.
  - wet ecosystems where residual MPB-killed snags will decay to a degree appropriate for cavity nester habitat.
  - stands with a high residual live-tree component.

What to Retain

Tree Choice

- Retain conifer species other than lodgepole pine (to maintain some forest structure in the short term and create less MPB-susceptible stands in the future).
- Retain all possible aspen and other deciduous trees (including dead and dying trees), preferably in patches with conifers (to maintain cavity-nester habitat).
- Retain larger trees (>30 cm will accommodate most cavity nesters).
- Retain a range of size and age classes of dead/dying trees (to ensure sustained provision of dead/dying wood and timely onset of decay).
- Select residual trees that are placed in deep soils, close to riparian areas, or in patches with high snag composition.

Retention Pattern and Size

- Allocate retention targets to larger uncut reserves, rather than retaining multiple patches within cutblocks, when the maintenance of mature forest-dependent species is a priority.
- Increase retention targets to 30–40% to accommodate harvest-sensitive species.

- Retain trees in an aggregated, rather than a dispersed pattern.
- Keep retention patches to a minimum of 1 ha, and include a few larger patches (>10–50 ha) for mature-forest-dependent species; size of retention patches should increase with decreased proportion of old forest on the landscape.
- Provide small buffers of dead lodgepole pine around retained inclusions of other tree species (to prevent blowdown).
- Follow former Forest Practice Code guidelines when harvesting near streams and rivers (to retain forest patches with the greatest habitat potential).
- Increase the retention area in harvested opening in proportion to the size of the opening.

Additional Legacies

- Control minor vegetation sparingly (to maintain understory habitat and advanced regeneration).
- Leave any slash >15 cm in diameter where it lies (to provide downed wood habitat).
- Leave standing any trees remaining in clearcuts for woodpecker foraging sites and potential nest trees. If it is necessary to prevent competition with growing seedlings, live deciduous trees can be killed (through herbicide treatments or girdling) but should be left standing.
- Create snags through girdling, topping or stubbing where safety standards permit it and where conditions are appropriate for the creation of cavity nester habitat (i.e., DBH >30 cm, deep soil, and moist conditions).
- Preferentially leave/create snags where cavities already exist.

Restoration

- Refrain from restoration where advanced regeneration of non-pine species exists.
- Do not remove downed wood.
- Focus restoration effort on stands that lack sufficient advanced regeneration (to promote understory development).
- Convert homogeneous pine to non-pine (through planting and non-pine species retention).

Landscape Considerations

- Balance silvicultural mosaics at a landscape level to mimic natural disturbance patterns, maximize the number of species provided with suitable habitat (since silvicultural options differ in the species they benefit), and minimize the susceptibility of the landscape to future MPB infestation.
- Leave what was originally planned under existing landscape level plans (i.e., provisions for old-growth management areas, since areas with considerable dead pine are still of value to biodiversity).
- Do not change the provisions made for riparian management areas (RMAs) and riparian reserve zones (RRZs).
- Vary amount and pattern of retention with forest type (i.e., what is represented in the surrounding matrix) and natural disturbance pattern.

- Increase the role of prescribed burning as a management tool. Fire, with no salvage, can act as an agent of both beetle control and forest regeneration much more effectively and cheaply than building roads, logging, planting, and other intensive silvicultural activities.
- Extend rotations to allow trees to reach sufficient size to provide appropriate nesting and foraging habitat for cavity nesters.

www.**ec.gc.ca**

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