

# Population trends of woodland and scrubland birds from the Canadian Breeding Bird Survey, 1966-94

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## Abstract

Data from the North American Breeding Bird Survey (BBS) can be used to determine long-term population trends in terrestrial birds at regional, national and continental scales. In this paper, data from the Canadian Breeding Bird Survey are used to examine population trends in woodland and scrub/successional birds. Population trend estimates are calculated for Canada overall, and for each of 7 biogeographical regions over the periods 1966-94, 1966-79, 1980-94 and 1993-94. The proportion of individual species increasing or decreasing was also calculated. Long-term trends (1966-1994) for Canada indicate that woodland birds as a group are not declining, although annual indices showed high year-to-year variation. Several individual species showed long-term declines, yet 60% of the species showed increasing population trends in Canada during the period 1966-1994. There is evidence of more decreases in total woodland bird numbers after 1980. Declines in scrub/successional species were detected between 1966 and 1994 in Canada overall, and in the Atlantic Maritime and Boreal Shield regions. Trends for both woodland and scrub/successional birds vary widely among biogeographic regions. These results can be compared with trends in the United States to determine the relative status of breeding birds in Canada.

## Résumé

Les données du relevé des oiseaux nicheurs de l'Amérique du Nord (RON) peuvent être utilisées pour déterminer les tendances à long terme des populations d'oiseaux terrestres aux échelles régionale, nationale et continentale. Dans ce papier, les données du RON sont utilisées pour examiner les tendances des populations d'oiseaux forestiers et buissonniers (de forêts de succession). Les tendances sont calculées pour le Canada entier, et pour chacune des 7 régions biogéographiques pour les périodes 1966-94, 1966-79, 1980-94 et 1993-94. La proportion d'espèces avec des tendances positives ou négatives a été calculée. Les tendances à long terme (1966-94) pour le Canada indiquent que les oiseaux forestiers comme groupe ne sont pas en déclin quoique les indices annuels révèlent de fortes variations d'année en année. Quoique plusieurs espèces aient décliné depuis les années 60, 60% des espèces ont augmenté durant la même période (1966-94) au Canada. Certaines évidences indiquent un déclin pour plusieurs espèces forestières après 1980. Des déclins dans les espèces buissonnières/de succession furent détectées entre 1966 et 1994 à l'échelle du Canada de même que dans les régions des Maritimes et du bouclier boréal. Les tendances pour les espèces forestières et buissonnières variaient beaucoup entre les régions biogéographiques. Ces résultats peuvent être comparés avec les tendances aux États-Unis pour déterminer le statut relatif des espèces nichant au Canada.

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## Introduction

The North American Breeding Bird Survey (BBS) provides data on population changes in terrestrial birds at regional, national and continental scales (Peterjohn and Sauer 1994). The BBS began in 1966 in the eastern United States and maritime Canada and has since expanded throughout the United States and Canada including Alaska, Yukon and a few surveys in the Northwest Territories. For most landbirds, the BBS is the only source of long-term data on population change that extends throughout the continent. The BBS is jointly co-ordinated by the U.S. Geological Survey, Patuxent Wildlife Research Center and the National Wildlife Research Centre, Canadian Wildlife Service (CWS).

Several authors have examined trends among habitat or migratory groups and time periods for landbirds and analyses have been conducted using data from the North American Breeding Bird Survey for physiographic regions and the continent (e.g., Robbins et al. 1989; Johnston and Hagan 1992; Askins 1993; Böhning-Gaese et al. 1993; Peterjohn and Sauer 1994; Peterjohn et al. 1994, 1996; Sauer et al. 1996). These papers have generated much concern and discussion about the status of landbirds in North America and the causes of population change.

Robbins et al. (1989) examined populations of neotropical migrants in the eastern United States, many of which are woodland birds, and found more declines between 1978 and 1987 as compared with 1966-78. More recent analyses of BBS data across the continent (Peterjohn et al. 1994, 1996) indicate that although fewer species were increasing than decreasing over the course of the BBS in the Eastern and Central regions of the continent, more Neotropical migrant species increased during the 1990s than the long-term trends (1966-95) in those regions. Long-term trends (1966-95) for Neotropical migrants in the Western region of the continent showed more species increasing than decreasing (Peterjohn et al. 1996). Peterjohn et al. (1996) suggest these recent results are more positive for Neotropical migrants than the declines reported in the late 1980s (Robbins et al. 1989), but do not yet indicate a long-term reversal of these declines.

Population trends have also been examined for birds grouped by habitat type (i.e., woodland, scrubland/successional) as well as migratory habits. Sauer and Droege (1992) reported that while populations of Neotropical migrants generally increased over the long-term of the BBS survey (between 1966 and 1988), they showed declines after

1978, especially for eastern forest and central scrub/successional species. Peterjohn and Sauer (1994) found a similar increase in the proportion of decreasing woodland species between 1982 and 1991. More woodland species were increasing than decreasing over the long-term (1966-95) in the eastern and western regions of North America and across the continent (Peterjohn et al. 1996). Recent short-term trends for woodland birds during the 1990s were variable among regions (Peterjohn et al. 1994, 1996). Peterjohn et al. (1995) also examined BBS trends in woodland birds between 1966-79 and 1980-91. During the early period more woodland birds increased than decreased in the eastern North America and continent-wide analyses. In the later period, decreasing species outnumbered increasing species in the Eastern region and no other region had significantly more increasing species. In comparison to other habitat groups there was a higher proportion of woodland birds showing increasing trends than in the grassland or scrub/successional groups (Peterjohn and Sauer 1994) over 30 years of the BBS (1966 to 1995).

Long-term trends (1966-95) for scrub/successional birds showed more species decreasing than increasing in eastern and central regions of North America and across the continent as a whole. Recent short-term trends for scrubland birds in the 1990s were variable from year to year (Peterjohn et al. 1994, 1996). During the early years of the BBS (1966-79), more scrub/successional birds were increasing than decreasing in eastern and western North America and continent-wide regions. In the later years (1980-91), more species were increasing in western North America while other regions showed no significant differences (Peterjohn et al. 1995). Other authors have shown declines in various individual species of scrub/successional birds. Using data from the BBS, banding and migration counts from eastern North America, Askins (1993) reported that the majority of scrub/successional species were showing declining populations between 1960s and 1980s. Hagan (1993) showed consistent, long-term declines (8-10% per year) in eastern United States populations of Rufous-sided Towhees (see Appendix 1 for scientific names).

The causes for these changes in population trends are still uncertain but include habitat loss and fragmentation (Whitcomb et al. 1981; Askins and Philbrick 1987; Wilcove 1985; Terborgh 1989), parasitism (Brittingham and Temple 1983) and predation (Wilcove 1985; Böhning-Gaese et al. 1993). Some authors have suggested that forest birds may be

exhibiting cyclic changes in populations, rather than long-term declines (Askins 1993), that may be associated with spruce budworm outbreaks and cold winters (Hussell et al. 1992). Sauer et al. (1996) found that weather influenced populations of short-distance migrants during the mid-1970s. Declining eastern populations of shrubland birds may be responding to habitat loss through the reversion of early-successional to more forested habitat and more intensive agricultural practices that reduce old-field habitat (Askins 1993; Hagan 1993).

In this paper we use data from the Canadian BBS to examine regional and national population trends for woodland and scrubland birds between 1966 and 1994. These results for Canada and Canadian ecozones illustrate the variation in trends among regions and can be compared with United States results to determine the relative status of breeding birds in Canada.

Broad-scale monitoring of bird populations, such as the BBS, will help in the detection of environmental changes not observable at smaller geographical scales. Trends in species characteristic of particular habitats may be used to assess those habitat types. We hope such information will be useful in establishing national and regional conservation objectives for birds.

## Methods

The BBS is run each year during the peak of the breeding season. In Canada, volunteers are encouraged to carry out their surveys after 1 June (or for the boreal regions after 5 June) and before 7 July. Surveys are made along designated "routes" located on all-weather, secondary roads. The starting point and starting direction of routes are selected randomly in order to sample a range of habitats representative of the region. Participants are encouraged to run their routes for as many consecutive years as possible in order to reduce the effects of observer variability on data analysis (Collins and Wendt 1989; Sauer et al. 1994).

Routes consist of 50 stops spaced 0.8 km apart along a 39.4-km stretch of secondary roads. Participants run their route once a year starting a half hour before dawn. The total number of individual birds heard or seen within 0.4 km of each stop during a 3-minute observation period is recorded by participants. Data on starting and finishing time, and weather conditions, are also recorded. Canadian volunteers submit data forms to the National Wildlife Research Centre, Canadian Wildlife Service, where data are checked for errors, trends are analysed, and the Canadian BBS database is maintained. Canadian data

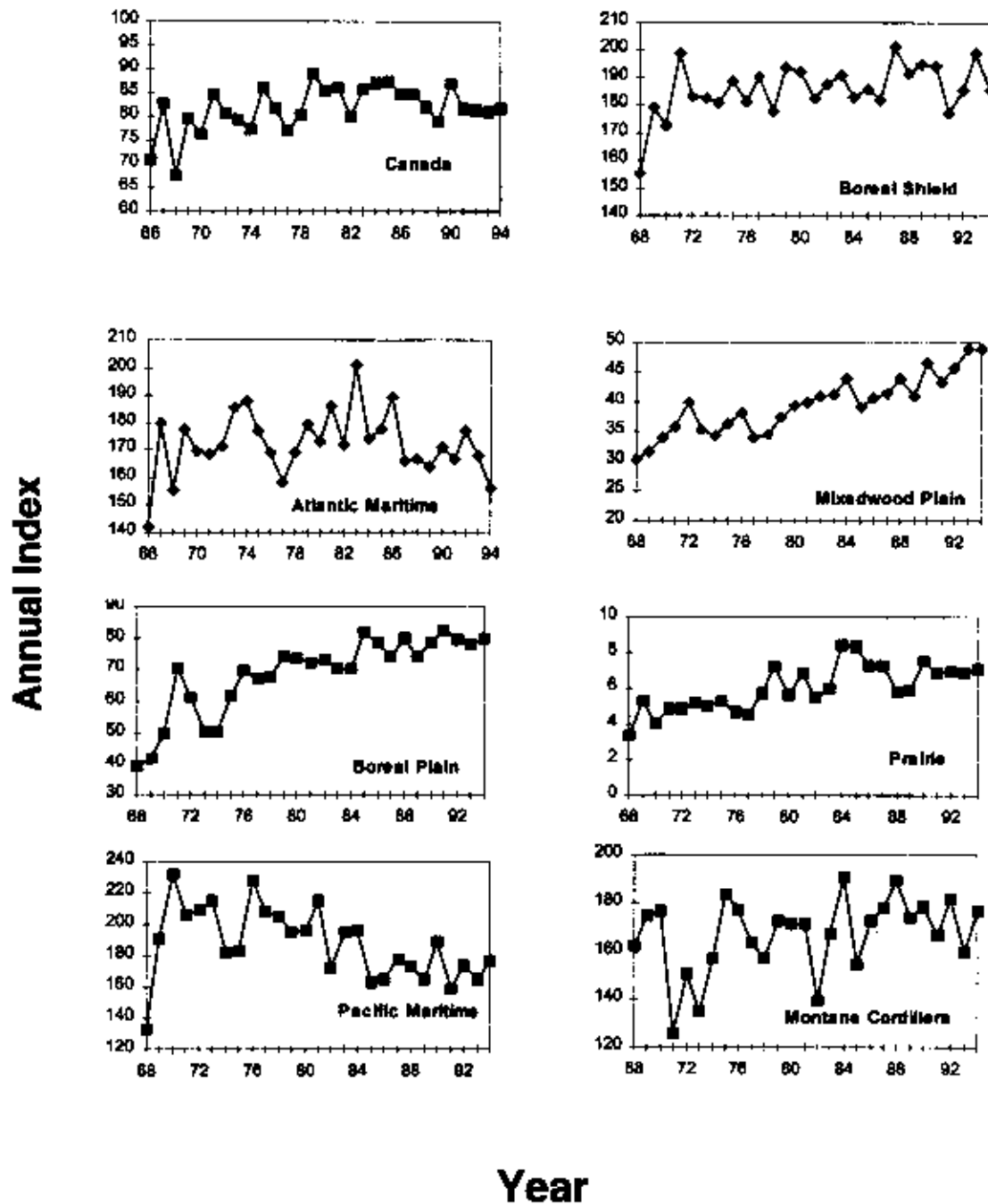
are also forwarded to the U.S. Geological Survey, Patuxent Wildlife Research Center for inclusion in the North American BBS database.

Birds were classified into two habitat groups, woodland and scrubland / successional, according to Peterjohn et al. (1994) (see Appendix 1). Group trends were estimated for species designated as forest and scrubland / successional birds using a linear route-regression method described by Geissler and Noon (1981), but with some modifications (Downes and Collins 1996). Analyses for each group were based on the total number of individuals of all birds within the two habitat groups recorded along each route.

For a more detailed description of BBS methodology and statistical analyses, see Downes and Collins (1996). Annual indices of population trend are an estimate of the mean count of individuals that would be recorded on a route if all routes were run each year under comparable conditions. Annual indices were calculated as the sum of the predicted count under average conditions and the average annual residual. These indices allow an examination of the annual variability within the long-term trend for a group. The proportion of species increasing and decreasing in each habitat type was also calculated. In contrast to the calculation for group population trends, the proportion of species increasing or decreasing was calculated using the individual species trends for all species within each habitat group. Individual species trends were estimated only for those species for which there was considered sufficient data to calculate a population trend (Downes and Collins 1996). Therefore, the number of species with individual trends used in the calculation of proportions is smaller than that used in the group analyses of population trend. Species with trend equal to zero are rare and were excluded from the analysis.

Here we calculate short- and long-term trends for seven biogeographical areas or "ecozones" (Ecological Stratification Working Group 1996): Boreal Shield, Atlantic Maritime, Mixed Wood Plain, Boreal Plain, Montane Cordillera, Pacific Maritime and Prairie, and for Canada overall (see Figure 1). Trends are reported for 4 time periods: beginning of survey to 1994, beginning of survey to 1979, 1980-94, and 1993-94. The first year of the analyses was determined by the availability of data for that ecozone. Although there are approximately 15 active BBS routes in the Boreal Cordillera, those routes were not run consistently until the early 1980s and trends are not reported for that ecozone.

Figure 1. Annual indices of woodland bird abundance in Canada.



## Results and Discussion

In 1994, 377 BBS routes were run in Canada by approximately 292 volunteers. Coverage is highest in the southern part of Canada close to areas of high human population and a good road network. In the northern parts of the provinces, the territories and Newfoundland, coverage is less regular or non-existent. In particular, in the Boreal Shield ecozone the majority of routes are located in the southern part of boreal Ontario and Quebec, and trends may therefore not reflect the entire ecozone. Coverage is also sparse in the northern section of the Pacific Maritime ecozone.

The division of trends into time periods in this paper is arbitrary and is intended to allow an examination of the persistence of trends over the entire period of the survey. The route-regression technique assumes a linear change in population (Table 1). The graphs of annual indices (Figure 1) illustrate the non-linear, year-by-year changes in direction of the trends over the survey period. When comparing trends among regions it should be noted that species composition and abundance varies (i.e., not all members of each habitat group will be present or in the same numbers in all regions). The number of species in each group in each ecozone and in Canada is listed in Table 1 (1966-1994). These sample sizes do not vary widely among regions. However, the number of individual records for each species in a particular habitat group will vary among regions and may be another source of variation in the trends.

Because there are many ways in which species can be grouped and because group analyses mask changes at the individual species level, examining population changes for species groupings should be viewed as only a first step in understanding how bird populations are changing. Although this paper does not examine individual species trends, we present the proportion of species showing increasing and decreasing population trends (Table 2) within each habitat type in Canada. We also include the group trend as an indication of whether the average annual trend estimate (Table 1) for the group is driven by a small number of species or whether it reflects the majority of species within the group. However, trends for individual species have also been calculated (Peterjohn et al. 1994; Downes and Collins 1996) and should be taken into account when assessing the need for conservation action.

## Woodland

Over the entire period of the survey (1966-94),

woodland birds as a group showed few statistically significant trends (Table 1). Only the Prairie ecozone showed a significant increase in total woodland bird numbers ( $p=0.024$ ); the Mixed Wood Plain had a positive trend approaching significance ( $p=0.061$ ). During the early part of the survey (pre-1980) increasing trends ( $p<0.05$ ) were detected in 4 ecozones and for Canada as a whole. These increases contrast with the 1980-94 period in which no significant positive trends were detected. During this latter period, 4 ecozones had negative population trends although only the Atlantic Maritime trend approached statistical significance ( $p=0.051$ ).

For the woodland group, the proportion of increasing species was significantly higher than the proportion of decreasing species in Canada overall over the period 1966-94 (Figure 1). However, the percentage of decreasing species rose from 32% nationally to 56% between 1966-79 and 1980-94. The annual indices for the woodland group in Canada overall are variable from year-to-year, but the general pattern does not indicate a large change between the 1960s and the 1990s. Annual indices for the Mixed Wood Plain, Boreal Plain and, less so, in the Prairie show increasing populations in the 1980s. The strongest pattern of decrease occurred in the Pacific Maritime from the late 1970s onwards; a less pronounced pattern of decline is indicated in the Atlantic Maritime from the mid-1980s onwards. Annual indices for the Boreal Shield were relatively stable or slightly increasing. In the Montane Cordillera the indices are highly variable, but show little change in the overall population over the course of the survey. The larger fluctuations during the first few years of the survey in many of the regions are likely attributable to small sample sizes in those years. (In 1966 and 1967, 34 and 66 routes were run, respectively, and all were located in eastern Canada as compared with the 387 routes run in 1994 and located throughout Canada in all provinces and territories.)

Our results show that, over the course of the survey, woodland birds as a group are not declining. However, there is evidence of more decreases in total woodland bird numbers after 1980. Trends for individual woodland species varied (Downes and Collins 1996). Several woodland species showed long-term declines in population throughout much of their range in Canada (e.g., Ruffed Grouse, Black-billed Cuckoo, Boreal Chickadee, Eastern Wood-Pewee, Olive-sided Flycatcher, Purple Finch) while others declined in one or more regions (e.g., Northern Flicker, Mixed Wood Plain; Pine Siskin, Pacific

**Table 1.** Summary of trends from the Canadian Breeding Bird Survey for woodland and scrubland/successional birds during 3 time periods. "ns" indicates  $p > 0.05$ . "N" indicates the number of species in each group for the 1966(68)-94 period.

Guild	Area	1966(68)-94*			1966(68)-79*		1980-94	
		Trend	P	N	Trend	P	Trend	P
<b>Woodland</b>								
	Canada	0.2	ns	103	2	0	-0.02	ns
	Boreal Shield	0.2	ns	75	1.4	ns	0	ns
	Atlantic Maritime	0	ns	68	1.8	0.016	-1.2	0.051
	Mixedwood Plain	1.4	0.061	73	0.3	ns	2	ns
	Boreal Plain	1.6	ns	81	7.6	0.01	-0.2	ns
	Prairie	1.9	0.024	52	4.9	<0.001	0.1	ns
	Pacific Maritime	-0.9	ns	61	4	0.042	-0.9	ns
	Montane Cordillera	0.3	ns	75	0.6	ns	0.3	ns
<b>Scrubland/successional</b>								
	Canada	-0.5	0.029	44	-0.4	ns	0.2	ns
	Boreal Shield	-0.7	0.067	27	-0.4	ns	-0.3	ns
	Atlantic Maritime	-1.3	0.013	21	-1.1	0.01	-1.1	ns
	Mixedwood Plain	0.3	ns	27	-2.2	0.043	0	ns
	Boreal Plain	-0.3	ns	27	0.7	ns	0.1	ns
	Prairie	0.5	0.089	25	0.5	ns	1.5	0
	Pacific Maritime	-1.1	ns	21	1.3	ns	-0.3	ns
	Montane Cordillera	1.7	0	25	0.4	ns	2.4	<0.001

\* In 1966 BBS routes were run only in the Atlantic Maritimes; by 1968 routes were run in all provinces.

**Table 2.** Proportion of species showing increasing and decreasing population trends in Canada, grouped by habitat. Proportions are listed for all species for which trends could be calculated and for those species with trends significant at  $p < 0.15$ . \* indicates a significant difference from a 50:50 ratio.

Habitat Group	Time Period	% Increasing		% Decreasing		N	
		All Trends	Significant Trends	All Trends	Significant Trends	All Trends	Significant Trends
<b>Woodland</b>							
	1966-94	59%	50%	41%	50%	66	22
	1966-79	68% *	61%	32%	29%	63	24
	1980-94	44%	29%	56%	61%	66	23
<b>Scrub/Successional</b>							
	1966-94	50%	50%	50%	50%	30	10
	1966-79	62%	66%	38%	33%	29	6
	1980-94	53%	70%	47%	30%	30	10

Maritime) (Downes and Collins 1996). Other species (e.g., Hairy Woodpecker, Black-capped Chickadee and American Robin) showed increases throughout much of their range and several species increased in one or more regions (e.g., Downy Woodpecker, Boreal Shield; Hairy Woodpecker, Boreal Plain; Least Flycatcher, Prairie).

### Scrubland/Successional

Statistically significant ( $p < 0.05$ ) declines in scrub/successional species as a group were detected between 1966 and 1994 in Canada overall and the Atlantic Maritime, while the Boreal Shield approached a significant decline ( $p = 0.067$ ) (Table 1). An increase occurred in total scrubland bird numbers in the Montane Cordillera and in the Prairie during that period. During the early part of the survey (pre-1980) only the Mixed Wood Plain and Atlantic Maritime showed statistically significant ( $p < 0.05$ ) decreases in total scrubland birds. No regions showed increasing trends during the pre-1980 period, although increasing trends were detected in both the Prairie and the Montane Cordillera ( $p < 0.05$ ) between 1980 and 1994. Over the entire survey period the scrub/successional group had equal proportions of increasing and decreasing species in Canada overall (Table 2), although the percentage of decreasing species rose between the years 1966-79 (38%) and 1980-94 (47%). Annual indices of population abundance for Canada suggest a general decline in total scrubland bird numbers that appears to taper off after the early 1990s (Figure 2). Annual indices for the Boreal Shield, Atlantic Maritime and Pacific Maritime ecozones reflect a similar decline; the Prairie and Montane Cordillera show marginal increases during the latter part of the survey. The Mixed Wood Plain and Boreal Plain are highly variable, but show a generally stable population over the course of the survey.

Similar to the forest birds, the trends for scrubland birds vary widely among ecozones. However, the general trend for Canada shows a long-term decrease that appears to be more pronounced during the early years of the survey. These results are consistent with other studies of population change (e.g., Askins 1993). Individual species showing long-term declines throughout much of their range include the Gray Catbird, Brown Thrasher, White-throated Sparrow and Song Sparrow. Other species that are increasing throughout much of their range include the Yellow Warbler and House Wren (Downes and Collins 1996).

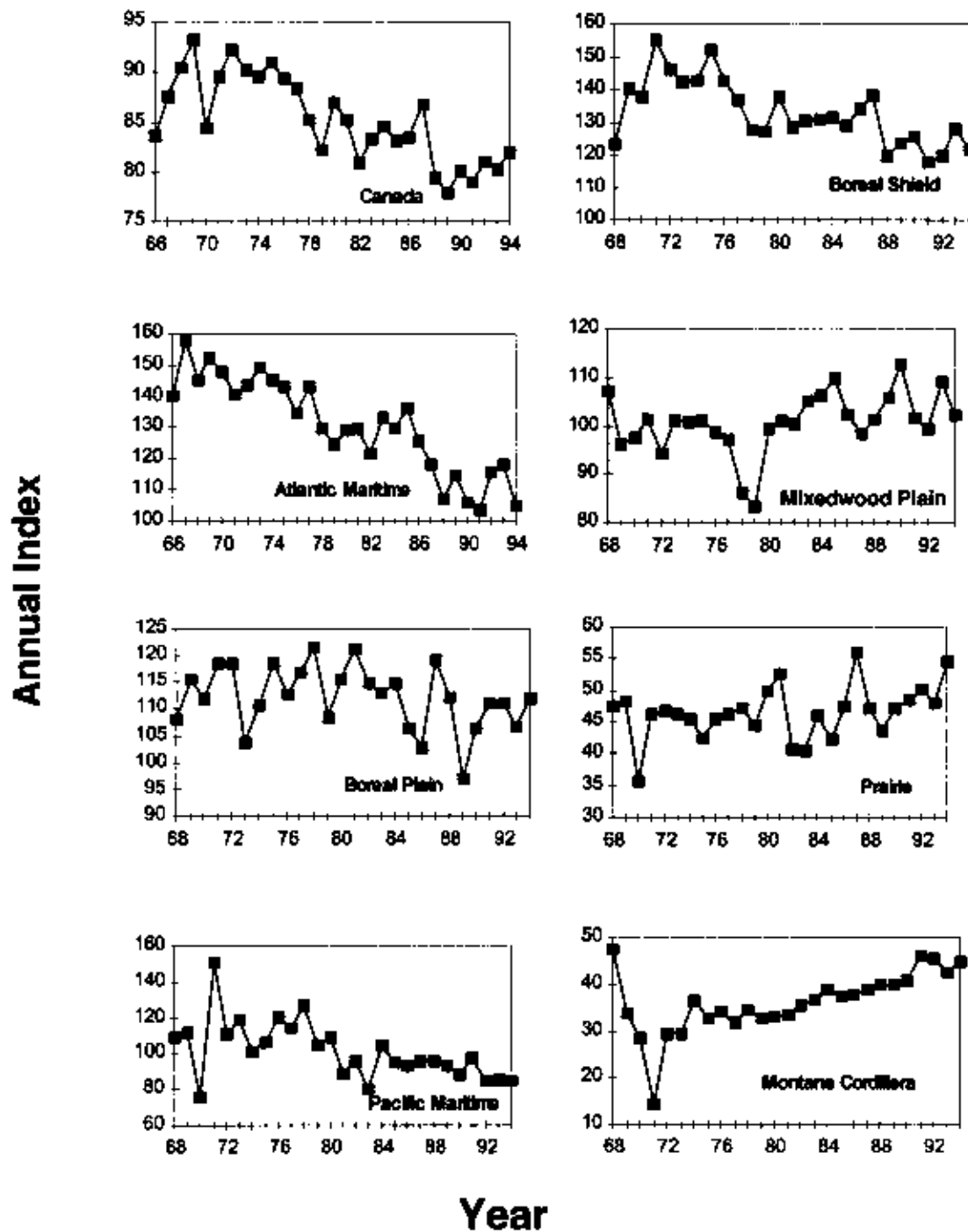
The many factors influencing bird numbers vary in type and intensity over their range, which results in

population changes that vary both regionally and temporally. However, some general patterns emerge. Woodland birds as a group showed relatively stable population trends in most ecozones and in Canada overall, and a higher number of species increased than decreased in Canada over the course of the survey. This pattern of population change is generally in agreement with similar studies in the literature (Peterjohn and Sauer 1994; Peterjohn et al. 1996). There was much variation in the trends of individual woodland species with some species showing long-term declines (Downes and Collins 1996; Peterjohn et al. 1996). Several species with long-term declines continentally (Peterjohn and Sauer 1994) also declined in Canada over the long term (e.g., Olive-sided Flycatcher, Veery, Wood Thrush, Eastern Woodpecker). The fact that these reports and our study indicate the number of negative population trends increased in the late 1980s and 1990s suggests some cause for concern. Askins (1993) emphasized that concern for woodland species is warranted in light of continued habitat fragmentation and loss.

Consistent with other studies (Peterjohn et al. 1996), our results indicate that scrubland birds are declining more rapidly than woodland birds. Losses in scrubland birds have been attributed to the loss of successional habitat as abandoned farmland matured and intensive agricultural practices diminished remnant patches of successional habitat (Askins 1993). Peterjohn et al. (1996) found greater numbers of scrubland/successional species decreasing in the east as compared to central or western North America. This pattern was evident in the population trends for the Atlantic Maritime region of Canada, but was less pronounced in the Mixed Wood Plain ecozone encompassing southern Ontario and Quebec.

Declines in both scrubland and woodland birds in our study and others were considerably less than those shown in the grassland bird group (Askins 1993; Peterjohn et al. 1996; C.M. Downes unpubl.). Since it is often difficult to distinguish actual change in bird populations from short-term fluctuations, long-term data are required that allow an examination of population patterns. The BBS is the only nation-wide long-term survey of songbirds. However, not all species and habitats are covered equally. Crepuscular, rare and secretive species are not covered or are poorly covered, as are some habitats such as marshes and high-altitude areas. Because the BBS is run along all-weather roads the large expanses of roadless areas in the boreal forest, taiga and tundra regions of Canada are not covered. The interiors of

Figure 2. Annual indices of scrubland / successional bird abundance in Canada.





large, unbroken tracts of forest or grassland in other areas may not be well covered. Despite these limitations, the BBS provides a system to monitor over 200 species in Canada and gives an early warning of those species and species groups showing signs of population change. Results from the BBS are now being used to establish regional and national priorities for conservation action and to encourage and focus research efforts in Canada (Dunn 1998).

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**Appendix 1.** Species groups used in analyses.

Common name	Scientific name	Common name	Scientific name
<b>Woodland Species</b>			
Sharp-shinned Hawk	<i>Accipiter striatus</i>	Warbling Vireo	<i>V. gilvus</i>
Cooper's Hawk	<i>A. cooperii</i>	Philadelphia Vireo	<i>V. philadelphicus</i>
Northern Goshawk	<i>A. gentilis</i>	Red-eyed Vireo	<i>V. olivaceus</i>
Red-shouldered Hawk	<i>Buteo lineatus</i>	Gray Jay	<i>Perisoreus canadensis</i>
Broad-winged Hawk	<i>B. platypterus</i>	Steller's Jay	<i>Cyanocitta stelleri</i>
Merlin	<i>Falco columbarius</i>	Clark's Nutcracker	<i>Nucifraga columbiana</i>
Ruffed Grouse	<i>Bonasa umbellus</i>	Black-capped Chickadee	<i>Parus atricapillus</i>
Spruce Grouse	<i>Falcapennis canadensis</i>	Mountain Chickadee	<i>P. gambeli</i>
Blue Grouse	<i>Dendragapus obscurus</i>	Chestnut-backed Chickadee	<i>P. rufescens</i>
Wild Turkey	<i>Meleagris gallopavo</i>	Boreal Chickadee	<i>P. hudsonicus</i>
Band-tailed Pigeon	<i>Columba fasciata</i>	Tufted Titmouse	<i>Baeolophus bicolor</i>
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>	Red-breasted Nuthatch	<i>Sitta canadensis</i>
Yellow-billed Cuckoo	<i>C. americanus</i>	White-breasted Nuthatch	<i>S. carolinensis</i>
Western Screech-Owl	<i>Otus kennicottii</i>	Pygmy Nuthatch	<i>S. pygmaea</i>
Eastern Screech-Owl	<i>O. asio</i>	Brown Creeper	<i>Certhia americana</i>
Northern Pygmy-Owl	<i>Glaucidium gnoma</i>	Winter Wren	<i>Troglodytes troglodytes</i>
Barred Owl	<i>Strix varia</i>	Golden-crowned Kinglet	<i>Regulus satrapa</i>
Long-eared Owl	<i>Asio otus</i>	Ruby-crowned Kinglet	<i>R. calendula</i>
Northern Saw-whet Owl	<i>Aegolius acadicus</i>	Blue-gray Gnatcatcher	<i>Poliophtila caerulea</i>
Whip-poor-will	<i>Caprimulgus vociferus</i>	Western Bluebird	<i>Sialia mexicana</i>
Vaux's Swift	<i>Chaetura vauxi</i>	Townsend's Solitaire	<i>Myadestes townsendi</i>
Ruby-throated Hummingbird	<i>Archilochus colubris</i>	Veery	<i>Catharus fuscescens</i>
Black-chinned Hummingbird	<i>A. alexandri</i>	Gray-cheeked Thrush	<i>C. minimus</i>
Calliope Hummingbird	<i>Stellula calliope</i>	Swainson's Thrush	<i>C. ustulatus</i>
Rufous Hummingbird	<i>Selasphorus rufus</i>	Hermit Thrush	<i>C. guttatus</i>
Red-bellied Woodpecker	<i>Melanerpes carolinus</i>	Wood Thrush	<i>Hylocichla mustelina</i>
Williamson's Sapsucker	<i>Sphyrapicus thyroideus</i>	Varied Thrush	<i>Ixoreus naevius</i>
Downy Woodpecker	<i>Picoides pubescens</i>	Bohemian Waxwing	<i>Bombycilla garrulus</i>
Hairy Woodpecker	<i>P. villosus</i>	Tennessee Warbler	<i>Vermivora peregrina</i>
Three-toed Woodpecker	<i>P. tridactylus</i>	Northern Parula	<i>Parula americana</i>
Black-backed Woodpecker	<i>P. arcticus</i>	Magnolia Warbler	<i>Dendroica magnolia</i>
Pileated Woodpecker	<i>Dryocopus pileatus</i>	Cape May Warbler	<i>D. tigrina</i>
Olive-sided Flycatcher	<i>Contopus cooperi</i>	Black-throated Blue Warbler	<i>D. caerulescens</i>
Western Wood-Pewee	<i>C. sordidulus</i>	Yellow-rumped Warbler	<i>D. coronata</i>
Eastern Wood-Pewee	<i>C. virens</i>	Black-throated Green W.	<i>D. virens</i>
Yellow-bellied Flycatcher	<i>Empidonax flaviventris</i>	Townsend's Warbler	<i>D. townsendi</i>
Acadian Flycatcher	<i>E. virescens</i>	Blackburnian Warbler	<i>D. fusca</i>
Least Flycatcher	<i>E. minimus</i>	Pine Warbler	<i>D. pinus</i>
Hammond's Flycatcher	<i>E. hammondii</i>	Bay-breasted Warbler	<i>D. castanea</i>
Dusky Flycatcher	<i>E. oberholseri</i>	Blackpoll Warbler	<i>D. striata</i>
Great Crested Flycatcher	<i>Myiarchus crinitus</i>	Cerulean Warbler	<i>D. cerulea</i>
Yellow-throated Vireo	<i>Vireo flavifrons</i>	Black-and-white Warbler	<i>Mniotilta varia</i>
Solitary Vireo	<i>V. solitarius</i>	American Redstart	<i>Setophaga ruticilla</i>
Hutton's Vireo	<i>V. huttoni</i>	Ovenbird	<i>Seiurus aurocapillus</i>

## Appendix 1 (continued)

Common name	Scientific name	Common name	Scientific name
Northern Waterthrush	<i>S. noveboracensis</i>	Black-headed Grosbeak	<i>P. melanocephalus</i>
Louisiana Waterthrush	<i>S. motacilla</i>	Pine Grosbeak	<i>Pinicola enucleator</i>
Hooded Warbler	<i>Wilsonia citrina</i>	Purple Finch	<i>Carpodacus purpureus</i>
Canada Warbler	<i>W. canadensis</i>	Cassin's Finch	<i>C. cassinii</i>
Scarlet Tanager	<i>Piranga olivacea</i>	Red Crossbill	<i>Loxia curvirostra</i>
Western Tanager	<i>P. ludoviciana</i>	White-winged Crossbill	<i>L. leucoptera</i>
Dark-eyed Junco	<i>Junco hyemalis</i>	Pine Siskin	<i>Carduelis pinus</i>
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	Evening Grosbeak	<i>Coccothraustes vespertinus</i>
<b>Scrubland/Successional Species</b>			
Sage Grouse	<i>Centrocercus urophasianus</i>	Prairie Warbler	<i>D. discolor</i>
California Quail	<i>Callipepla californica</i>	Palm Warbler	<i>D. palmarum</i>
Northern Bobwhite	<i>Colinus virginianus</i>	Connecticut Warbler	<i>Oporornis agilis</i>
American Woodcock	<i>Scolopax minor</i>	Mourning Warbler	<i>O. philadelphia</i>
Common Poorwill	<i>Phalaenoptilus nuttallii</i>	MacGillivray's Warbler	<i>O. tolmiei</i>
Gray Flycatcher	<i>Empidonax wrightii</i>	Common Yellowthroat	<i>Geothlypis trichas</i>
White-eyed Vireo	<i>Vireo griseus</i>	Wilson's Warbler	<i>Wilsonia pusilla</i>
Bushtit	<i>Psaltriparus minimus</i>	Yellow-breasted Chat	<i>Icteria virens</i>
Carolina Wren	<i>Thryothorus ludovicianus</i>	Rufous-sided Towhee	<i>Pipilo erythrophthalmus</i>
Bewick's Wren	<i>Thryomanes bewickii</i>	Clay-colored Sparrow	<i>Spizella pallida</i>
House Wren	<i>Troglodytes aedon</i>	Brewer's Sparrow	<i>S. breweri</i>
Gray Catbird	<i>Dumetella carolinensis</i>	Field Sparrow	<i>S. pusilla</i>
Sage Thrasher	<i>Oreoscoptes montanus</i>	Lark Sparrow	<i>Chondestes grammacus</i>
Brown Thrasher	<i>Toxostoma rufum</i>	Fox Sparrow	<i>Passerella iliaca</i>
Blue-winged Warbler	<i>Vermivora pinus</i>	Song Sparrow	<i>Melospiza melodia</i>
Golden-winged Warbler	<i>V. chrysoptera</i>	Lincoln's Sparrow	<i>M. lincolnii</i>
Orange-crowned Warbler	<i>V. celata</i>	White-throated Sparrow	<i>Zonotrichia albicollis</i>
Nashville Warbler	<i>V. ruficapilla</i>	White-crowned Sparrow	<i>Z. leucophrys</i>
Yellow Warbler	<i>Dendroica petechia</i>	Golden-crowned Sparrow	<i>Z. atricapilla</i>
Chestnut-sided Warbler	<i>D. pensylvanica</i>	Northern Cardinal	<i>Cardinalis cardinalis</i>
Black-throated Gray Warbler	<i>D. nigrescens</i>	Lazuli Bunting	<i>Passerina amoena</i>
		Indigo Bunting	<i>P. cyanea</i>
		American Goldfinch	<i>Carduelis tristis</i>