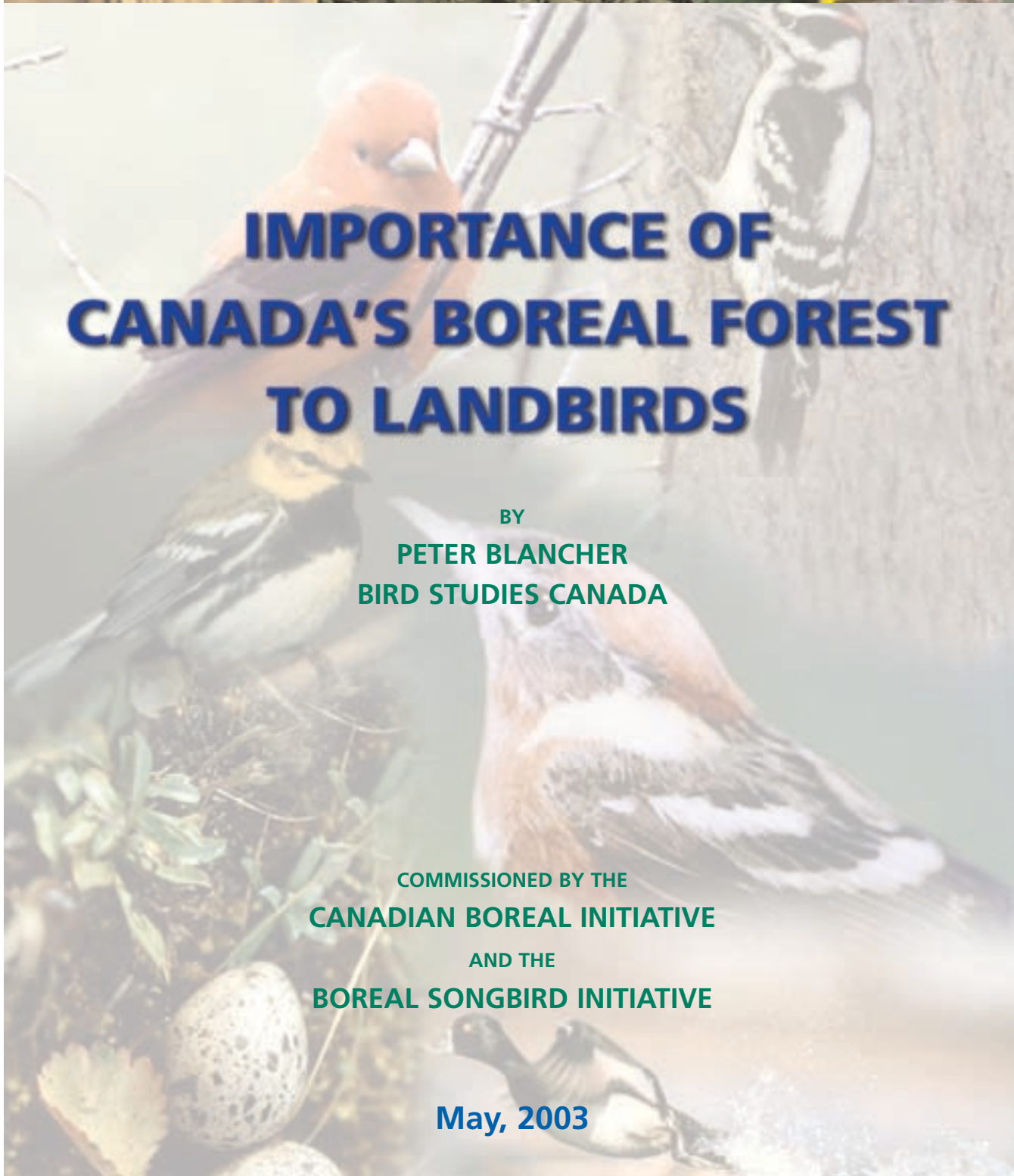


IMPORTANCE OF CANADA'S BOREAL FOREST TO LANDBIRDS

BY
PETER BLANCHER
BIRD STUDIES CANADA

COMMISSIONED BY THE
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Author Dr. Peter Blancher currently works as Partners in Flight (PIF) Scientist for *Bird Studies Canada*, with support from Environment Canada's *Canadian Wildlife Service*. He provides technical support for landbird conservation planning at continental, national and regional scales. As a member of the PIF Technical Committee, he is a co-author of the *Partners in Flight North American Landbird Conservation Plan*.



Bird Studies Canada is recognized nation-wide as a leading and respected not-for-profit conservation organization dedicated to advancing the understanding, appreciation and conservation of wild birds and their habitats, in Canada and elsewhere, through studies that engage the skills, enthusiasm and support of its members, volunteers, staff and the interested public.



The *Canadian Boreal Initiative* (CBI) is working with a wide range of conservation organizations, First Nations, industry and other interested parties to link science, policy and conservation activities in Canada's boreal forest. The CBI's long term vision is to safeguard the balance of nature for all time in Canada's boreal forest through establishing an interconnected network of large-scale protected areas and conservation lands; applying state-of-the-art sustainable development practices on the remainder of the landscape; and engaging and empowering local communities and First Nations on land management decisions.



The *Boreal Songbird Initiative* (BSI) is a new project dedicated to educating birdwatchers and naturalists throughout the United States about the importance of the boreal forest to migratory birds. The BSI is part of an emerging network of U.S. organizations — including the American Bird Conservancy, Ducks Unlimited, the National Wildlife Federation, and the Natural Resources Defense Council — working to raise awareness about the boreal forest and assist efforts in Canada and Alaska to conserve it.

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This report was possible because of the ready availability of many valuable datasets, either directly from the Internet, or from database contacts and publications. Our thanks to the following organizations for making these data available:

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NOTE TO READERS

The term “landbird” is used in this report to include vultures, hawks, grouse, doves, cuckoos, owls, nighthawks, swifts, hummingbirds, kingfishers, woodpeckers and passerines (or perching birds, often referred to as songbirds).

The term “family” refers to a group of closely-related species of birds, defined as members of the same family by scientists, in this case by the American Ornithologists’ Union (AOU). Examples of landbird families include thrushes (family Turdidae), finches (family Fringillidae) and swallows (family Hirundinidae).

At least one species of 35 out of 40 landbird families in Canada live in the boreal forest (see Appendix B for listing).

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EXECUTIVE SUMMARY

The boreal forest stretches across a vast northern expanse of North America, from Alaska in the west to Newfoundland & Labrador in the east. This forest is of immense global importance to landbirds, especially during the spring and summer when billions of them rely on boreal nesting grounds that are found mainly in Canada.¹ This research report illustrates just how important the boreal forest is to landbirds across North America, the Western Hemisphere and globally, by examining broad patterns in their population sizes, trends and links to wintering grounds.

How many landbirds of how many species are produced in Canada's boreal forest?

There are 186 species of landbirds in 35 families that regularly inhabit Canada's boreal regions. An additional 41 or more species occur there accidentally, or in very small numbers, because the boreal forest is at the edge of their range.

Estimates of the number of landbirds breeding in Canada's boreal region range from one to three billion, depending on the data source and method of calculation. These numbers represent about 60% of the landbirds in all of Canada, and close to 30% of all landbirds in Canada and the United States combined. Sparrows, warblers and thrushes account for more than half of all boreal landbirds.

Boreal landbirds are highly migratory; approximately 93% of them leave the boreal each fall and almost all of those migrants leave Canada for the winter. In total, about three to five billion boreal landbirds migrate south each fall. More than an estimated one-half billion warblers of 27 species migrate from the boreal, as do at least one billion sparrows, representing 25 species.

During the breeding season, Canada's boreal is home to more than one-half of the global population of approximately 40 species of landbirds. Canada's Boreal provides breeding habitat for over 80% of the global population of 14 species including, Palm Warblers, Tennessee Warblers, Black-backed Woodpeckers, Connecticut Warblers, Northern Shrikes, Smith's Longspurs, Spruce Grouse, Yellow-bellied Flycatchers, Philadelphia Vireos, White-throated Sparrows, Lincoln's Sparrows, Cape May Warblers, Bay-breasted Warblers and Swamp Sparrows.

In winter, boreal landbirds are scattered across much of the Western Hemisphere. The United States is the biggest beneficiary of the boreal, since almost all boreal migrants spend at least part of the non-breeding season there. Over one billion boreal migrants remain in the U.S. throughout the winter, mainly in the southern states. Dark-eyed Juncos and White-throated Sparrows are particularly abundant boreal migrants in winter in the United States. Mexico is the winter home for the widest diversity of Canada's boreal birds. Many other countries in Central America, northern South America and the West Indies provide important wintering grounds too. Use of these wintering grounds differs dramatically from one family of boreal birds to another.

¹ For the purpose of this report, Canada's boreal forest is defined as the area covered by the Canadian portion of four boreal and taiga Bird Conservation Regions (BCRs). Together these BCRs encompass 5.2 million km² of land (2 million square miles).

How significant are boreal landbirds throughout Canada, North America and the Western Hemisphere?

Based on standardized bird surveys, boreal migrants form an estimated 10% of all landbirds in the United States during winter, and 17% and 31% of birds during fall and spring migration respectively.² At winter bird feeders, 17% of landbirds across the United States are estimated to be migrants from Canada's boreal. These proportions vary significantly, depending upon the time of year and region. For example, boreal migrants form an estimated 32% of Georgia's winter birds, but during fall migration they grow to 37%, and in spring they swell to 48% of the state's bird population. Blackbirds, sparrows and thrushes are the dominant families of boreal landbirds in the U.S. during winter, whereas warblers are dominant during migration, particularly in spring. Dark-eyed Juncos are by far the most dominant boreal migrants at winter feeders in the United States. In fact they are one of the top feeder birds in most states.

Which boreal landbird species are experiencing significant declines?

At least 40 species of landbirds are experiencing population declines in the boreal forest and range-wide, according to long-term *Breeding Bird Survey* trends. These species come from a wide variety of families and habitats and employ an equally wide array of foraging habits and migration strategies. The Rusty Blackbird, which breeds largely within the boreal forest, has undergone one of the steepest declines among birds surveyed by the *Breeding Bird Survey*.

Which species or species groups best illustrate the importance of the boreal to landbirds?

Band recovery data illustrate direct links between the boreal forest and sites further south, mostly within the United States. Warblers in particular stand out as a bird species group highly reliant on the boreal for breeding, that pass through the United States to neotropical wintering grounds. Up to two billion warblers breed in the boreal forest.

Dark-eyed Juncos and other sparrows and finches are abundant boreal birds that attract considerable attention at bird feeders across North America. Sparrows and other short-distance migrants provide important links between the boreal and thousands of birders who participate in Christmas Bird Counts each year. As many as one billion sparrows breed in the boreal forest.

Christmas Bird Count maps are provided for several boreal species to illustrate their wintering grounds concentrations in the United States.

² These figures are based respectively on data from the *Christmas Bird Counts* and the *Gulf Coast Bird Observatory* network.

INTRODUCTION

The boreal forest stretches across a vast northern expanse of North America, from Alaska in the west to Newfoundland & Labrador in the east. This vastness itself is one of the most important aspects of the boreal. Not only does it provide critical habitat for very large numbers of birds of many species, but it also allows many species to live a somewhat nomadic lifestyle, taking advantage of abundant food in one part of the boreal one year, and moving long distances to new areas the next year. Thus infrequently seen Black-backed Woodpeckers can suddenly become abundant in areas burned by forest fires, while Tennessee and Bay-breasted Warblers increase greatly when there are outbreaks of spruce budworm. Concentrations of boreal finches shift dramatically over thousands of kilometers as seed supplies change, and owls periodically invade the south due to great swings in small mammal abundance in large areas of the north.

Figure 1 *Bird Conservation Regions in North America's Boreal Forest*



Figure 1: The boreal forest in North America encompasses four Bird Conservation Regions: the Northwestern Interior Forest, BCR 4 (blue), the Boreal Taiga Plains, BCR 6 (red), the Taiga Shield and Hudson Plains, BCR 7 (light green), and the Boreal Softwood Shield, BCR 8 (dark green). Analyses in this report exclude the Alaskan part of BCR 4. Together these BCRs encompass some 5.2 million km², or approximately two million square miles.

Although the boreal is known to be of considerable significance to landbirds, until now there has been no systematic survey of boreal birds across the whole of the region, due to its size and remote location. But increasing pressures on the boreal forest from resource extraction industries, road access, development and climate change are creating a greater need for information about boreal landbirds. In this report we make use of several large-scale datasets to outline broad patterns in boreal landbird population sizes, trends and links to wintering grounds. Together these illustrate the significance of Canada's portion of the boreal forest to landbirds, not just within the boreal forest, but also across North America, the Western Hemisphere and globally.

In order to understand the significance of Canada's boreal forest for landbirds, the following questions are addressed:

1. How many landbirds of how many species breed in Canada's boreal forest?

- a. How many species of landbirds breed in the boreal forest?
- b. How many individual landbirds are estimated to breed in the boreal forest?
- c. How many landbirds leave the boreal forest after breeding each year?

2. How significant are boreal landbirds throughout Canada, North America and the Western Hemisphere?

- a. What proportion of Canada's landbirds are produced in the boreal forest?
- b. Which species of landbirds rely most heavily on Canada's boreal forest for breeding, based on percentage of population and/or range?
- c. What proportion and what number of landbirds migrate from the boreal and from Canada after the breeding season?
- d. Where do boreal migrants go when they leave Canada?
- e. How significant are these migrants to the avifauna of other countries?

3. Which boreal landbird species are experiencing significant declines?

4. Based on answers to the above, which species or species groups best illustrate the importance of the boreal to landbirds?

For these species or groups, are there important links to migratory or wintering grounds that can be shown with banding recovery data? Where are their U.S. wintering grounds?

PART 1: HOW MANY LANDBIRDS OF HOW MANY SPECIES ARE PRODUCED IN CANADA'S BOREAL FOREST?

1. a. How many species of landbirds breed in the boreal forest?

Range maps from *Environment Canada's Wildspace* program show that 222 landbird species breed in Canada's boreal *Bird Conservation Regions* (BCRs). Of these, 78 also have some winter range in the boreal. Nearly 200 landbird species have been recorded on *Breeding Bird Survey* (BBS) routes within Canada's boreal. Data from both the range maps and the BBS suggest that a total of 227 species of landbirds breed in Canada's boreal region.

Of these, 41 species extend their range to the boreal forest only occasionally or accidentally, as less than an estimated 1% of their population is found there. The remaining 186 species, from 35 landbird families, are regular boreal residents.³

Of the regular boreal residents, 39 species are circum-boreal in distribution, meaning that they breed in Eurasia as well as North America. For these species, the *Partners in Flight* (PIF) Technical Committee has estimated rough proportions of their range outside of North America. These estimates have been used in calculating the percentage of the global population found in Canada.⁴

1. b. How many individual landbirds are estimated to breed in the boreal forest?

This report uses ballpark estimates, which are the best available, to illustrate major patterns of boreal breeding birds. It relies on methodology that is as consistent as possible across the boreal. This methodology also enables us to produce comparable estimates for the remainder of birds found in Canada and the United States, so that in Part 2, we can estimate the proportion of North America's birds that rely on the boreal region.⁵ The North American *Breeding Bird Survey* (BBS) and the *Breeding Bird Census* (BBC) are the only two standardized bird surveys that are widespread enough in Canada to allow estimation of Canada's boreal breeding population for most landbird species. These are the primary sources of data used to estimate breeding bird populations for this report.

The main advantage of using BBC data is that the count procedure is intensive, and produces density estimates. Sites are not randomly assigned, but habitat data collected with the surveys can be used to extrapolate to a broader landscape. However, not all habitats have been covered well by the BBC in Canada and data collection peaked between 1965 and 1982, so most of the data are now more than two decades old.⁶

³ See Appendices A & B for listings of birds found in Canada's boreal regions.

⁴ The Partners in Flight Technical Committee's North American Landbird Conservation Plan is in preparation.

⁵ These estimates are the best that can be made as survey data are limited or lacking altogether for some species, especially those breeding in the more remote northern parts of the boreal.

⁶ The Canadian Breeding Bird Census (BBC) Database (Kennedy et al. 1999) provides a relatively simple means of estimating total populations, as it contains breeding pair density information from 640 sites spread across 76 of Canada's 194 ecoregions (Figure 2). Of these sites, 138 were sampled in the boreal, mainly in the southern parts of BCRs 6 and 8.

Figure 2

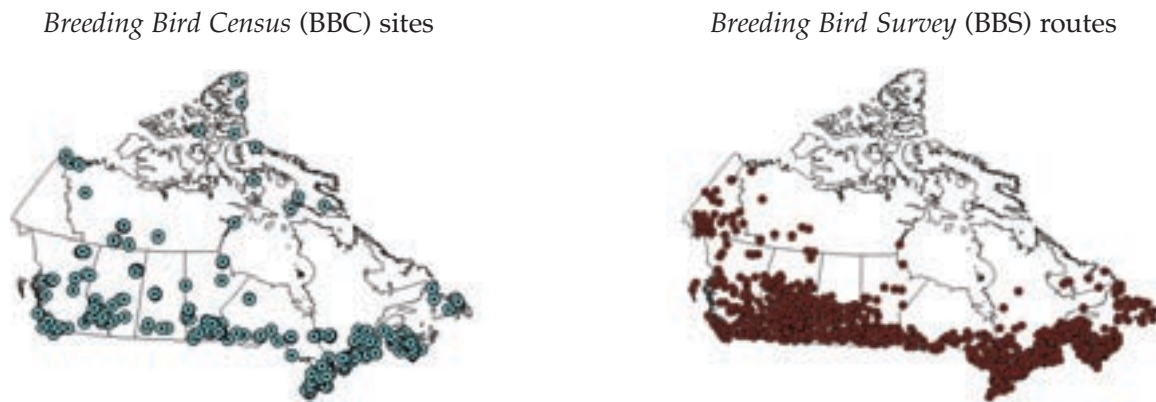


Figure 2: Sites with data from Breeding Bird Census and Breeding Bird Survey, in Canada.

The North American *Breeding Bird Survey* routes are particularly rich in data and often contain several years of data collection per route. Coverage is good across southern Canada (see Figure 2) and the United States. The most important deficiency of the BBS is poor geographic coverage of the boreal. Most of the 221 boreal routes with usable data are located in the southern portions of the boreal, and very few are located in taiga regions.⁷

Using calculations based on both sources of data, we estimate that one to three billion landbirds breed in Canada's boreal forest each year. (see Table 1).

Total populations were estimated from BBC data by averaging BBC bird densities within ecoregions, multiplying by ecoregion area to obtain ecoregion totals, then extrapolating to Bird Conservation Regions based on BCR size. For the Quebec taiga portion of the boreal, and for BCR 4, range maps were used in combination with BBC data to avoid extrapolating populations outside of their range, as these two large areas are lacking BBC data.

⁷ To avoid inappropriate extrapolation of BBS densities from the heavily-sampled south to less-sampled north, calculations were stratified by ecozone within BCRs 6 and 7, and stratified by province within BCR 8.

BBS data are indices of abundance; additional data and/or assumptions are needed to convert to bird densities. In this report BBS indices have been converted to densities by a method developed by Rosenberg and Blancher (MS submitted). Briefly, this involves calculating stratified average counts per BBS route in each BCR, adjusting upwards to best time of day using the ratio of maximum to average detection rates across all 50 stops within BBS routes, converting to density using estimated point count detection distances (landbirds were assigned to one of 4 detection distance classes) to calculate the area sampled per BBS route, and extrapolating to a regional estimate based on region area. The time of day adjustment allows estimation of population for some species that are typically detected only on BBS stops sampled before dawn. BBS estimates probably underestimate early season breeders (e.g. woodpeckers and owls) and misses some of the more uncommon nocturnal birds. BBS may also under represent some habitats and their associated birds, e.g. some kinds of wetlands, possibly interior forests and grasslands.

Table 1: Estimates of breeding landbirds in Canada's Boreal Forest, by Bird Conservation Region

BCR Name	BCR #	BCR Area		Total Landbirds	
		(km ²)	(sq miles)	BB Survey	BB Census
Boreal Softwood Shield	8	1,471,238	568,101	430,000,000	1,100,000,000
Taiga Shield & Hudson Plains	7	1,725,659	666,342	430,000,000	580,000,000
Boreal Taiga Plains	6	1,310,443	506,012	360,000,000	570,000,000
Northwestern Interior Forest	4	704,762	272,135	160,000,000	290,000,000
Boreal Canada Totals		5,212,102	2,012,590	1,400,000,000	2,500,000,000

Table 2: Estimated Number of Boreal-breeding Landbirds, by Family

Family	Species	BB Census	BB Survey
Parulidae (Wood-Warblers)	27	1,000,000,000	310,000,000
Emberizidae (Sparrows & Allies)	26	680,000,000	460,000,000
Turdidae (Thrushes)	11	270,000,000	200,000,000
Tyrannidae (Flycatchers)	15	130,000,000	54,000,000
Vireonidae (Vireos)	6	88,000,000	84,000,000
Regulidae (Kinglets)	2	84,000,000	53,000,000
Picidae (Woodpeckers)	9	51,000,000	18,000,000
Fringillidae (Finches)	10	30,000,000	47,000,000
Corvidae (Jays, Crows & Allies)	7	30,000,000	23,000,000
Phasianidae (Grouse & Allies)	9	25,000,000	6,700,000
Paridae (Chickadees & Allies)	4	25,000,000	14,000,000
Icteridae (Blackbirds & Allies)	11	20,000,000	27,000,000
Hirundinidae (Swallows)	7	19,000,000	23,000,000
Troglodytidae (Wrens)	4	17,000,000	25,000,000
Cardinalidae	2	7,800,000	1,800,000
25 other landbird families	54	39,000,000	34,000,000
Boreal Canada Totals	204	2,500,000,000	1,400,000,000

Warblers, sparrows and thrushes are particularly abundant in the boreal forest (see Table 2). These three landbird families comprise more boreal birds than all other landbird families put together. In part this is due to the large number of warbler and sparrow species that breed in the boreal.

The top 25 landbirds found in the boreal, in terms of estimated abundance, are listed in Table 3. Warblers and sparrows dominate this list too, with 10 and nine species respectively of each. The breeding population of each of the most abundant species is estimated to exceed 100 million, using both BBS and BBC data. Many of these species breed outside of the boreal forest as well. All of these species are migratory, emphasizing the seasonal nature of bird abundance in the boreal forest, and underscoring the importance of non-boreal habitats during non-breeding periods of the year.

Table 3: Estimated Boreal Populations of 25 Abundant Landbird Species

Species	BB Census	BB Survey
Dark-eyed Junco	210,000,000	170,000,000
Yellow-rumped Warbler	180,000,000	82,000,000
Tennessee Warbler	160,000,000	21,000,000
Swainson's Thrush	120,000,000	56,000,000
White-throated Sparrow	110,000,000	110,000,000
Ovenbird	98,000,000	12,000,000
Chipping Sparrow	82,000,000	44,000,000
American Robin	73,000,000	92,000,000
Red-eyed Vireo	69,000,000	68,000,000
Ruby-crowned Kinglet	68,000,000	45,000,000
Magnolia Warbler	67,000,000	23,000,000
Blackpoll Warbler	60,000,000	13,000,000
Least Flycatcher	59,000,000	8,800,000
Yellow Warbler	45,000,000	13,000,000
Chestnut-sided Warbler	45,000,000	4,300,000
Lincoln's Sparrow	44,000,000	30,000,000
White-crowned Sparrow	42,000,000	35,000,000
Bay-breasted Warbler	41,000,000	2,500,000
Northern Waterthrush	40,000,000	6,900,000
Swamp Sparrow	37,000,000	7,300,000
American Tree Sparrow	37,000,000	6,000,000
Gray-cheeked Thrush	37,000,000	4,000,000
Savannah Sparrow	36,000,000	20,000,000
Palm Warbler	35,000,000	8,500,000
Fox Sparrow	35,000,000	7,500,000

In all of the above tables, BBC estimates tend to be higher than those based on BBS. This is at least partly because many birds present within detection distance at BBS stops are not counted, even at peak detection times of day.

1. c. How many landbirds are there in the boreal forest after breeding?

At the end of the breeding season, landbird numbers roughly double with the influx of juveniles into the population. Boreal data from the *Monitoring Avian Productivity and Survival* program (MAPS), which come mostly from Alaska, support this estimate. Based on a doubling of population and the estimates shown in Table 1, we can conclude that there are about three to five billion landbirds in Canada's boreal forest at the end of the breeding season.

PART 2: HOW SIGNIFICANT ARE BOREAL LANDBIRDS THROUGHOUT CANADA, NORTH AMERICA AND THE WESTERN HEMISPHERE?

2. a. What proportion of Canada's landbirds are produced in the boreal forest?

Estimates from BBS and BBC data indicate that about 60% of Canada's landbirds breed in the boreal forest (see Table 4), or almost 30% of landbirds in Canada and the United States combined. Several landbird families are reliant on the boreal forest for most of their Canadian population. Canada's warblers are particularly reliant on the boreal forest; approximately three out of every four of them are found there. In fact, about 50% of the world's population of the 37 warbler species that live in Canada live in the boreal forest (see Table 4).

Table 4: Estimated Proportion of Canada's Landbirds that Breed in the Boreal Forest, by Family

Family	Canadian Species	% of Canada's Landbirds Breeding in Boreal		% of Global Population Breeding in Boreal *
		BB Survey	BB Census	BBS & Range
Regulidae (Kinglets)	2	69%	62%	56%
Parulidae (Wood-Warblers)	37	76%	71%	51%
Emberizidae (Sparrows & Allies)	31	66%	67%	40%
Vireonidae (Vireos)	8	65%	52%	38%
Alcedinidae (Kingfishers)	1	70%	11%	38%
Turdidae (Thrushes)	13	67%	65%	36%
Tyrannidae (Flycatchers)	18	67%	52%	30%
Bombycillidae (Waxwings)	2	55%	26%	30%
Picidae (Woodpeckers)	14	64%	63%	25%
Paridae (Chickadees & Allies)	6	50%	43%	20%
Corvidae (Jays, Crows & Allies)	8	62%	63%	18%
Troglodytidae (Wrens)	8	57%	33%	18%
Fringillidae (Finches)	12	55%	46%	18%
Falconidae (Falcons)	5	54%	51%	15%
Sittidae (Nuthatches)	3	42%	36%	14%
25 other landbird families	108	29%	29%	2%
All Canadian Landbirds *	276	62%	62%	20%

* includes only those landbird species with Canadian breeding populations as recorded by BBS and/or BBC

2. b. Which species of landbirds rely most heavily on Canada's boreal forest for breeding?

Forty landbird species have an estimated 50% or more of their global population breeding in Canada's boreal forest (see Table 5), including 5 species with 90% or more of global population in the boreal.

Table 5: Estimated Proportion of Species Populations Breeding in Canada's Boreal Forest

Species	% of Canada's Breeding Population in Boreal		% of West Hem Popn Breeding in Boreal *	% of Global Population Breeding in Boreal *
	BB Survey	BB Census	BBS & Range	BBS & Range
50% or more of Global Population Breeds in Canada's Boreal Forest:				
Palm Warbler	98%	96%	98%	98%
Tennessee Warbler	97%	92%	97%	97%
Black-backed Woodpecker	97%	61%	93%	93%
Connecticut Warbler	94%	83%	92%	92%
Northern Shrike	99%		90%	90%
Smith's Longspur	92%	100%	89%	89%
Spruce Grouse	96%	96%	87%	87%
Yellow-bellied Flycatcher	87%	68%	87%	87%
Philadelphia Vireo	86%	91%	86%	86%
White-throated Sparrow	87%	79%	85%	85%
Lincoln's Sparrow	93%	95%	84%	84%
Cape May Warbler	84%	78%	83%	83%
Bay-breasted Warbler	82%	60%	82%	82%
Swamp Sparrow	88%	88%	80%	80%
Boreal Chickadee	94%	88%	78%	78%
Magnolia Warbler	78%	75%	77%	77%
Mourning Warbler	82%	88%	75%	75%
Gray Jay	93%	93%	73%	73%
Hermit Thrush	90%	66%	72%	72%
Rusty Blackbird	91%	78%	70%	70%
Le Conte's Sparrow	78%	73%	70%	70%
Ruby-crowned Kinglet	83%	79%	68%	68%
Dark-eyed Junco	88%	80%	66%	66%
Least Flycatcher	74%	54%	65%	65%
Blackpoll Warbler	94%	88%	65%	65%
Canada Warbler	74%	55%	64%	64%
Nashville Warbler	76%	62%	63%	63%
Yellow-rumped Warbler	84%	86%	63%	63%
Alder Flycatcher	88%	97%	63%	63%
Swainson's Thrush	77%	70%	59%	59%
Blackburnian Warbler	67%	54%	57%	57%
Northern Waterthrush	82%	87%	56%	56%
Yellow-bellied Sapsucker	70%	73%	55%	55%
Blue-headed Vireo	69%	58%	55%	55%
Ruffed Grouse	57%	67%	54%	54%
Black-and-white Warbler	69%	83%	53%	53%
Red-eyed Vireo	74%	59%	52%	52%
Clay-colored Sparrow	59%	62%	51%	51%
Black-throated Green Warbler	66%	66%	50%	50%
American Redstart	56%	29%	50%	50%

Table 5: Estimated Proportion of Species Populations...(continued)

Species	% of Canada's Breeding Population in Boreal		% of West Hem Popn Breeding in Boreal *	% of Global Population Breeding in Boreal *
	BB Survey	BB Census	BBS & Range	BBS & Range
<50% of Global, but ≥50% of Western Hemisphere Population Breeds in Canada's Boreal				
Pine Grosbeak	98%	89%	88%	44%
White-winged Crossbill	95%	70%	85%	43%
Bohemian Waxwing	98%	100%	77%	38%
Three-toed Woodpecker	95%	87%	76%	38%
Boreal Owl	94%		66%	20%
Great Gray Owl	82%		50%	25%
<50% of Western Hemisphere, but ≥80% of Canadian Population Breeds in Boreal Forest				
Northern Hawk Owl	100%	100%	45%	23%
Golden-crowned Sparrow	100%	42%	12%	12%
Gray-cheeked Thrush	83%	93%	39%	35%
Fox Sparrow	83%	86%	48%	48%
Orange-crowned Warbler	81%	54%	47%	47%
225 other landbird species *	42%	45%	12%	8%

* includes only those landbird species with Canadian breeding populations as recorded by BBS and/or BBC

An additional six species are circumboreal in distribution, but most of their population in the western hemisphere breeds in Canada's boreal (Table 5). A further five species are reliant on the boreal forest for most of their Canadian population.

2. c. What proportion of landbirds, and what number of landbirds, migrate from the boreal and from Canada after the breeding season?

Overall, boreal landbirds tend to be highly migratory. An estimated 93% of Canada's boreal landbirds migrate from the boreal after the breeding season (Table 6). Based on an average of two juveniles per family surviving to migration age, an estimated 2.5 billion landbirds migrate from Canada's boreal forest in the fall. This number could be as high as five billion landbirds if BBC estimates were used.¹

¹ The proportion of landbirds that are migratory has been calculated from the change in breeding range compared to wintering range for each species, as well as the estimated proportion of the North American population that breeds in the boreal. The latter is based on Breeding Bird Survey data because of comparable BBS data from the United States. The number of migrants is a simple multiplication of boreal population size by proportion leaving the boreal. Numbers of migrants would be approximately 50-100% higher if based on Breeding Bird Census data.

Table 6: Number and Proportion of Landbirds Migrating from Canada's Boreal Forest

Landbird Family	# of Spp	# of Boreal Birds *		Proportion of Population Migrating out of Boreal			
		Migrating	Remaining	%Boreal Pop'n	%Canadian Pop'n	%WHem Pop'n	%Global Pop'n
Emberizidae (Sparrows & Allies)	25	910,000,000	6,600,000	99%	68%	46%	43%
Parulidae (Wood-Warblers)	27	610,000,000	0	100%	76%	53%	53%
Turdidae (Thrushes)	10	390,000,000	1,700,000	100%	67%	36%	36%
Vireonidae (Vireos)	5	170,000,000	0	100%	66%	42%	42%
Tyrannidae (Flycatchers)	14	110,000,000	0	100%	69%	34%	34%
Regulidae (Kinglets)	2	110,000,000	1,500,000	99%	68%	55%	55%
Icteridae (Blackbirds & Allies)	10	55,000,000	0	100%	32%	5%	5%
Troglodytidae (Wrens)	4	51,000,000	15,000	100%	57%	33%	22%
Hirundinidae (Swallows)	7	46,000,000	0	100%	46%	10%	6%
Fringillidae (Finches)	8	29,000,000	64,000,000	31%	20%	13%	7%
Picidae (Woodpeckers)	8	20,000,000	16,000,000	56%	39%	18%	17%
Bombycillidae (Waxwings)	2	11,000,000	250,000	98%	53%	32%	29%
Corvidae (Jays, Crows & Allies)	5	9,900,000	35,000,000	22%	14%	6%	4%
27 other Landbird Families	63	32,000,000	72,000,000	30%	9%	2%	1%
Total Landbirds	190	2,550,000,000	200,000,000	93%	59%	27%	20%

* assumes 2 young produced per breeding pair, on average

Several entire, or nearly entire, families of boreal landbirds leave the boreal for the winter (see Table 6). Among these species, the number of birds migrating from Canada's boreal forest often represents a substantial proportion of their global population. For example, the estimated one-half billion warblers migrating from the boreal represents about one-half of the global population of those 27 warbler species.

Those families that largely remain in the boreal, including finches, woodpeckers, jays and chickadees, tend to have smaller overall breeding numbers than many of the largely migratory families (Table 6).

Table 7 lists those boreal landbirds whose estimated migration numbers are highest. As in Table 3, most of these species are sparrows or warblers.

Canadian boreal migrants comprise a substantial portion of the global population of many species. Table 8 shows that for 16 landbirds, boreal migrants comprise 70% or more of their global population.

Table 7: Number and Proportion of Landbird Species Migrating from Canada's Boreal Forest

Species	# of Boreal Birds *		Proportion of Population Migrating out of Boreal			
	Migrating	Remaining	%Boreal Pop'n	%Canadian Pop'n	%WHem Pop'n	%Global Pop'n
Dark-eyed Junco	330,000,000	6,500,000	98%	87%	65%	65%
White-throated Sparrow	220,000,000	0	100%	87%	85%	85%
American Robin	180,000,000	1,700,000	99%	60%	28%	28%
Yellow-rumped Warbler	160,000,000	0	100%	84%	63%	63%
Red-eyed Vireo	140,000,000	0	100%	74%	52%	52%
Swainson's Thrush	110,000,000	0	100%	77%	59%	59%
Ruby-crowned Kinglet	90,000,000	0	100%	83%	68%	68%
Chipping Sparrow	89,000,000	0	100%	78%	45%	45%
Hermit Thrush	72,000,000	0	100%	90%	72%	72%
White-crowned Sparrow	70,000,000	0	100%	74%	48%	48%
Lincoln's Sparrow	60,000,000	0	100%	93%	84%	84%
Alder Flycatcher	59,000,000	0	100%	88%	63%	63%
Orange-crowned Warbler	58,000,000	0	100%	81%	47%	47%
Magnolia Warbler	46,000,000	0	100%	78%	77%	77%
Nashville Warbler	43,000,000	0	100%	76%	63%	63%
Tennessee Warbler	42,000,000	0	100%	97%	97%	97%
Savannah Sparrow	39,000,000	0	100%	38%	25%	25%
Winter Wren	38,000,000	15,000	100%	59%	49%	24%
Mourning Warbler	27,000,000	0	100%	82%	75%	75%
Yellow Warbler	27,000,000	0	100%	71%	36%	36%
Blackpoll Warbler	26,000,000	0	100%	94%	65%	65%

* assumes 2 young produced per breeding pair, on average

Table 8: Landbird species whose Boreal migrants are a very high proportion of Global population

Species	Global Abundance post-breeding	Canadian Boreal Migrants	% of Global Pop'n Migrating from Canada's Boreal
Palm Warbler	17,000,000	17,000,000	98%
Tennessee Warbler	44,000,000	42,000,000	97%
Connecticut Warbler	6,300,000	5,800,000	92%
Smith's Longspur	1,300,000	1,200,000	89%
Yellow-bellied Flycatcher	12,000,000	11,000,000	87%
Philadelphia Vireo	8,200,000	7,000,000	86%
White-throated Sparrow	260,000,000	220,000,000	85%
Lincoln's Sparrow	71,000,000	60,000,000	84%
Cape May Warbler	6,500,000	5,400,000	83%
Bay-breasted Warbler	6,000,000	4,900,000	82%
Swamp Sparrow	18,000,000	15,000,000	80%
Magnolia Warbler	60,000,000	46,000,000	77%
Mourning Warbler	36,000,000	27,000,000	75%
Hermit Thrush	100,000,000	72,000,000	72%
Rusty Blackbird	4,900,000	3,400,000	70%
Le Conte's Sparrow	5,600,000	3,900,000	70%

2.d. Where do boreal migrants go when they leave Canada?

The United States is home to an estimated one billion or more boreal migrants in winter (see Table 9). Mexico, Brazil and Colombia also provide wintering grounds for substantial numbers of boreal birds.² Each are estimated to house more than 100 million of them in winter. And most other countries of the Western Hemisphere are estimated to have an influx of boreal migrants that reaches or exceeds one million birds. In comparison, relatively few boreal migrants remain in the non-boreal southern parts of Canada.

Mexico is home to the highest concentration of wintering boreal species (see Table 9), followed by the United States and several Central American countries. During the spring and fall migration seasons, the United States is home to almost all of the boreal migrants.

Table 9: Estimated distribution of Canadian Boreal migrants on wintering grounds

Country / Islands	Boreal Species *	Millions of Migrants	Country / Islands	Boreal Species *	Millions of Migrants
Mexico	115	680	(continued)		
Guatemala	70	34	Bolivia	31	39
U.S.A.	66	1,150	Cayman Islands	30	<1
Honduras	63	30	Haiti	26	4
Nicaragua	58	31	Dominican Republic	26	7
El Salvador	55	6	Puerto Rico	26	1
Belize	54	7	Trinidad & Tobago	24	<1
Costa Rica	54	12	Paraguay	24	11
Panama	53	15	Argentina	24	34
Colombia	53	110	Windward Islands	23	<1
Venezuela	46	62	Leeward Islands	22	<1
Brazil	42	200	Suriname	22	4
Cuba	40	22	French Guiana	19	2
Ecuador	40	15	Chile	18	4
Peru	40	52	Uruguay	17	2
Bahamas	36	3	Canada (non-boreal)	4	<1
Guyana	32	8	Bermuda	1	<1
Jamaica	31	2	Falkland Islands	0	0

* from 190 boreal species with estimated population sizes in Canada's Boreal

Overlaying *Environment Canada's WildSpace* winter range maps of boreal-breeding species, also illustrates their patterns of winter distribution. According to these maps, the areas of highest species richness are found across much of the United States, especially in the coastal and southern regions, and down through Mexico and Central America (Figure 3a). The areas of highest boreal bird density are similar, though they shift slightly

² A combination of winter range maps and knowledge of the numbers and proportions of birds that migrate out of Canada's boreal forest were used to arrive at these estimated numerical distributions.

Figure 3

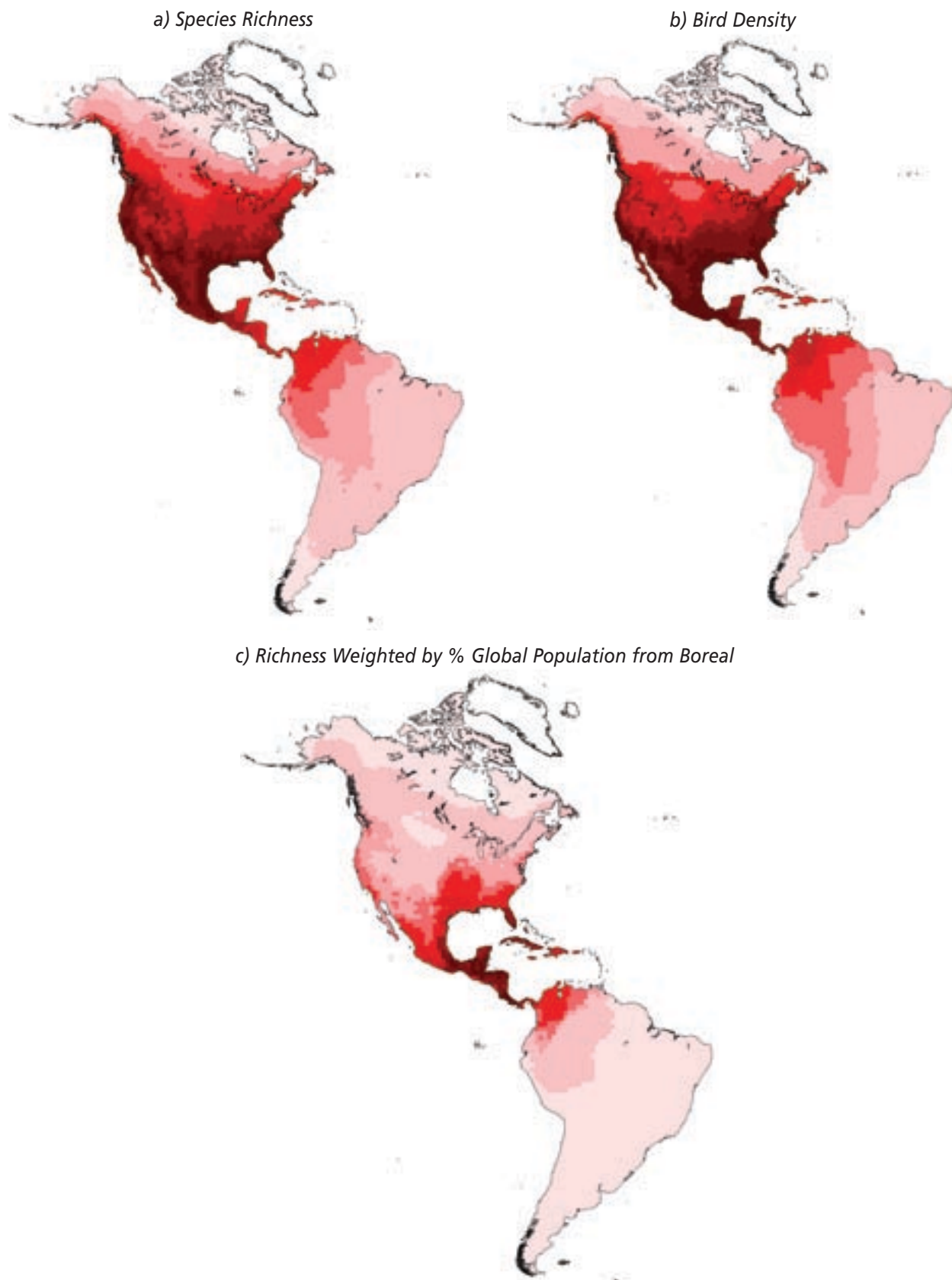


Figure 3: Distribution of Canada's Boreal landbirds in winter, shown in three ways

southward, and higher numbers are found in Central America, Cuba and Colombia (Figure 3b). When each species range is weighted by proportion of global population that originates in Canada's boreal forest, the area of greatest concentration is much narrower, emphasizing countries all around the Gulf of Mexico and Caribbean Sea (Figure 3c).

Figure 4 shows weighted species richness maps for boreal species from each of the four Bird Conservation Areas making up the boreal. Boreal birds from BCRs 6 and 8 tend to be concentrated furthest south and include important Central and South American regions; boreal birds from BCR 4 are concentrated more often on the west coast, and south-central and south-eastern United States and Mexico are very important wintering grounds for birds from taiga portions of the boreal (BCRs 7 and 6).

Figure 4

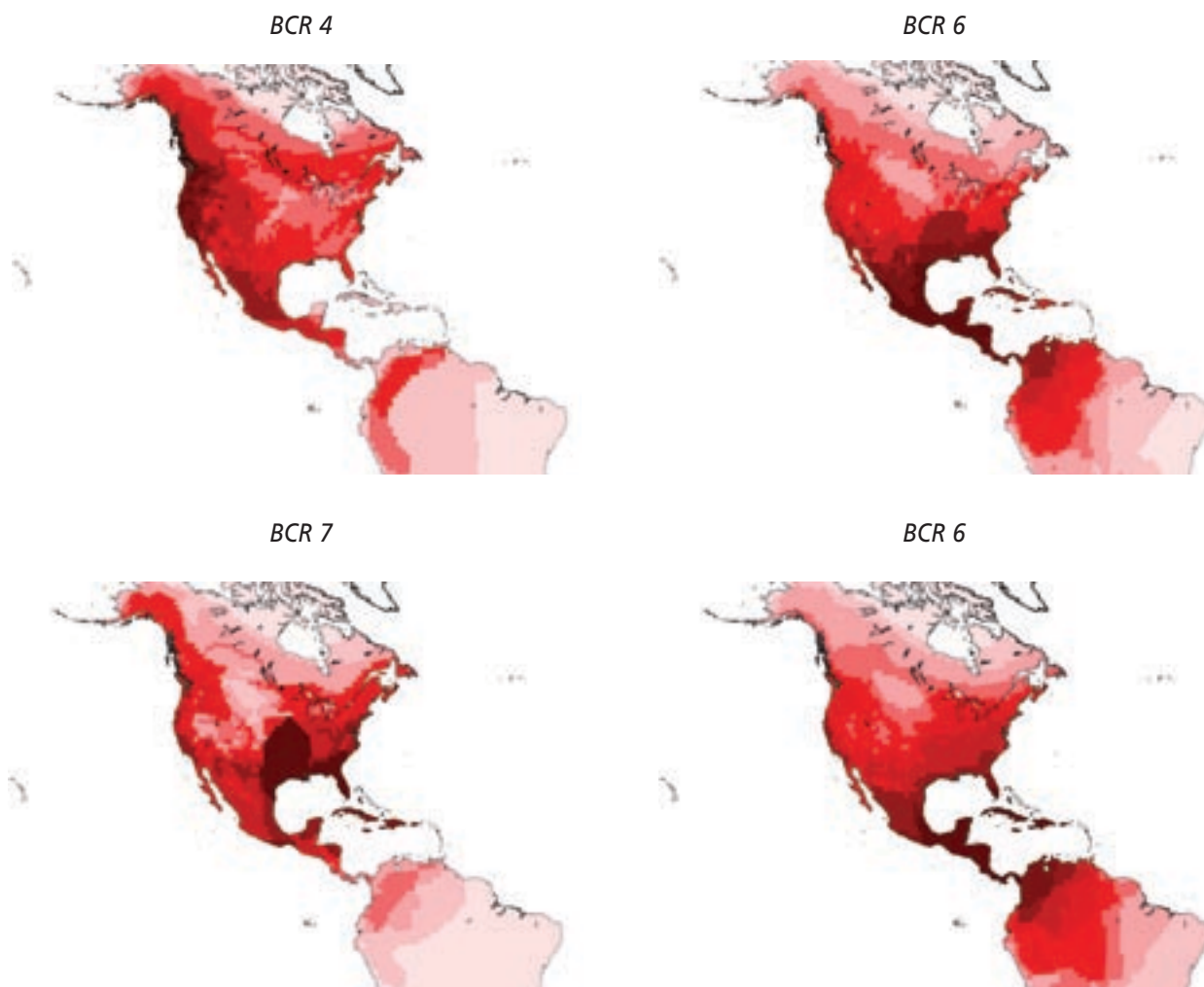


Figure 4: Species Richness of Boreal Landbirds in winter, weighted by percentage of global population from each of the four Bird Conservation Regions in the Boreal.

Figure 5

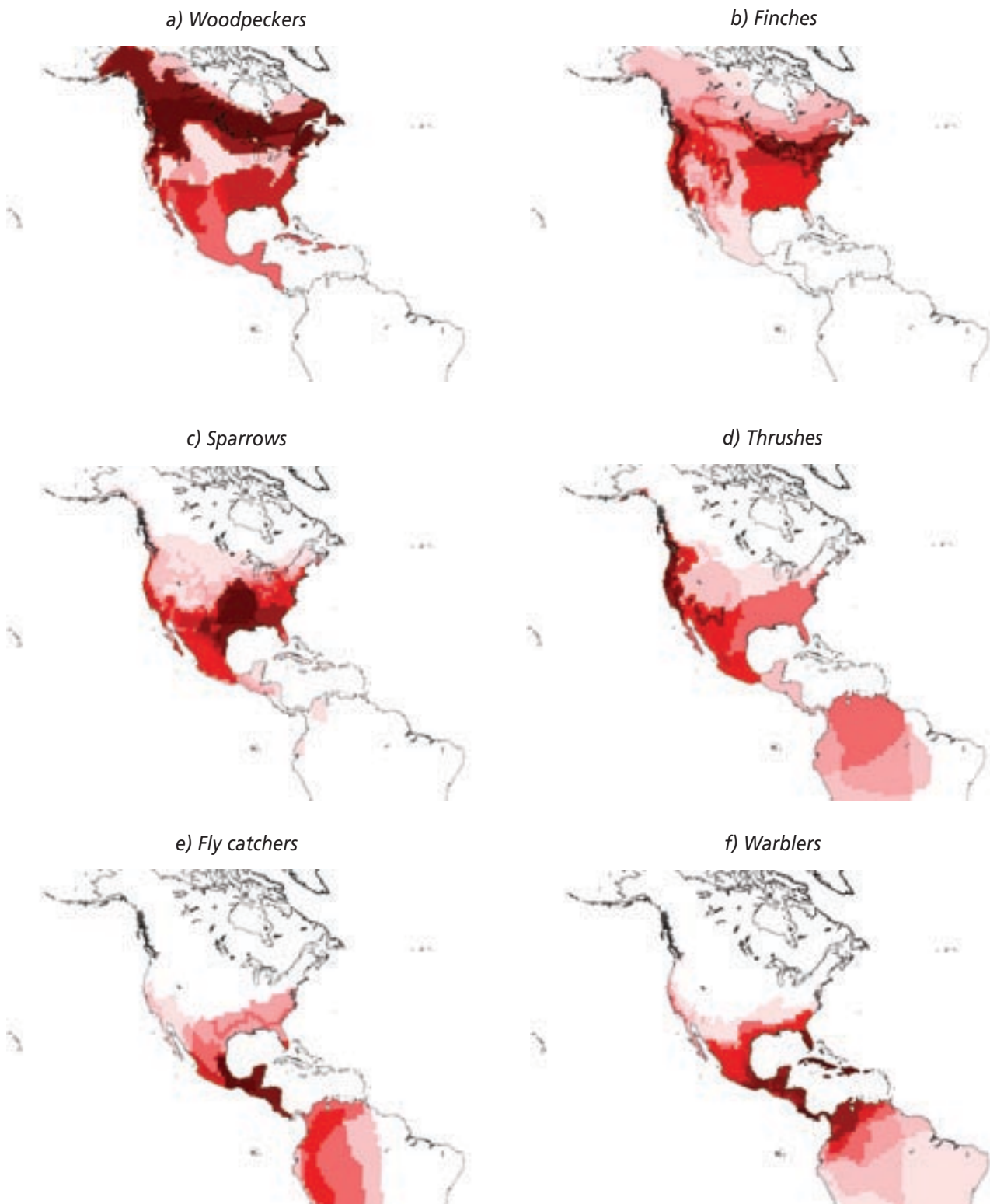


Figure 5: Distribution of Boreal Landbirds on wintering grounds, by taxonomic family; maps show species richness weighted by proportion of global breeding population from Canada's boreal.

Families of boreal birds show stunningly different winter distributions from each other. Woodpeckers largely winter in the boreal forest, though some species migrate to the southern United States and beyond (Figure 5a). Finches also show a strong northern wintering concentration; in this case south of the boreal forest in northeastern United States, the Great Lakes Basin and the western mountains (Figure 5b). Sparrows and thrushes are concentrated in parts of the United States and Mexico although their patterns vary noticeably from each other (Figures 5c, 5d). Flycatchers and warblers are principally neotropical wintering groups (Figures 5e, 5f) as are vireos (not shown). Although their continental distributions are similar, warblers differ from flycatchers because the former has important wintering grounds in Florida and the West Indies.

2. e. How significant are these migrants to the avifauna of other countries?

This analysis focuses on the United States, as there are several good datasets from which to estimate proportions of boreal migrants among all birds surveyed.³ Below are the results from the three datasets used for this report.

- 1) *The Gulf Coast Bird Observatory* network for spring and fall migration (<http://www.gcbo.org/>) provides a useful dataset because it includes over 45,000 single day counts collected across a broad front of several states north of the Gulf of Mexico (Figure 6). Data were filtered to include counts only during periods of spring and fall migration (from March 20 to June 1, and from July 15 to October 31). This network detects mainly landbird species.

Figure 6

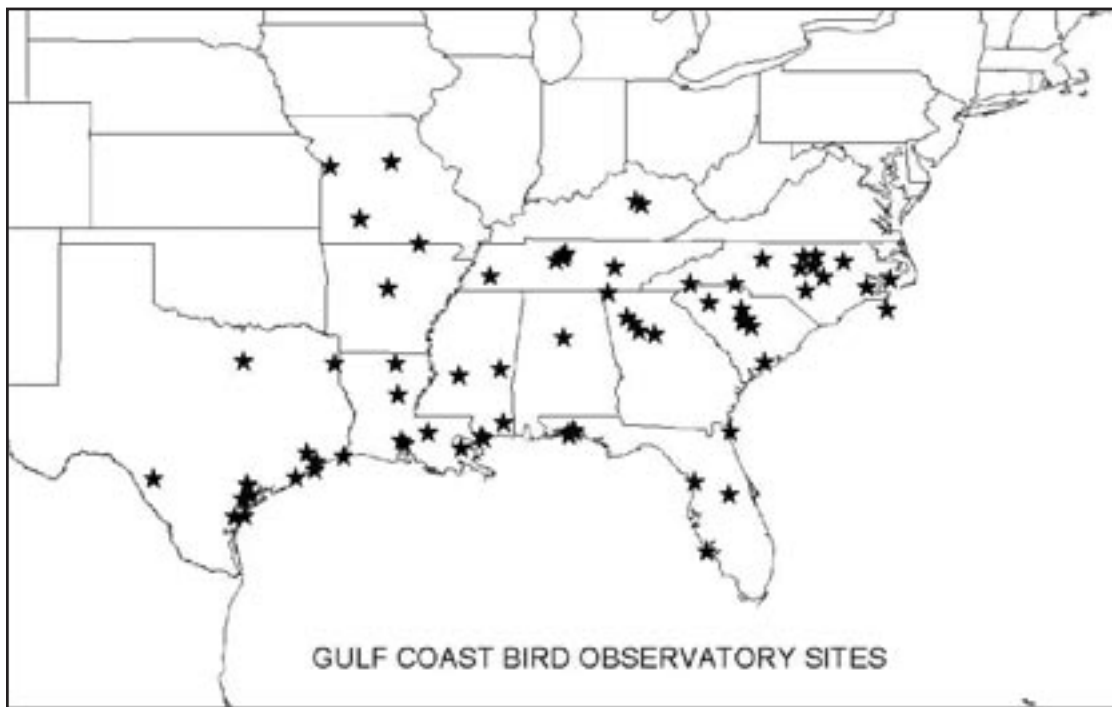


Figure 6: GCBO sample sites for spring and fall migration

³ The proportion of birds originating from Canada's boreal forest was estimated by calculating the number of boreal migrants that leave Canada (boreal migrants as in Tables 6 & 7 minus migrants remaining in non-boreal Canada, Table 9), and then dividing by the total numbers of birds (migrants or not) in the United States. This method was applied against three datasets.

- 2) *Christmas Bird Count* data from the contiguous U.S. (48 states) for 1990 to 1998 were also analysed. These data are the result of one day counts of all species observed within a 24-km (15-mile) diameter circle. Abundance indices were weighted among states by area covered.
- 3) *Project FeederWatch* data from 1997 to 2001 were also examined. For this comparison, statewide geometric mean abundance indices have been used as a measure of relative abundance of each species at feeders within the lower 48 states. Weighting of indices across states in the U.S.A. was done on the basis of number of feeder stations reporting in each state, on the assumption that this is reasonably proportional to interest in bird feeding in the various states.

Spring and Fall Migration: *Gulf Coast Bird Observatory* network

Out of about 160,000 birds counted by the *Gulf Coast Bird Observatory* during fall migration, an estimated 17% were migrants from Canada's boreal forest (see Table 10). Warblers and swallows were the most common Canadian fall migrants, together making up over half of estimated boreal birds.

Table 10: Fall migration counts by Gulf Coast Bird Observatory, showing landbird families with highest estimated numbers of Boreal migrants

Landbird Family	Boreal Migrants	All Fall Landbirds	% Boreal Migrants	Boreal Species	All Species
Parulidae (Wood-Warblers)	10,497	18,331	57%	23	38
Hirundinidae (Swallows)	4,525	41,754	11%	6	7
Turdidae (Thrushes)	3,028	7,851	39%	7	7
Vireonidae (Vireos)	1,535	5,208	29%	5	7
Accipitridae (Hawks & Eagles)	1,523	6,300	24%	6	10
Emberizidae (Sparrows & Allies)	1,403	3,255	43%	10	15
Tyrannidae (Flycatchers)	684	7,898	9%	8	18
Trochilidae (Hummingbirds)	666	6,320	11%	1	4
Regulidae (Kinglets)	613	778	79%	1	1
Icteridae (Blackbirds & Allies)	565	9,246	6%	6	10
21 other Landbird Families	2,202	54,692	4%	26	49
Total Landbirds	27,243	161,633	17%	99	166

In contrast, 31% of 134,000 birds counted in spring were estimated to be on their way to Canada's boreal forest (Table 11). Warblers were by far the most numerous of estimated boreal migrants, comprising over 50% of all boreal birds, and largely accounting for the big increase in percent of boreal birds in spring compared to fall.

Table 11: Spring migration counts by Gulf Coast Bird Observatory, showing landbird families with highest estimated numbers of Boreal migrants

Landbird Family	Boreal Migrants	All Spring Landbirds	% Boreal Migrants	Boreal Species	All Species
Parulidae (Wood-Warblers)	21,365	40,006	53%	24	39
Emberizidae (Sparrows & Allies)	4,418	6,620	67%	13	14
Vireonidae (Vireos)	3,733	9,100	41%	5	9
Bombycillidae (Waxwings)	2,332	5,783	40%	1	1
Hirundinidae (Swallows)	2,224	9,982	22%	6	7
Turdidae (Thrushes)	1,875	5,509	34%	7	7
Regulidae (Kinglets)	1,816	2,306	79%	2	2
Tyrannidae (Flycatchers)	764	6,450	12%	10	17
Icteridae (Blackbirds & Allies)	660	10,582	6%	7	10
Cardinalidae	515	6,649	8%	2	6
20 other Landbird Families	1,440	31,436	5%	35	53
Total Landbirds	41,141	134,423	31%	112	165

There were substantial differences in species counts in spring versus fall migration. Barn Swallows were the most numerous boreal migrants in fall, comprising 8% of boreal birds, while Yellow-rumped Warblers dominated the spring count at 25% of the total estimated to breed in the boreal forest (Table 12). Several species of warblers were among the top boreal species in both seasons.

Table 12: Gulf Coast Bird Observatory - species with highest numbers of Boreal migrants by season

Fall Migration				Spring Migration			
Species	Boreal Migrants	All Birds	% Boreal	Species	Boreal Migrants	All Birds	% Boreal
Barn Swallow	2,301	22,940	10%	Yellow-rumped Warbler	10,277	13,936	74%
Swainson's Thrush	1,546	2,141	72%	Red-eyed Vireo	3,305	5,193	64%
American Redstart	1,444	1,766	82%	White-throated Sparrow	3,088	3,136	98%
Red-eyed Vireo	1,374	2,158	64%	Cedar Waxwing	2,332	5,783	40%
Tennessee Warbler	1,362	1,363	100%	Tree Swallow	1,889	4,504	42%
Broad-winged Hawk	1,186	3,436	35%	Ruby-crowned Kinglet	1,809	2,294	79%
Magnolia Warbler	1,157	1,184	98%	Black-and-white Warbler	1,433	2,033	71%
American Robin	1,076	2,991	36%	Palm Warbler	1,115	1,117	100%
Black-and-white Warbler	984	1,396	71%	Chestnut-sided Warbler	933	1,377	68%
Tree Swallow	946	2,254	42%	Tennessee Warbler	839	839	100%
Chestnut-sided Warbler	942	1,390	68%	American Redstart	750	917	82%
Yellow Warbler	851	1,662	51%	Blackburnian Warbler	741	946	78%
Cliff Swallow	815	7,167	11%	Ovenbird	716	1,165	61%
Yellow-rumped Warbler	813	1,102	74%	Swainson's Thrush	698	967	72%
Blackburnian Warbler	762	972	78%	Magnolia Warbler	652	667	98%
Ruby-throated Hummingbird	666	6,204	11%	American Robin	621	1,726	36%
White-throated Sparrow	614	623	98%	Blackpoll Warbler	614	907	68%
Ruby-crowned Kinglet	613	778	79%	Black-throated Green Warbler	527	776	68%
Common Yellowthroat	419	1,345	31%	Rose-breasted Grosbeak	514	1,050	49%
Red-winged Blackbird	416	5,621	7%	Bay-breasted Warbler	467	471	99%

There is substantial geographic variation in proportions of boreal migrants counted (see Table 13). In both migration seasons, the proportion of boreal migrants was highest in Georgia, Missouri, Tennessee and Alabama, reaching 45% in spring in the former two states. The proportions of boreal migrants in Texas and Florida on the other hand were consistently low.

Table 13: Gulf Coast Bird Observatory - percentage of Canadian Boreal migrants by state

Fall Migration				Spring Migration			
State	Boreal Migrants	All Birds	% Boreal	State	Boreal Migrants	All Birds	% Boreal
Georgia	9,602	25,758	37%	Georgia	16,785	34,899	48%
Tennessee	1,180	3,730	32%	Missouri	571	1,282	45%
Missouri	360	1,218	30%	Tennessee	3,692	10,816	34%
Alabama	191	757	25%	Alabama	587	1,838	32%
North Carolina	1,346	6,291	21%	South Carolina	2,799	9,533	29%
Kentucky	482	2,343	21%	Louisiana	1,967	7,619	26%
Mississippi	772	3,899	20%	Arkansas	193	757	26%
South Carolina	1,403	7,399	19%	Mississippi	1,197	5,171	23%
Louisiana	3,440	21,552	16%	Texas	10,411	47,337	22%
Texas	7,758	80,872	10%	North Carolina	1,554	7,398	21%
Florida	709	7,814	9%	Florida	1,312	7,628	17%

Winter Bird Abundance: Christmas Bird Counts in the U.S.A.

Overall, *Christmas Bird Counts* indicate that about 10% of landbirds wintering in the lower 48 states migrated there from Canada's boreal forest. This is substantially lower than the figures during migration season, particularly in spring. Winter counts of boreal bird families differed markedly from those during migration as well. The Blackbird family formed nearly one-half of all estimated Canadian boreal migrants remaining in the United States in winter (see Table 14), along with large numbers of boreal-breeding sparrows and thrushes.

Table 14: Christmas Bird Count indices of total population in the U.S.A., by bird family

Family	CBC Index		% Boreal Migrants	Boreal Species	All Species
	Boreal Birds	All Birds			
Icteridae (Blackbirds & Allies)	24,000,000	360,000,000	6%	10	23
Emberizidae (Sparrows & Allies)	9,900,000	18,000,000	58%	25	48
Turdidae (Thrushes)	8,400,000	24,000,000	35%	10	14
Parulidae (Wood-Warblers)	2,600,000	3,800,000	70%	27	50
Corvidae (Jays, Crows & Allies)	1,600,000	12,000,000	15%	2	18
Hirundinidae (Swallows)	1,300,000	3,100,000	42%	7	8
Bombycillidae (Waxwings)	1,200,000	2,400,000	47%	2	2
Fringillidae (Finches)	950,000	7,400,000	12%	6	18
Regulidae (Kinglets)	840,000	1,200,000	68%	2	2
Sturnidae (Starlings & Mynas)	410,000	61,000,000	1%	1	4
Picidae (Woodpeckers)	350,000	2,100,000	14%	3	22
Accipitridae (Hawks & Eagles)	240,000	1,300,000	18%	11	23
Motacillidae (Wagtails & Pipits)	140,000	550,000	26%	2	3
Falconidae (Falcons)	100,000	400,000	26%	3	7
35 other Landbird Families	330,000	30,000,000	1%	40	220
All Landbird Families	52,000,000	520,000,000	10%	151	462

Red-winged Blackbirds are by far the most numerous of boreal migrants seen on *Christmas Bird Counts* in the lower 48 states, accounting for about 40% of boreal landbird migrants (see Table 15). Even without Redwings, blackbirds are one of the more numerous families of boreal migrants in the U.S. because other species such as Grackles, Cowbirds and Brewer's Blackbirds also include numerous migrants from Canada.

Table 15: Christmas Bird Count indices of total population in the U.S.A., by species

Family	CBC Index		% Boreal Migrants
	Boreal Birds	All Birds	
Red-winged Blackbird	21,000,000	280,000,000	7%
American Robin	8,200,000	23,000,000	36%
Dark-eyed Junco	4,000,000	5,500,000	72%
Yellow-rumped Warbler	2,400,000	3,300,000	74%
White-crowned Sparrow	1,800,000	3,100,000	58%
American Crow	1,600,000	8,000,000	20%
White-throated Sparrow	1,400,000	1,400,000	98%
Tree Swallow	1,300,000	3,100,000	42%
Brown-headed Cowbird	1,200,000	21,000,000	6%
Common Grackle	1,200,000	46,000,000	3%
Cedar Waxwing	720,000	1,800,000	40%
American Tree Sparrow	680,000	1,400,000	49%
Brewer's Blackbird	660,000	5,000,000	13%
Ruby-crowned Kinglet	610,000	770,000	79%
Bohemian Waxwing	500,000	670,000	75%

Among those landbird species which come mainly (75% or more) from Canada's boreal forest, several of the most abundant on U.S. *Christmas Bird Counts* are members of the sparrow family (see Table 16).

Table 16: Most abundant landbirds on U.S. Christmas Bird Counts, limited to migrants with >75% of population from Canada's Boreal

Family	CBC Index		% Boreal Migrants
	Boreal Birds	All Birds	
White-throated Sparrow	1,400,000	1,400,000	98%
Ruby-crowned Kinglet	610,000	770,000	79%
Bohemian Waxwing	500,000	670,000	75%
Swamp Sparrow	340,000	380,000	90%
Harris's Sparrow	340,000	340,000	100%
Rusty Blackbird	150,000	190,000	76%
Hermit Thrush	100,000	130,000	79%
Lincoln's Sparrow	100,000	110,000	90%
Palm Warbler	71,500	71,600	100%
Northern Shrike	18,000	21,000	85%
Smith's Longspur	17,000	18,000	96%
Le Conte's Sparrow	14,000	16,000	87%
Merlin	9,800	12,000	84%

The species composition of Christmas Bird Counts differs substantially among U.S. regions and states. So too does the proportion of birds from the boreal forest (Figure 7). The proportion of landbirds that originate from Canada's boreal varies from a low of five to six percent in Delaware, North Dakota and Tennessee, to highs of about 27% in Florida and 32% in Georgia, where Tree Swallows and Robins respectively are abundant migrants. This pattern is quite different than the one seen during migration, when Florida has a very low proportion of landbirds from the boreal, and Tennessee has one of the highest counts (see Table 13).

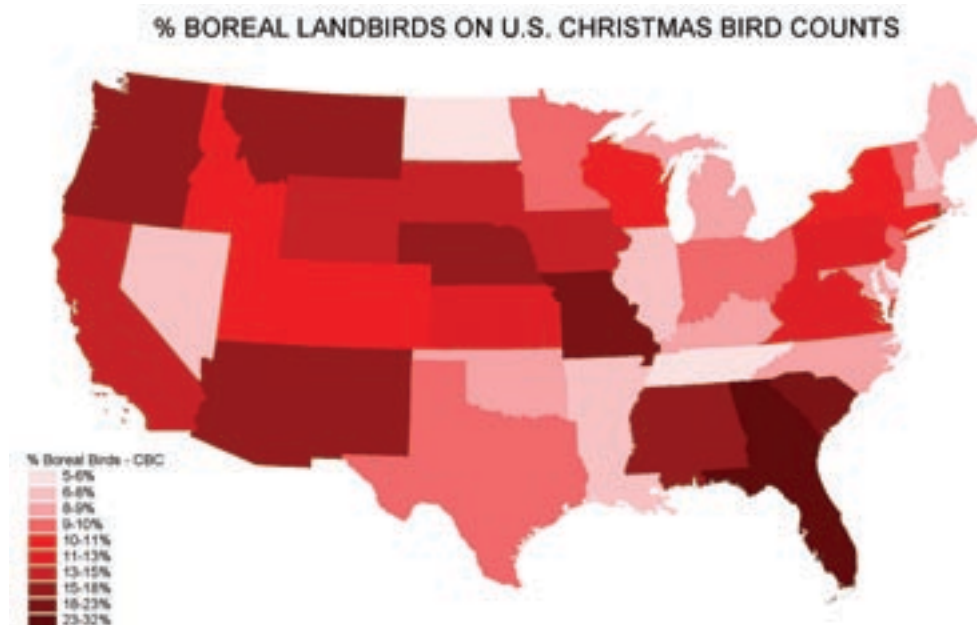


Figure 7: Proportional Distribution of Boreal birds on Christmas Bird Counts in the U.S.

Winter Birds at U.S. Feeders: *Project FeederWatch*

Birds from Canada's boreal forest constitute about 17% of landbirds counted at feeders in the contiguous United States. This is a somewhat higher figure than the 10% of total birds estimated from *Christmas Bird Counts*. Sparrows and finches make up the bulk of boreal birds at feeders (Table 17). The boreal forest produces many other species of birds that are regularly attracted to feeders, such as chickadees, woodpeckers, nuthatches and jays, but most of those species are not migratory. Many boreal finches are migratory but a large proportion of their population remains in southern Canada.

Table 17: Project FeederWatch (PFW) indices of average abundance, by bird family

Landbird Family	PFW Abundance Index		%	Shared	All
	Boreal Birds	All Birds			
Emberizidae (Sparrows & Allies)	3.07	4.47	69%	19	36
Fringillidae (Finches)	0.65	5.02	13%	6	15
Turdidae (Thrushes)	0.09	0.30	31%	9	12
Corvidae (Jays, Crows & Allies)	0.09	1.81	5%	2	19
40 other Landbird Families	0.24	13.09	2%	99	262
Total Landbirds	4.13	24.69	17%	135	344

Dark-eyed Juncos are by far the most abundant of boreal birds at feeders in the U.S. (see Table 18), and Juncos exported from Canada's boreal are estimated to make up on average about nine % of all U.S. feeder birds. Juncos are numerically the most abundant species in 14 of 48 states, and one of the top five species in 39 states. "Snowbirds", as they are sometimes called, have the distinction of being recorded at the highest proportion of feeders in North America (Dunn & Tessaglia-Hymes 1999). American Goldfinches and White-throated Sparrows from Canada's boreal are also numerically important.

Table 18: Project FeederWatch (PFW) indices of average abundance, for species with most birds from Canada's Boreal Forest

Species	PFW Abundance Index		%
	Boreal Birds	All Birds	
Dark-eyed Junco	2.20	3.06	72%
White-throated Sparrow	0.49	0.50	98%
American Goldfinch	0.34	2.02	17%
Pine Siskin	0.13	0.23	58%
Purple Finch	0.13	0.22	60%
White-crowned Sparrow	0.11	0.20	58%
American Tree Sparrow	0.10	0.20	49%
American Crow	0.09	0.44	20%
American Robin	0.08	0.22	36%
Chipping Sparrow	0.06	0.10	59%
Song Sparrow	0.05	0.20	27%
Northern Flicker	0.04	0.10	40%
Evening Grosbeak	0.03	0.07	50%
Yellow-rumped Warbler	0.03	0.04	74%
Red-breasted Nuthatch	0.03	0.15	19%

The distribution of boreal birds, expressed as a proportion of all birds at feeders, is shown in Figure 8. The proportion of boreal birds varies more than three-fold across states, from nine % in Florida to 31% in Oregon. The overall distribution is heavily weighted towards the distribution of Dark-eyed Juncos, which are slightly more abundant at feeders in the west (Dunn & Tessaglia-Hymes 1999).

Figure 8

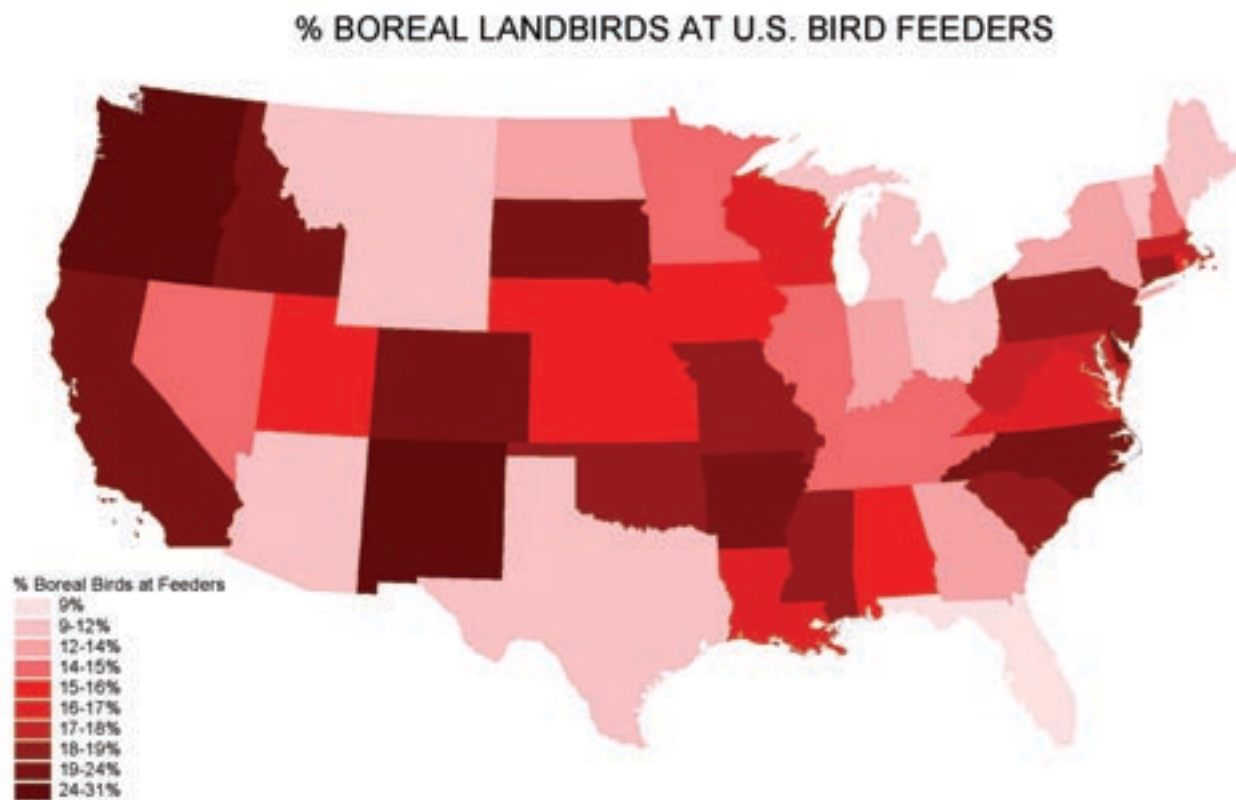


Figure 8: Distribution of Boreal birds at U.S. Bird Feeders, from Project FeederWatch

PART 3: WHICH BOREAL LANDBIRD SPECIES ARE EXPERIENCING SIGNIFICANT POPULATION DECLINES?

Population trends are available for most boreal species from the North American *Breeding Bird Survey*. Since BBS routes are biased towards the more accessible southern portions of the boreal forest, these trends are most representative of the birds found there. Important declines in more remote parts of the boreal may be missed by BBS, as could declines in species poorly detected during BBS counts. Lists of declining species below are therefore conservative. All trend information shown below is for the longest time period available, typically in the order of 30 or more years.

There are from six to 19 species exhibiting significant declines in population, depending on region and type of trend analysis (Table 19). Some species also appear to be increasing, and there is no consistent predominance of population declines or increases across the boreal.

Table 19: Summary of Population Trends for Boreal Species, from the Breeding Bird Survey (BBS)

BBS Trend Region	Years	Species Restriction	Declining Species*	Increasing Species*	# of Species	Source ^
Closed Boreal Forest Stratum	1966-2001	none	11	14	105	(1)
BCR 8 (Boreal Shield)	1969-2000	none	11	6	71	(2)
BCR 6 (Boreal Taiga Plains)	1969-2000	none	15	7	93	(2)
BCR 4 (NW Interior Forest)	1985-2000	none	6	1	23	(2)
Canada	1966-2001	≥50% Canadian Pop'n in Boreal	19	23	79	(1)
Canada	1967-2000	≥50% Canadian Pop'n in Boreal	19	13	82	(2)
North America (BBS-wide)	1966-2001	≥50% North Am. Pop'n in Boreal	10	12	40	(1)

* includes species with trends different than 0 at $P \leq 0.10$

^ Sources: (1) Sauer, J. R., J. E. Hines, and J. Fallon. 2002. The North American Breeding Bird Survey, Results and Analysis 1966 - 2001, Version 2002.1, USGS Patuxent Wildlife Research Center, Laurel, MD. (2) Canadian Wildlife Service, Bird Trends web site: http://www.cws-scf.ec.gc.ca/cws-scf/birds/Trends/default_e.cfm

Table 20 shows those 40 species that are currently showing evidence of decline within the boreal forest and also at a larger geographic scale. Some of these species, like Connecticut Warbler, White-throated Sparrow and Boreal Chickadee, are principally boreal forest species, while others like Horned Lark, Western Meadowlark and Barn Swallow are typical of more southern agricultural landscapes, but are experiencing declines in the boreal as they are elsewhere.

Table 20: Boreal Canada Species with Declining Population Trends from Breeding Bird Survey (BBS)

Declining Species *	Global Pop'n in Boreal	BBS Population Trend ^						
		Closed Boreal	BCR8	BCR6	BCR4	Canada1	Canada2	North Am
<i>Neotropical Migrants</i>								
Connecticut Warbler	92%	-20.9		-2.9		-1.5	-8.9	-1.3
Mourning Warbler	75%	-2.3	-2.0	-6.5		-1.2	-0.2	-0.8
Least Flycatcher	65%	-1.3	1.3	-1.1		-0.9	-0.8	-1.0
Blackpoll Warbler	65%	-3.8	-4.5	-11.2		-3.7	-3.7	-3.9
Canada Warbler	64%	-1.2	-0.3			-1.9	-6.2	-1.9
Swainson's Thrush	59%	-0.3	1.5	0.9	-7.9	-0.5	-0.5	-0.5
Clay-colored Sparrow	51%			-0.5		-1.4	-0.1	-1.2
Chestnut-sided Warbler	46%	-4.1	-4.8	-0.2		-0.7	-1.6	-0.6
Olive-sided Flycatcher	38%	-1.9	-3.7	3.3	-15.3	-2.9	-3.3	-3.3
Gray-cheeked Thrush	35%		-10.6				-8.8	
Wilson's Warbler	31%	-2.9	-0.6		-2.7	-1.6	-1.3	-1.0
Common Yellowthroat	26%	-2.7	0.3	-2.0		-0.5	-0.6	-0.3
Western Wood-Pewee	19%			-3.4	-10.8	-1.1	-2.7	-1.4
Baltimore Oriole	12%			-2.2		-0.9	-0.5	-0.6
Common Nighthawk	6%	0.6		-24.6		-2.4	-7.4	-1.7
Bank Swallow	6%	-11.6		-8.2		-2.1	-6.3	-0.3
Eastern Kingbird	4%	-7.2		-6.7		-1.3	-1.6	-0.9
Bobolink	4%	-2.8	-17.7	-0.2		-2.3	-2.8	-1.6
Barn Swallow	2%	-1.0	-9.3	-4.1		-2.3	-2.8	-0.7
<i>Short-Distance Migrants</i>								
White-throated Sparrow	85%	-0.1	-0.8	-1.1		-0.7	-0.9	-0.7
Rusty Blackbird	70%	-12.4	-15.4			-10.9	-14.7	-10.7
Dark-eyed Junco	66%	-1.6	2.3	0.7	-9.0	-1.6	-0.8	-1.3
White-crowned Sparrow	48%				-12.9	0.7	-1.7	-1.6
Purple Finch	47%	-0.2	-1.5	-13.4		-2.2	-4.2	-1.7
Pine Siskin	46%	-0.8	-3.6	0.6		-1.1	-2.6	-1.2
Belted Kingfisher	38%	-5.0	2.7			-2.0	-1.4	-1.5
Northern Flicker	31%	-1.2	-4.2	-4.3	-7.0	-1.1	-1.7	-2.1
Song Sparrow	20%	-2.2	-3.3	-2.3		-1.1	-0.9	-0.5
American Kestrel	18%	-7.1	-6.2	3.9		-1.2	0.6	-0.2
Vesper Sparrow	10%	-6.8		-3.3		-0.5	-0.6	-0.9
Red-winged Blackbird	6%	-1.6	-0.5	-2.2		-1.1	-1.0	-1.0
Northern Harrier	5%	-5.7		-10.0		-1.4	-4.6	-0.9
Brown-headed Cowbird	5%	-8.8	-15.0	-1.3		-2.3	-2.2	-1.1
European Starling	2%	-1.6	-4.9	-2.1		-1.9	-2.1	-0.9
Western Meadowlark	1%			-5.5		-2.2	-1.5	-0.7
Horned Lark	1%			-15.2		-3.4	-3.3	-2.1
<i>Resident Species</i>								
Boreal Chickadee	78%	-4.4	-6.7	1.4	-12.5	-2.9	-4.8	-2.7
Gray Jay	73%	-1.3	-6.0	-6.2	-14.3	33.9	-3.4	32.0
Great Horned Owl	6%			-18.9		-1.0	-5.6	-0.2
House Sparrow	<1%	-8.0		-4.3		-2.6	-2.0	-2.5

* species listed here show evidence of declines within the boreal and across Canada/ North America; trends highlighted in bold are significantly different than zero at $P < 0.1$

^ Trends shown are annual % decline in population, sources are as listed in Table 19:

• Closed Boreal, Canada1 and North Am. trends are from Sauer et al (2002), others are from CWS web site

In addition to species showing consistent declines in the boreal and more widely (see Table 20), some species are declining in parts of their range but not in others. For example, Blue-headed Vireos are currently declining significantly in BCR 8 (boreal shield) but increasing in BCR 6 (boreal taiga plains), while the reverse is true for Chipping Sparrows. Yellow-bellied Sapsuckers are declining Canada-wide but trending upwards in BCR 6. Other species are declining significantly across North America but show evidence of increases in parts of the boreal. Examples include the Veery, Orange-crowned Warblers and Black-billed Cuckoos. Finally, Black-throated Green Warbler is an example of a species that is declining significantly within the boreal (in BCR 8), but not across Canada or North America.

It is readily apparent from the list of consistently declining species in Table 20 that a wide variety of taxonomic families are represented, with species typical of a variety of habitats, and employing a wide variety of foraging strategies. In addition, they have a range of migration strategies, showing no consistent tendency for more declines among residents or short-distance migrants or neotropical migrants (see Table 21). For this reason it is likely that several causes are behind the declines of such a diverse group.

Table 21: Proportion of Declines by Migration Strategy

Migration Guild / Wintering Destination	Declining Species (Table 20)	Landbirds with Boreal BBS Trends	% Declining Species
Resident Species	4	14	29%
Short-Distance Migrants	17	50	34%
Neotropical Migrants	19	62	31%
Totals	40	126	32%

Declining boreal species are broadly distributed across North and South America during the winter (Figure 9a). The highest densities of declining birds are short-distance migrants that spend the winter in the southeastern United States (Figure 9b). However when declining species richness is weighted by percent of population from the boreal forest, the focus shifts to neotropical migrants wintering in Central and northern South America (Figure 9c).

Figure 9

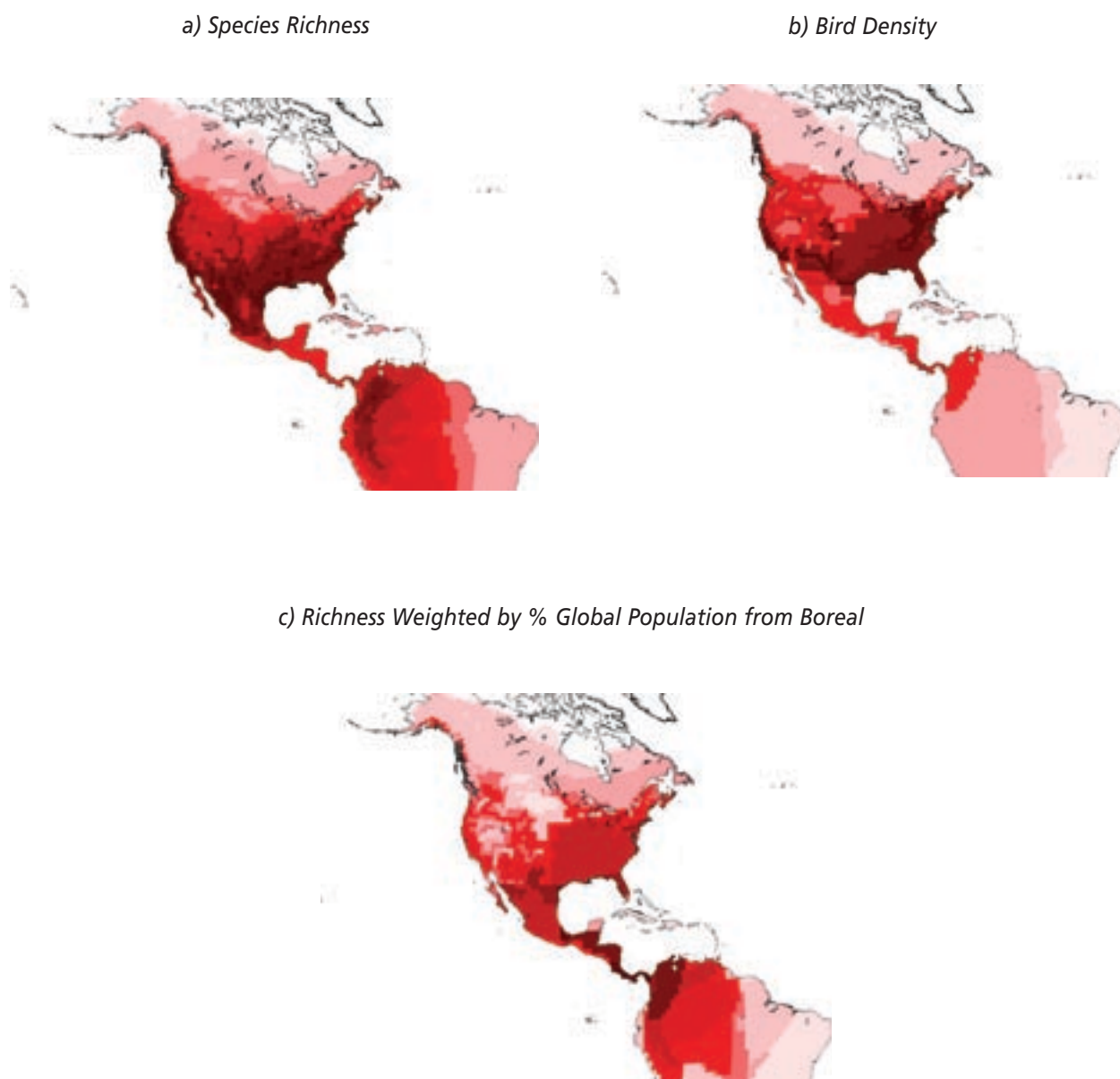


Figure 9: Winter distribution of 40 Boreal Landbirds with Declining Populations (see Table 20 for list of species)

PART 4: WHICH SPECIES OR SPECIES GROUPS BEST ILLUSTRATE THE IMPORTANCE OF THE BOREAL TO LANDBIRDS?

Several characteristics of birds may be used to illustrate the importance of Canada's boreal forest within its own borders, and in the United States, the Western Hemisphere and globally.

- One is the degree of reliance of a species on the boreal; some landbirds are almost completely reliant on boreal habitat during the breeding season.
- Another is the extent of migration; species groups that migrate long distances through many countries demonstrate how important it is to link education and conservation actions in widely separated regions or countries.
- Species that are charismatic, colourful, rare or seen only at certain times of year are often the target of bird-watchers, while birds that are attracted to bird feeders have large followings across southern Canada and the United States.
- Finally, species undergoing long-term declines can become the focus of conservation attention through programs like *Partners in Flight*.

Here are a selection of birds and bird groups that have some or all of those characteristics:

Warblers

Warblers stand out as a group for all of the above reasons. They are highly reliant on Canada's boreal forest during the breeding season – the boreal produces about half of the world's population of the 27 warbler species that regularly breed there (see Table 6). Warblers are also one of the boreal forest's most numerous birds. Hundreds of millions, possibly even one billion warblers breed there (see Table 2). All warblers are migratory and most are neotropical migrants, so that this bird family forms a significant link to all countries south of Canada, to northern South America (Figure 5f). Warblers are also one of the most numerous bird groups recorded during migration through the southeastern United States in spring and fall (see Tables 10 and 11). The populations of several warbler species are declining in the boreal forest and elsewhere in their range (Table 20). Some of them, such as Bay-breasted Warbler and Canada Warbler, are candidates for *Partners in Flight* Watch List status.

Moreover, warblers are colourful and charismatic birds of the forest that are sought after by birders during spring migration. They are beautiful emblems of the wildlife of the vast boreal forest.

Dark-eyed Junco and other feeder birds

Canada's "snowbird", the Dark-eyed Junco is perhaps the most abundant breeding bird in the boreal forest (Tables 3 & 7). A short-distance migrant from the boreal that is found at bird feeders in almost all Canadian provinces and U.S. states, according to *Project FeederWatch* this Junco is observed at more feeders across North America than any other species. Its abundance highlights the economic importance of Canada's boreal forest to the North American birding industry. Several other species of boreal birds, principally finches and sparrows, are also common at feeders in most parts of North America (see Table 18).

The Dark-eyed Junco population has declined in recent years in the northwestern boreal forest and range-wide (Table 20).

Sparrows and other short-distance migrants

For many persons with even a mild interest in bird watching, the *Christmas Bird Count* is an annual highlight. Boreal species typically observed on the day of the count include several short-distance migrants (see Table 15). Many of those that come principally from the boreal are sparrows (including White-throated, Swamp, Harris's, Lincoln's, and Le Conte's Sparrows, plus Smith's Longspurs, see Table 16). Some such as Harris's Sparrow, Smith's Longspurs and Nelson's Sharp-tailed Sparrow are restricted to certain regions in winter, leading to regional bird-watching opportunities and also to conservation concern (species with narrow distributions are more vulnerable to single catastrophic events or other local impacts). The populations of other members of this family, such as White-throated and White-crowned Sparrows also appear to be declining (see Table 20).

For the members of the North American public who participate in the *Christmas Bird Count*, all of the species listed in Table 16 provide important links to Canada's boreal forest.

Rusty Blackbirds and other species undergoing population declines

The Rusty Blackbird has the dubious distinction of showing one of the steepest population declines among all birds surveyed by the BBS (see Table 20, compare with other species listed on Canadian and U.S. BBS web sites). It is currently a candidate for *Partners in Flight* Watch List status across the continent, mainly because of its steep decline in numbers. Many other boreal species are also declining (see Table 20), causing them to be of conservation concern.

Links to migration sites and wintering grounds using bird band recovery data

Population estimates and range maps produces useful patterns, but they do not replace the value of establishing direct links for individual birds between breeding grounds, migration sites and wintering areas. Recoveries of bird bands provide an effective and demonstrable link between distant geographic locations.

Data prepared for the *Canadian Atlas of Bird Banding* (CF Brewer et al., 2000) provide a very useful tool for looking at patterns of recoveries. Although these data have limitations, particularly for countries south of the U.S., they provide particularly useful patterns when looking at groups of species, or when interested in short-distance links to southern Canada and the United States. Examples of these patterns are shown in the following figures.¹

¹ Most species of landbirds have a low rate of banding recovery, so that it is difficult to see much pattern in recovery locations for most species individually. In addition, reporting rates of bands are much lower in most countries south of the United States, biasing the picture we observe.

Figure 10

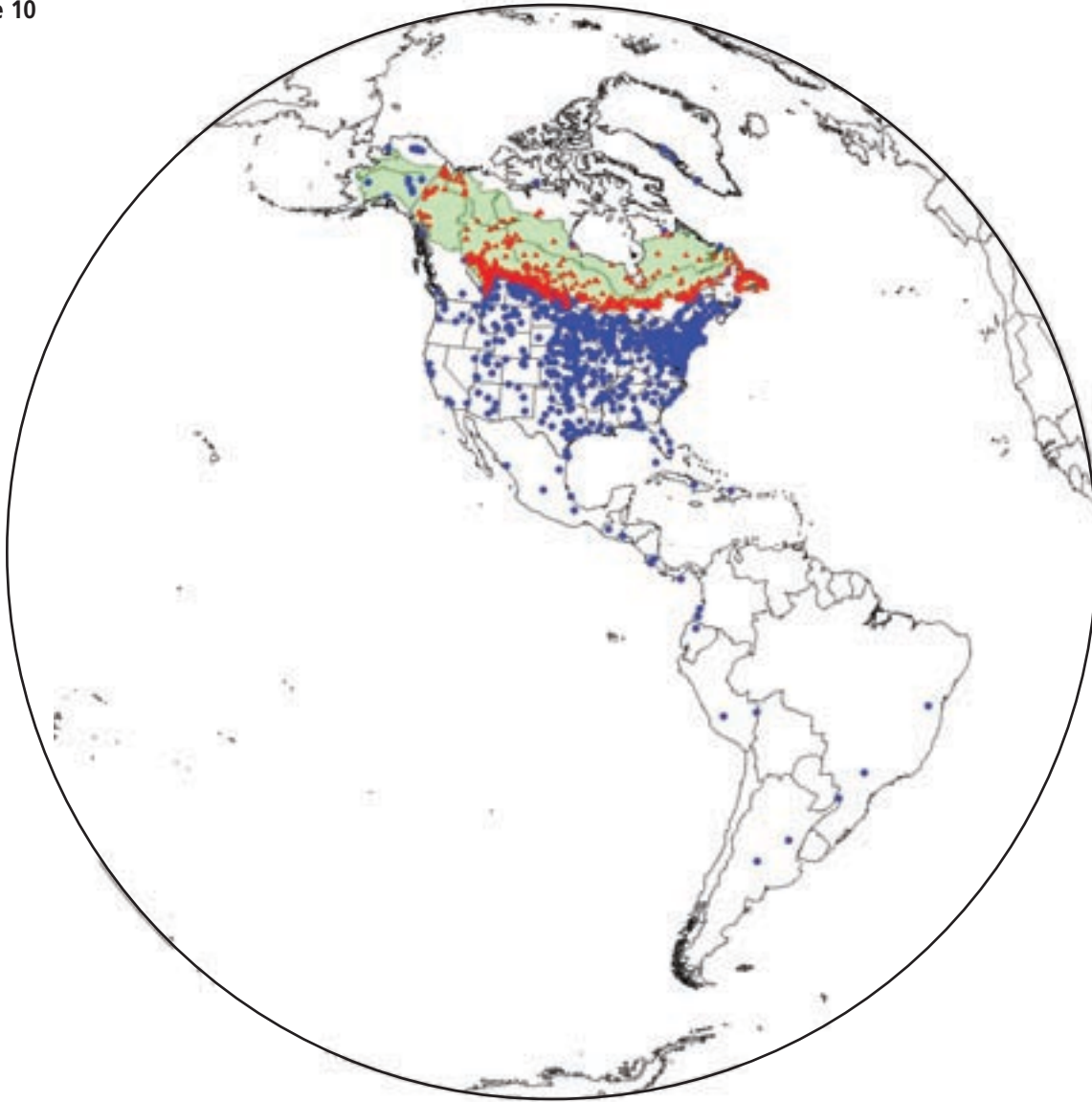


Figure 10: Banding Links for Individual Landbirds Captured (or Recovered) in the Canadian Boreal Forest (red triangles) and also Captured or Recovered outside of the Boreal (blue dots)

More than 1,400 boreal landbirds have been banded inside the boreal forest and then recovered later in other locations, or banded elsewhere and then recovered in the boreal.² Though some of these birds have been linked to countries as far away as Argentina (chiefly raptors), most have been linked to southern Canada and the United States, particularly central and eastern regions (Figure 10).

These can be broken down by Bird Conservation Region to show differences in banding links to the United States (Figure 11). Birds from BCR 6 in the Canadian boreal are frequently linked with the central United States, ranging from North Dakota and Minnesota, south to Texas (Figure 11b). Birds banded in BCR 8 in the boreal shield are typically linked with northeastern states (Figure 11d). The few birds with banding links to BCRs 4 and 7 are widely scattered elsewhere.

² Detailed species accounts showing the actual links can be found in Brewer et al. 2000.

Figure 11

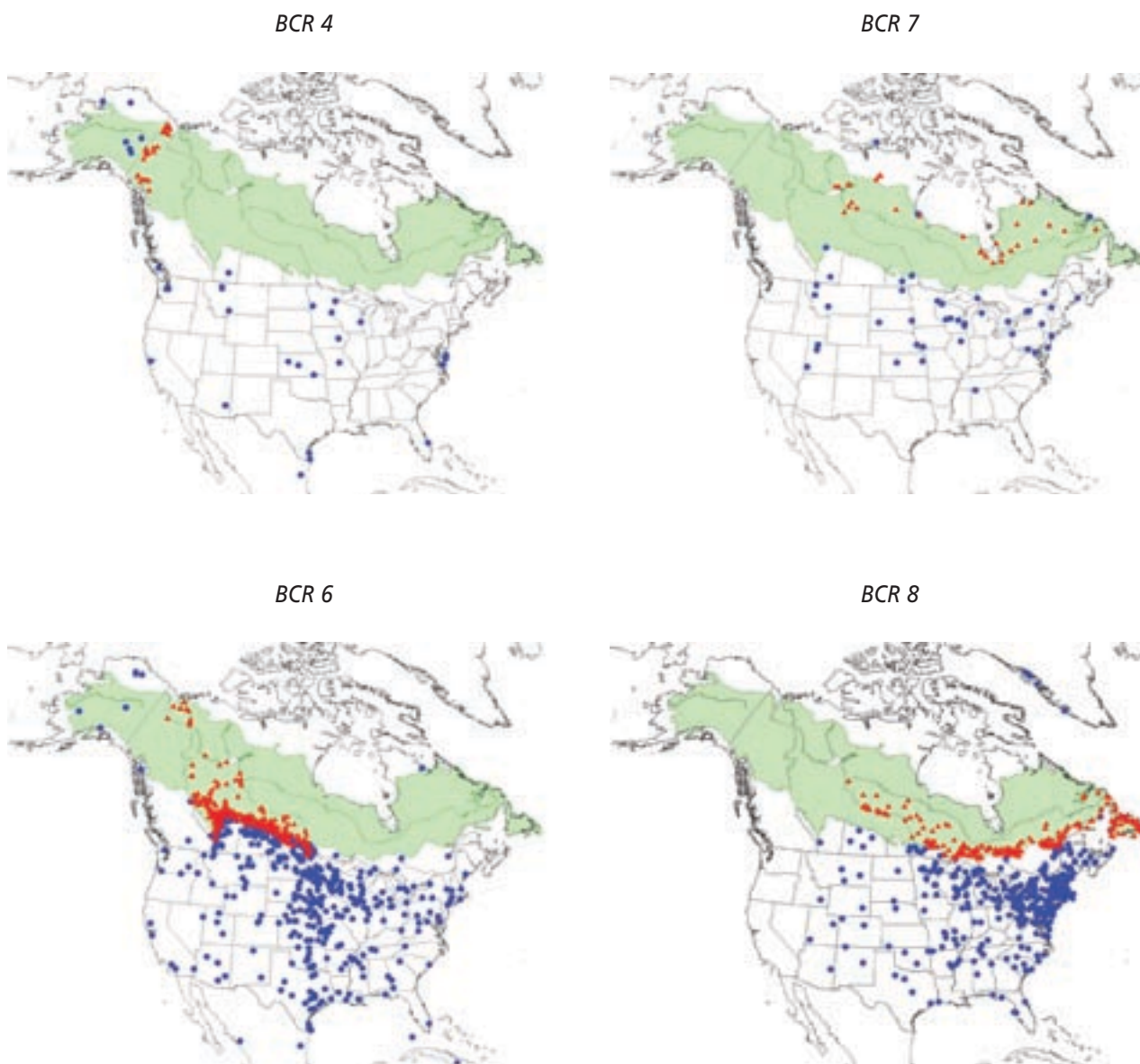


Figure 11: Landbird Banding Links with the Boreal, by Bird Conservation Region (BCR)

Banding links can also be informative when summarized by bird family as in Figure 12, or shown for those relatively few individual species with more than a few band recoveries (examples in Figure 13).

Figure 12

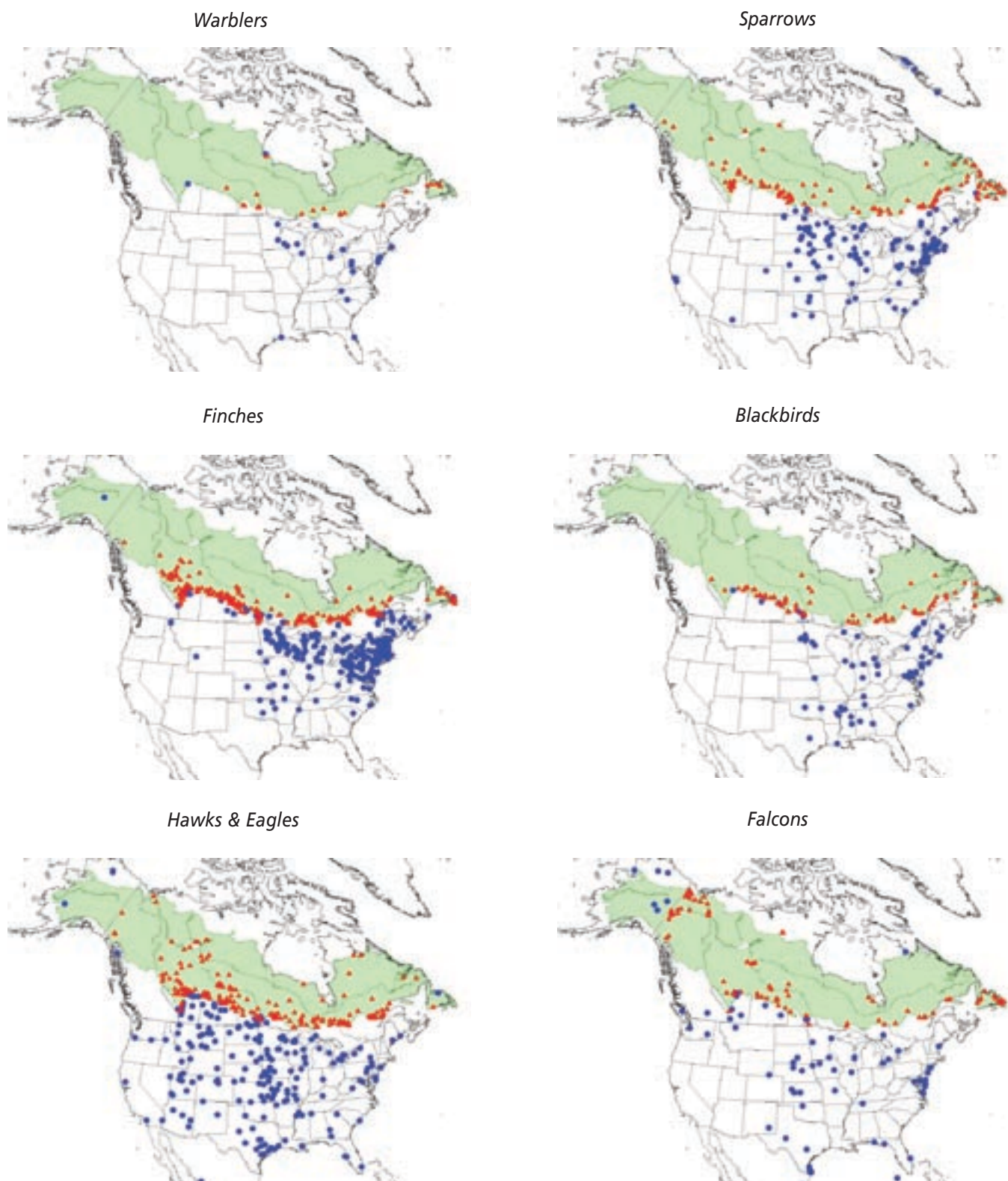


Figure 12: Landbirds with banding links to Canada's boreal forest, for a sample of bird families

Figure 13

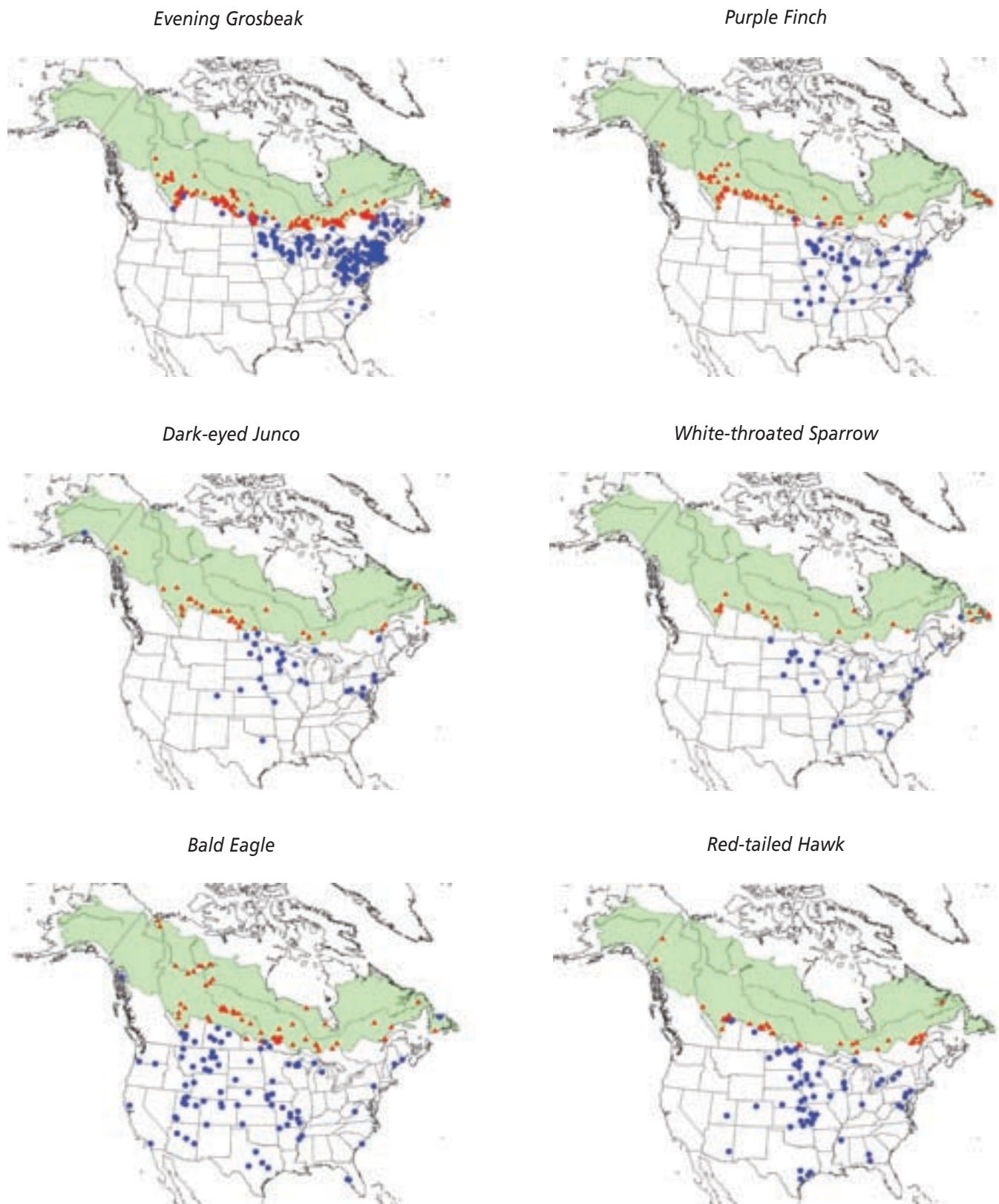
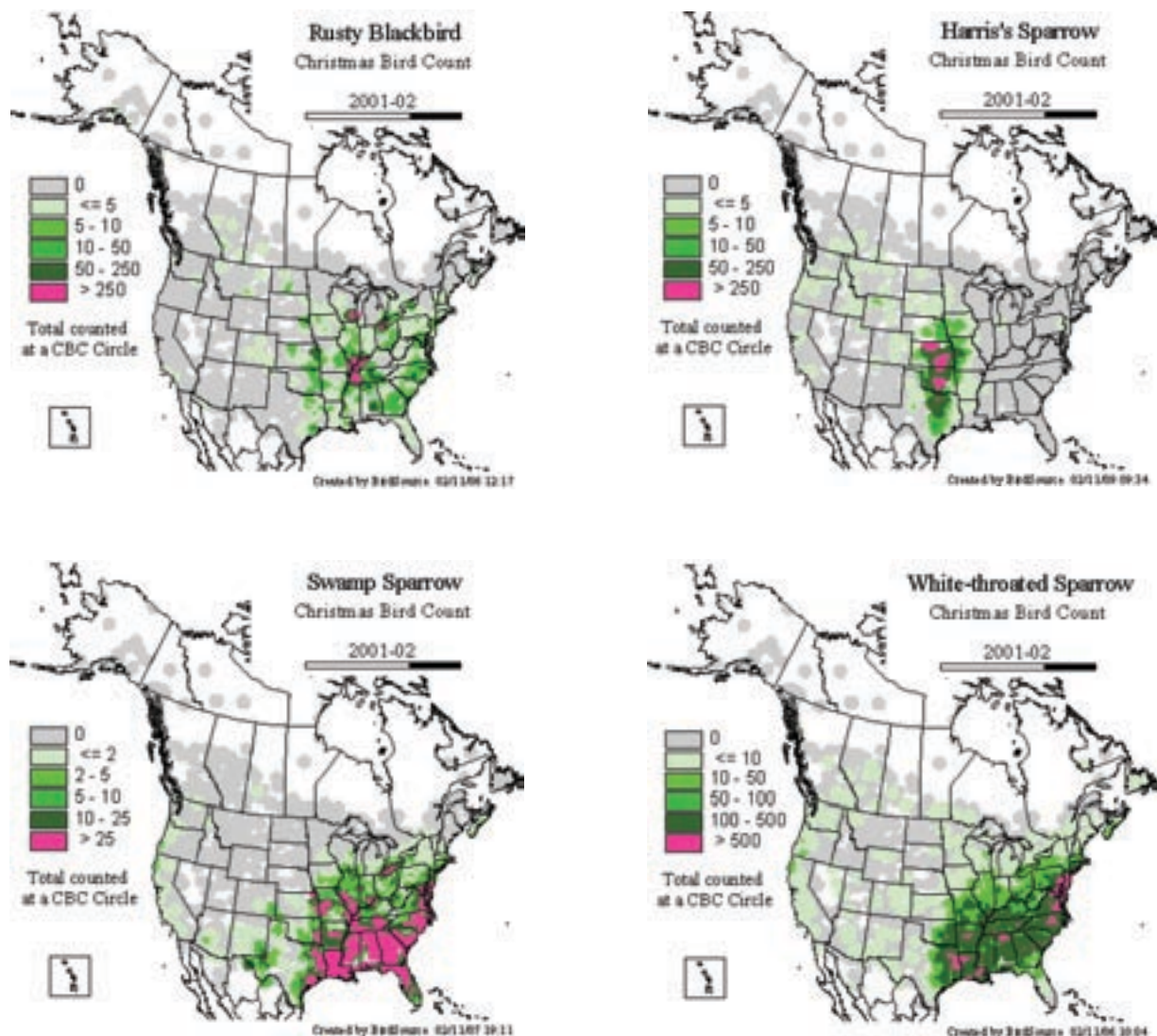


Figure 13: Landbird Banding Links with the Boreal, for a sample of species

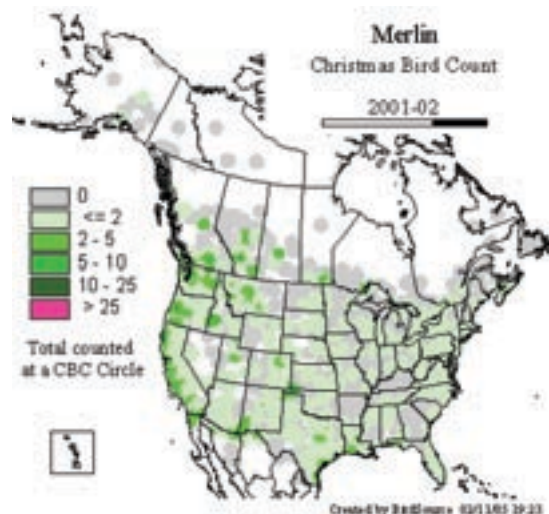
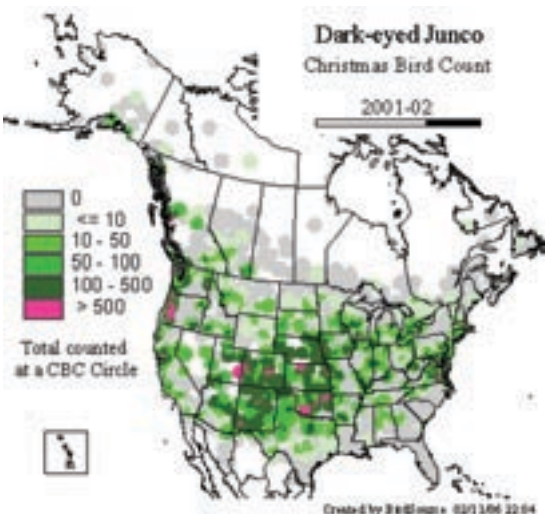
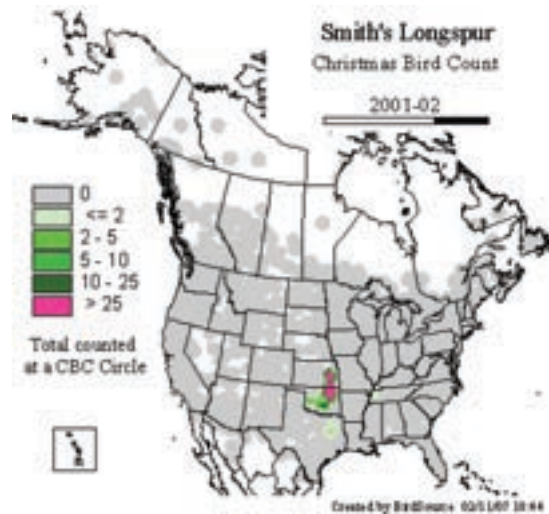
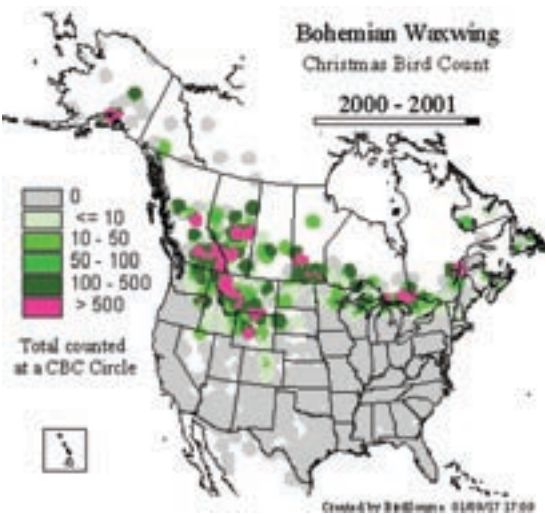
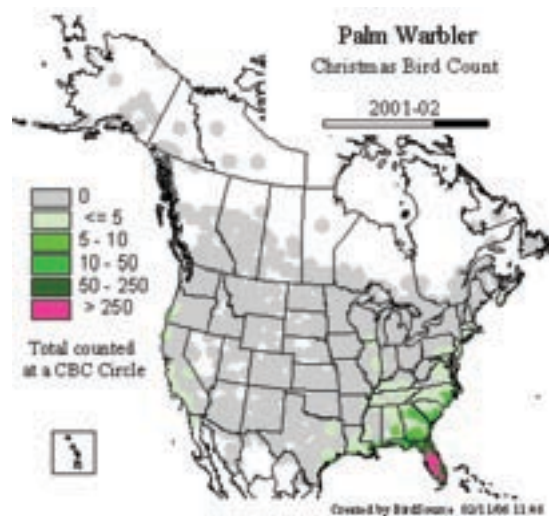
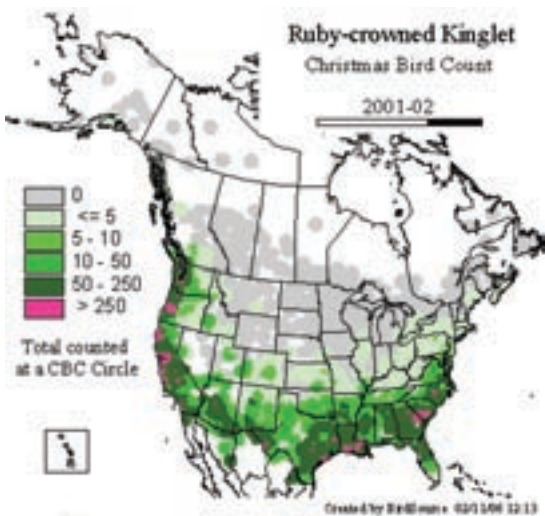
Use of *Christmas Bird Counts* data to illustrate U.S. wintering grounds

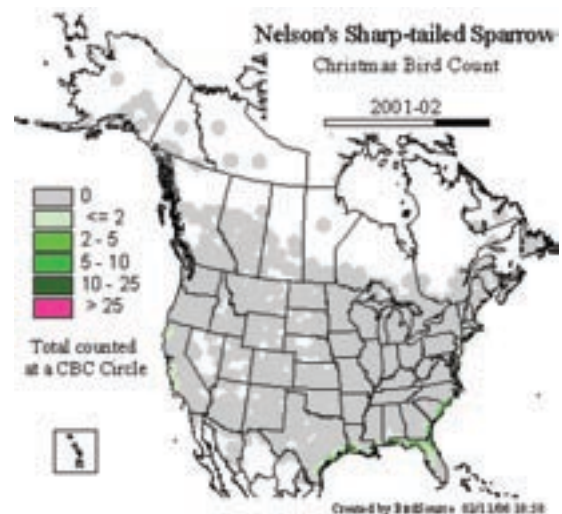
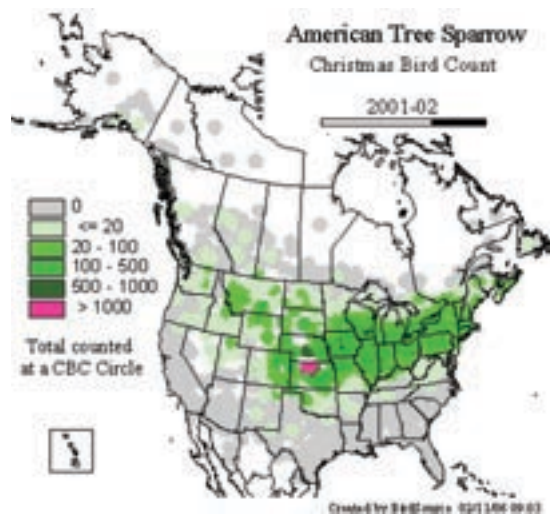
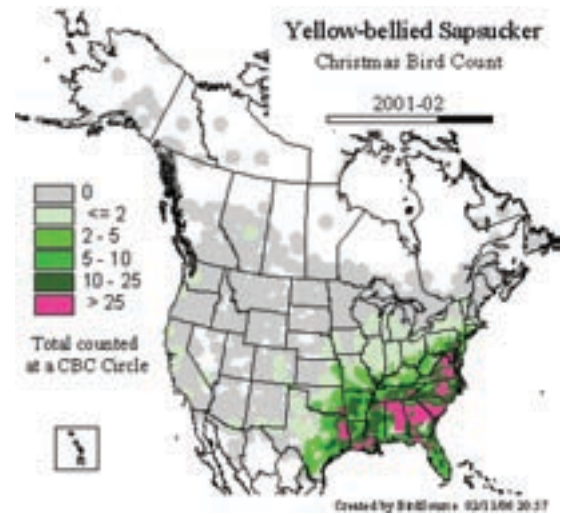
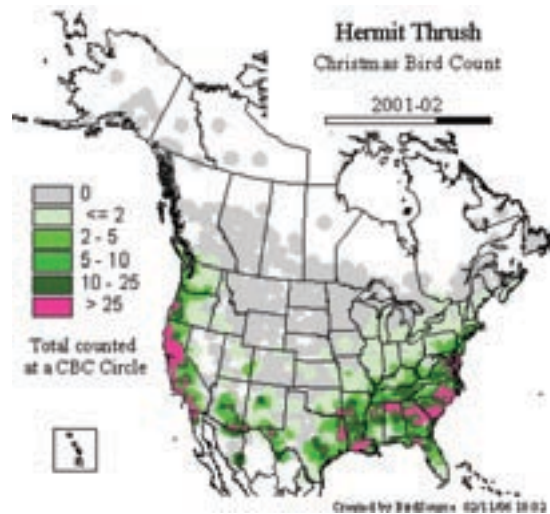
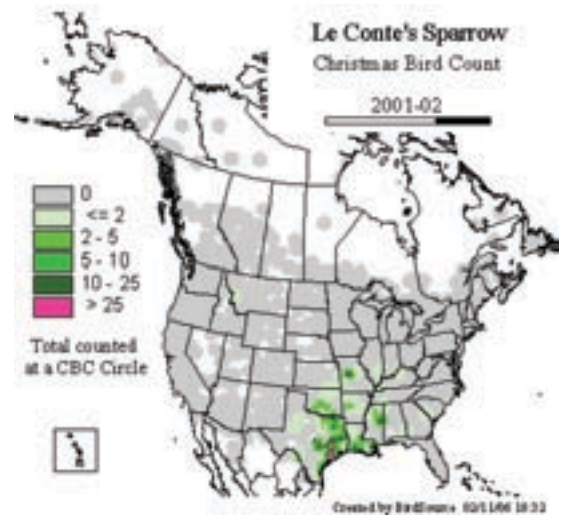
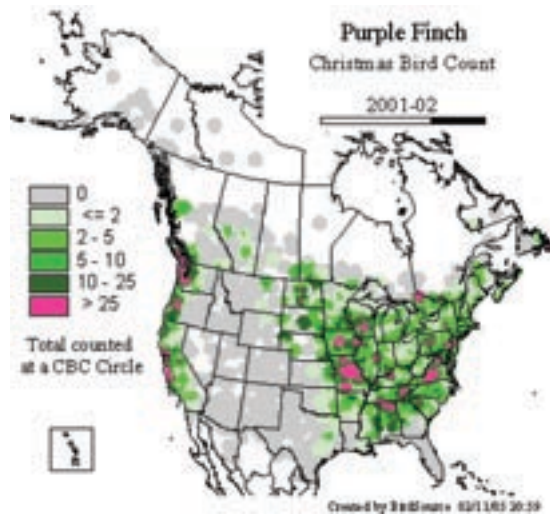
Christmas Bird Count (CBC) data provide a very useful means of showing the distribution of boreal species throughout wintering grounds in the United States. For most land birds, they provide a much more detailed picture than range maps and a much more complete distribution than band recoveries.¹ Several examples are shown below for species with important links to the boreal forest. The diversity of distribution patterns among species, and the specific concentration areas for some of the range-restricted species are of particular interest. For some species, such as Bohemian Waxwings and finches, it is important to keep in mind that winter distributions can vary dramatically between years. The distributions shown for each species are for the most recent year for which CBC data were available (usually 2001 or 2002).

Figure 14



¹ CBC distribution maps are available for view at the Audubon web site: <http://www.audubon.org/bird/cbc>





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APPENDIX A: LIST OF LANDBIRDS IN CANADA'S BOREAL FORESTS*

(Turkey Vulture)	Northern Saw-whet Owl	Philadelphia Vireo
*Osprey	Common Nighthawk	Red-eyed Vireo
Bald Eagle	Whip-poor-will	Gray Jay
*Northern Harrier	(Black Swift)	(Steller's Jay)
Sharp-shinned Hawk	Chimney Swift	Blue Jay
Cooper's Hawk	(Vaux's Swift)	(Clark's Nutcracker)
*Northern Goshawk	Ruby-throated Hummingbird	Black-billed Magpie
(Red-shouldered Hawk)	(Calliope Hummingbird)	American Crow
Broad-winged Hawk	Rufous Hummingbird	(Northwestern Crow)
Swainson's Hawk	Belted Kingfisher	*Common Raven
Red-tailed Hawk	(Lewis's Woodpecker)	*Horned Lark
*Rough-legged Hawk	(Red-headed Woodpecker)	Purple Martin
*Golden Eagle	Yellow-bellied Sapsucker	Tree Swallow
American Kestrel	(Red-naped Sapsucker)	Violet-green Swallow
*Merlin	(Red-breasted Sapsucker)	Northern Rough-winged Swallow
*Gyr Falcon	Downy Woodpecker	*Bank Swallow
*Peregrine Falcon	Hairy Woodpecker	Cliff Swallow
(Prairie Falcon)	* Three-toed Woodpecker	*Barn Swallow
*Gray Partridge	Black-backed Woodpecker	Black-capped Chickadee
*Ring-necked Pheasant	Northern Flicker	Mountain Chickadee
Ruffed Grouse	Pileated Woodpecker	Boreal Chickadee
Spruce Grouse	Olive-sided Flycatcher	*Gray-headed Chickadee
*Willow Ptarmigan	Western Wood-Pewee	(Chestnut-backed Chickadee)
*Rock Ptarmigan	Eastern Wood-Pewee	Red-breasted Nuthatch
White-tailed Ptarmigan	Yellow-bellied Flycatcher	White-breasted Nuthatch
Blue Grouse	Alder Flycatcher	Brown Creeper
Sharp-tailed Grouse	Willow Flycatcher	(Rock Wren)
*Rock Dove	Least Flycatcher	House Wren
Mourning Dove	Hammond's Flycatcher	*Winter Wren
Black-billed Cuckoo	Dusky Flycatcher	Sedge Wren
(Yellow-billed Cuckoo)	(Pacific-slope Flycatcher)	Marsh Wren
(Western Screech-Owl)	(Cordilleran Flycatcher)	American Dipper
(Eastern Screech-Owl)	Eastern Phoebe	Golden-crowned Kinglet
Great Horned Owl	Say's Phoebe	Ruby-crowned Kinglet
*(Snowy Owl)	Great Crested Flycatcher	*Northern Wheatear
*Northern Hawk Owl	(Western Kingbird)	Eastern Bluebird
Northern Pygmy-Owl	Eastern Kingbird	Mountain Bluebird
(Burrowing Owl)	Loggerhead Shrike	Townsend's Solitaire
Barred Owl	* Northern Shrike	Veery
* Great Gray Owl	Yellow-throated Vireo	* Gray-cheeked Thrush
*Long-eared Owl	(Cassin's Vireo)	Bicknell's Thrush
*Short-eared Owl	Blue-headed Vireo	Swainson's Thrush
*Boreal Owl	Warbling Vireo	

Hermit Thrush

Wood Thrush

American Robin

Varied Thrush

Gray Catbird

(Northern Mockingbird)

Brown Thrasher

*European Starling

*(Yellow Wagtail)

*American Pipit

Sprague's Pipit

***Bohemian Waxwing**

Cedar Waxwing

(Golden-winged Warbler)

Tennessee Warbler

Orange-crowned Warbler

Nashville Warbler

Northern Parula

Yellow Warbler

Chestnut-sided Warbler

Magnolia Warbler

Cape May Warbler

Black-throated Blue Warbler

Yellow-rumped Warbler

Black-throated Green Warbler

Townsend's Warbler

Blackburnian Warbler

(Pine Warbler)

Palm Warbler

Bay-breasted Warbler

Blackpoll Warbler

Black-and-white Warbler

American Redstart

Ovenbird

Northern Waterthrush

Connecticut Warbler

Mourning Warbler

MacGillivray's Warbler

Common Yellowthroat

Wilson's Warbler

Canada Warbler

(Yellow-breasted Chat)

Scarlet Tanager

Western Tanager

Spotted Towhee

(Eastern Towhee)

American Tree Sparrow

Chipping Sparrow

Clay-colored Sparrow

Brewer's Sparrow

(Field Sparrow)

Vesper Sparrow

(Lark Sparrow)

(Lark Bunting)

Savannah Sparrow

(Baird's Sparrow)

(Grasshopper Sparrow)

Le Conte's Sparrow

Nelson's Sharp-tailed

Sparrow

Fox Sparrow

Song Sparrow

Lincoln's Sparrow

Swamp Sparrow

White-throated Sparrow

Harris's Sparrow

White-crowned Sparrow

Golden-crowned Sparrow

Dark-eyed Junco

*Lapland Longspur

Smith's Longspur

(Chestnut-collared Longspur)

*Snow Bunting

Rose-breasted Grosbeak

(Black-headed Grosbeak)

(Lazuli Bunting)

(Indigo Bunting)

Bobolink

Red-winged Blackbird

Eastern Meadowlark

Western Meadowlark

Yellow-headed Blackbird

Rusty Blackbird

Brewer's Blackbird

Common Grackle

Brown-headed Cowbird

(Orchard Oriole)

Baltimore Oriole

Gray-crowned Rosy-Finch

***Pine Grosbeak**

Purple Finch

(House Finch)

*Red Crossbill

***White-winged Crossbill**

*Common Redpoll

*Hoary Redpoll

Pine Siskin

American Goldfinch

Evening Grosbeak

*House Sparrow

* An estimated 25% or more of the global population of species in bold are found in Canada's boreal forest. Asterisks indicate species that also breed in Eurasia, species in parentheses are peripheral or accidental in Canada's boreal region.

APPENDIX B: CANADA'S LANDBIRD FAMILIES AND THEIR PRESENCE IN THE BOREAL FOREST

Family	Description	Number of Boreal Species	
		Occur	Regularly Occur*
Cathartidae	Vultures	1	0
Accipitridae	Hawks & Eagles	12	11
Falconidae	Falcons	5	4
Odontophoridae	Quail	0	0
Phasianidae	Grouse & Allies	9	9
Columbidae	Pigeons & Doves	2	2
Cuculidae	Cuckoos	2	1
Tytonidae	Barn Owl	0	0
Strigidae	Owls	13	9
Caprimulgidae	Nighthawks & Nightjars	2	2
Apodidae	Swifts	3	1
Trochilidae	Hummingbirds	3	2
Alcedinidae	Kingfishers	1	1
Picidae	Woodpeckers	11	7
Tyrannidae	Flycatchers	16	13
Laniidae	Shrikes	2	2
Vireonidae	Vireos	6	5
Corvidae	Jays, Crows & Allies	8	5
Alaudidae	Larks	1	1
Hirundinidae	Swallows	7	7
Paridae	Chickadees & Allies	5	4
Aegithalidae	Bushtit	0	0
Sittidae	Nuthatches	2	2
Certhiidae	Creepers	1	1
Troglodytidae	Wrens	5	4
Cinclidae	Dippers	1	1
Regulidae	Kinglets	2	2
Sylviidae	Gnatcatchers	0	0
Turdidae	Thrushes	12	12
Mimidae	Thrashers & Allies	3	2
Sturnidae	Starlings & Mynas	1	1
Motacillidae	Wagtails & Pipits	3	2
Bombycillidae	Waxwings	2	2
Parulidae	Wood-Warblers	29	26
Thraupidae	Tanagers	2	2
Cardinalidae	Cardinals & Allies	4	1
Emberizidae	Sparrows & Allies	28	21
Icteridae	Blackbirds & Allies	11	10
Fringillidae	Finches	11	10
Passeridae	Old World Sparrows	1	1
* excludes species in parentheses in Appendix A			



Bird Studies Canada

P.O. Box 160, Port Rowan, Ontario Canada N0E 1M0

Phone: 1-888-448-BIRD

Email: generalinfo@bsc-eoc.org



Canadian Boreal Initiative

249 McLeod Street, Ottawa, Ontario, Canada K2P 1A1

Phone: (613) 230-4739

Email: info@borealcanada.ca www.borealcanada.ca



Boreal Songbird Initiative

1823 Warren Ave. N., Seattle, WA 98109

United States of America

Phone: (206) 352-8046

Email: Marilynheiman@attbi.com www.borealbirds.org