

A Long-term Survey of the Breeding Birds of the Cedarburg Bog and Cedarburg Beech Woods State Natural Areas

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ABSTRACT

We report here on a long-term survey of the breeding birds of the Cedarburg Bog and Cedarburg Beech Woods State Natural Areas, located in southeastern Wisconsin. The Cedarburg Bog is a large, diverse wetland containing southern outliers of northern vegetation types, while the Cedarburg Beech Woods is a mature beech-maple upland forest. Notable species

found included the state-threatened Acadian Flycatcher which bred in the Beech Woods and showed a 16.6% annual increase in abundance over the study period. The data suggested that birds with southern distributions were more likely than northern birds to show increases in numbers over time; recent climate warming could explain this result. Populations of long-distance migrants significantly increased over time in the Beech Woods, while

*Authors' note: This paper is a posthumous contribution by Charles Weise, who conceived the study and collected all of the data. The co-authors on this paper worked from Dr. Weise's data summaries to analyze and interpret the data.

short-distance migrants declined in both sites.

INTRODUCTION

Long-term records of bird populations are important to detect both natural and human-induced changes. Bird populations may fluctuate in response to changes in weather or food availability, and are increasingly affected by habitat destruction, habitat fragmentation, and climate changes. Birds that migrate long distances may be especially vulnerable to habitat loss, and several studies have raised concerns about population trends in long-distance migrants (Robbins et al. 1989, Maurer and Villard 1996). A new threat, the recently introduced West Nile virus, has the potential to affect many bird species (Friend et al. 2001). Historical long-term records from protected sites are valuable, as they can help to establish baselines to which current observations can be compared. Detailed datasets from individual sites can also complement nationwide efforts to monitor bird populations, such as the North American Breeding Bird Survey (USGS 2003).

We report here on a long-term survey of the breeding birds of the forested portions of the Cedarburg Bog and adjacent Cedarburg Beech Woods. These sites are both high-quality state natural areas located about 25 miles north of Milwaukee in Ozaukee County (Saukville Township). The Cedarburg Bog is one of the largest, most intact, and biologically interesting wetlands remaining in southeastern Wisconsin. A variety of vegetation types occur within its 810 hectares, including large expanses of conifer

swamp forest dominated by northern white cedar (*Thuja occidentalis*) and tamarack (*Larix laricina*), hardwood swamp forest, shrub carrs, and marshes. Its most unusual feature is the presence of a string or "patterned" bog, which consists of ridges of stunted cedars and tamaracks alternating with flatter, wetter areas dominated by sedges. String bogs are typically found in boreal regions, and the Cedarburg Bog represents an extreme southern outlier for this vegetation type (Grittinger 1970). The Cedarburg Beech Woods consists of approximately 24 hectares of upland hardwood forest, dominated by American beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), white ash (*Fraxinus americana*), and basswood (*Tilia americana*). An adjacent 8 hectare parcel with similar vegetation is owned by The Nature Conservancy.

Both sites are currently relatively undisturbed and have a history of protection. State acquisition of the Cedarburg Bog began in 1946 with a 210 hectare purchase, and it is currently owned primarily by the DNR and the University of Wisconsin, with some private inholdings. Although the Cedarburg Bog is mostly state-owned, it does not receive much public use because access into the wetland is difficult and the interior of the bog is rarely visited. The Cedarburg Beech Woods was acquired by the University of Wisconsin in 1964. The Beech Woods had been selectively logged prior to its acquisition by the university; in some areas the impact of logging was minimal while other areas were cut more heavily (Dunnum 1972). The Cedarburg Beech Woods is not open to the public; access is controlled by the UWM

Field Station which manages the site to minimize impacts on the natural area. The area surrounding both sites is currently primarily agricultural, but this area will likely come under increasing development pressure in the future because of its proximity to Milwaukee.

Annual surveys of breeding birds were carried out from 1971–1996 in the Cedarburg Bog and from 1974–1996 (except for 1976 and 1980) in the Cedarburg Beech Woods by a single observer (C. M. Weise). Surveys were done away from roads, in the interior of each natural area. Surveys spanning this length of time, done away from roads by one observer, are unusual, particularly for a habitat like the Cedarburg Bog. A few similar studies have been conducted in upland, forested habitats (for example, Johnston and Hagan 1992, Holmes and Sherry 2001, and references therein). We are unaware of any other long-term studies in a wetland habitat with northern vegetation types occurring far to the south of their normal range.

METHODS

Breeding Bird Surveys in the Bog and Upland Woods¹

Breeding birds were censused using point counts. At a series of sampling points, all birds detected within about 300 feet of the point during a 5-minute period were recorded. Birds were detected by song, call, or sighting and were recorded in terms of

probable pairs. Each singing bird was considered to represent a pair, as was a male and female bird together, or a visual record of a non-singing bird provided it was far separated from others of its species. Counts were conducted between May 13 and July 13, although the vast majority of counts occurred from May 26 to July 8. The counts were not corrected for detectability of different bird species and therefore represent relative abundance of each species over time and not absolute population estimates.

Three habitat types were surveyed in the Cedarburg Bog: bog conifer forest, dead bog conifer forest, and string bog. Bog conifer forest was closed canopy forest dominated by tall tamarack and cedar, dead bog conifer forest was areas of shrubs and thickets where the bog forest had died, and string bog was areas where open meadows of sedge and other herbaceous plants were interlaced with rows or strings of low stunted tamaracks and cedars (see Weise 1973 for further description). Point counts for these three habitats were summed in the analyses presented here. The number of points sampled per year ranged from 9 to 58 in the Cedarburg Bog (with a mean of 37) and from 8 to 23 in the Cedarburg Beech Woods (mean of 15). A different set of points was used in each year, with points chosen as randomly as possible, given the difficulties of moving around in the bog.

Each bird species was categorized as either a permanent resident of the study area, a short-distance migrant, intermediate migrant, or a long-distance migrant (AOU 1998). Permanent residents were considered to be

¹Methods were reconstructed from Weise (1973) and Weise's data notes.

species in which all or most individuals are non-migratory, while short-distance migrants were those whose wintering ranges are within the United States or northern Mexico, and long-distance migrants were those whose wintering ranges are in southern Mexico, Central or South America or the Greater and Lesser Antilles. Intermediate migrants were species that could not be cleanly assigned as either long or short-distance migrants.

Data analysis

The analyses presented here were restricted to breeding birds that were reliably censused by these methods and that were reasonably abundant over the study period. We included only species that occurred in 5 or more years of the study in either the bog or the beech woods, and those whose maximum abundance was greater than 1.5 pairs per 40 ha. Because it can be difficult to separate Alder and Willow flycatchers (*Empidonax alnorum* and *E. traillii*) in the field, the counts for these two species were combined for analysis. The number of breeding pairs per point was converted to the number of pairs per 40 ha.

Analysis of trends over time followed methods presented by Holmes and Sherry (1988, 2001). A simple linear regression was calculated using the following model: $\ln(\text{count} + 0.05) = \text{year}(\ln B) + \ln A$, where \ln is the natural logarithm, count equals the number of pairs of a given species per 40 ha, 0.5 is an arbitrary constant added because $\ln(0)$ is undefined, year ranges from 1–26 depending on the year of the census, $\ln B$ represents the slope of the line describing

change over time, and $\ln A$ equals the intercept of the line. To convert the slope of the line back from \ln -transformed units, trends were calculated from the following formula:

$$\text{trend} = e^{(\ln B - 0.5 \text{ variance})}$$

where variance equals the square of the standard error of the slope. Percent annual changes were then calculated from the trends as follows: percent change = $(\text{trend} - 1) * 100$.

Wisconsin Breeding Bird Surveys

We examined data from the North American Breeding Bird Survey to determine whether trends observed at our study sites matched patterns seen for a larger region. We used data for Wisconsin for the period 1966–2000 (Sauer et al. 2001). The North American Breeding Bird survey is conducted by volunteer birdwatchers along permanent survey routes. Routes consist of a 24.5 mile long stretch of roads, with fifty stops located at 0.5 mile intervals along the route. During the breeding season, the route is driven and point counts are taken at each stop. All birds detected within 0.25 miles of the point are counted for 3 minutes (Sauer et al. 1997). These methods are very similar to those used in the present study, with the exception that our surveys used a 5-minute count rather than a 3-minute count and were conducted away from roads in the interior of each site. Trends are expressed in percent annual change, so they are directly comparable to the trends that we calculated.

RESULTS AND DISCUSSION

A total of 45 species occurred on the study area in at least 5 years and were abundant enough for analysis (Table 1). Of these, 17 species were restricted to the bog, 14 species were found in the upland woods, and 14 occurred in both areas. Notable species found included the state-threatened (WDNR 2002) Acadian Flycatcher (*Empidonax vireescens*) and Cerulean Warbler (*Dendroica cerulea*) in the Cedarburg Beech Woods. The Acadian Flycatcher showed a remarkable 16.6% annual increase in abundance over the survey period (Fig. 1A); no statewide data are available for comparison. The Acadian Flycatcher is still present in the upland woods: it was detected on additional breeding bird surveys carried out in 1999, 2000, and 2001 by several observers. The Cerulean Warbler was a sporadic but regular breeder in the upland woods (Fig. 1B), where it showed no significant changes in abundance over time. On a state-wide basis, however, this species has been in decline (Table 1). The Cerulean Warbler was not detected in the 1999-2001 surveys. One other state-threatened species, the Hooded Warbler (*Wilsonia citrina*), was found on rare occasions in the

Cedarburg Beech Woods: it was recorded in 1982 and 1983, and then again in 1999. This species was too infrequent for any analyses of trends over time. The presence of these threatened species in the Cedarburg Beech Woods demonstrates the importance of this state natural area for birds. Mature beech-maple forest is a vegetation type that is increasingly hard to find in southeastern Wisconsin.

The breeding bird fauna of the Cedarburg Bog had a distinctly northern flavor and included such boreal species as the Brown Creeper (*Certhia americana*), Northern Waterthrush (*Seiurus noveboracensis*), Mourning Warbler (*Oporornis philadelphia*), and White-throated Sparrow (*Zonotrichia albicollis*). The Nashville Warbler (*Vermivora ruficapilla*) and Canada Warbler (*Wilsonia canadensis*), species of the coniferous-deciduous transitional forests, were also regular breeders (Fig. 2). The breeding populations in the bog are at the southern range limits for these northern species (Idzikowski 1982). This pattern of northern species reaching the southern limits of their range at the Cedarburg Bog also applies to plants and to mammals. Over 50 plant species are at or near their southernmost range

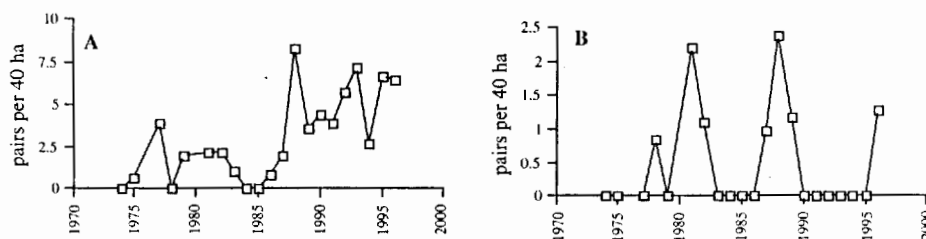


Figure 1. Trends over time for state-threatened species in the upland woods. A. Acadian Flycatcher, B. Cerulean Warbler.

Table 1. Mean abundance and trends over time for breeding bird species in the Cedarburg Bog and Cedarburg Beech Woods (upland). Abundance given in number of pairs per 40 ha. Migratory status: P = permanent resident, S = short-distance migrant, I = intermediate migrant, L = long-distance migrant. Stars indicate significance of trend: * = $p < 0.05$, ** = $p < .01$, *** = $p < 0.001$.

Bird Species	Migratory Status	Bog Mean \pm SD	Upland Mean \pm SD	% Change		
				Bog	Upland	Wisconsin
Mourning Dove (<i>Zenaida macroura</i>)	P	2.11 \pm 1.09		+1.26		+1.1
Black-billed Cuckoo (<i>Coccyzus erythrophthalmus</i>)	L	0.39 \pm 0.50	0.31 \pm 0.59	-1.04	-2.99	+2.7**
Yellow-billed Cuckoo (<i>Coccyzus americanus</i>)	L		0.41 \pm 0.73		-5.51	+3.8*
Red-headed Woodpecker (<i>Melanerpes erythrocephalus</i>)	S		0.45 \pm 0.93		-15.42***	-4.8***
Red-bellied Woodpecker (<i>Melanerpes carolinus</i>)	P		2.31 \pm 1.86		+18.93***	+5.1***
Downy Woodpecker (<i>Picoides pubescens</i>)	P	0.94 \pm 0.70	3.34 \pm 1.67	-5.44	+0.16	+0.8
Hairy Woodpecker (<i>Picoides villosus</i>)	P	1.12 \pm 0.57	1.79 \pm 1.22	-1.55	+10.21*	+1.1
Northern Flicker (<i>Colaptes auratus</i>)	S	0.96 \pm 0.68	1.74 \pm 1.59	-2.36	-7.14	n/a
Eastern Wood-Pewee (<i>Contopus virens</i>)	L	0.52 \pm 0.47	10.61 \pm 2.51	-0.32	+0.90	-0.3
Acadian Flycatcher (<i>Empidonax virens</i>)	L		3.02 \pm 2.60		+16.6**	n/a
Alder&Willow Flycatcher (<i>Empidonax alnorum</i> & <i>E. traillii</i>)	I	2.98 \pm 1.94		+5.20**		+2.5**
Least Flycatcher (<i>Empidonax minimus</i>)	L		0.56 \pm 0.90		-10.11	-2.4***
Great Crested Flycatcher (<i>Myiarchus cinerascens</i>)	L	3.40 \pm 1.28	4.61 \pm 2.34	-0.01	-0.94	-0.2
Yellow-throated Vireo (<i>Vireo flavifrons</i>)	L		0.38 \pm 0.81		+6.99	+3.1*
Red-eyed Vireo (<i>Vireo olivaceus</i>)	L		22.82 \pm 6.50		+3.55*	+2.2***
Blue Jay (<i>Cyanocitta cristata</i>)	S	5.56 \pm 2.02	3.26 \pm 1.70	-1.89*	+3.03	-0.1
Black-capped Chickadee (<i>Parus atricapillus</i>)	P	10.10 \pm 3.04	5.36 \pm 1.71	-1.79*	-0.71	+2***
White-breasted Nuthatch (<i>Sitta carolinensis</i>)	P		3.07 \pm 2.05		-0.71	+0.5
Brown Creeper (<i>Certhia americana</i>)	S	1.01 \pm 0.83		-1.22		+4.9
House Wren (<i>Troglodytes aedon</i>)	S	3.80 \pm 1.80	1.92 \pm 2.02	-5.06	-17.16**	+1.0***
Blue-gray Gnatcatcher (<i>Poliopitila caerulea</i>)	I	0.20 \pm 0.48	0.63 \pm 0.76	+2.43	+16.65**	+9.2***
Veery (<i>Catharus fuscescens</i>)	L	6.40 \pm 2.02		-1.69		-2.4***
Wood Thrush (<i>Hylocichla mustelina</i>)	I		4.49 \pm 2.23		-2.69	+0.1
American Robin (<i>Turdus migratorius</i>)	S	1.81 \pm 1.27	1.03 \pm 1.36	+4.18	+4.25	+0.6***
Gray Catbird (<i>Dumetella carolinensis</i>)	I	1.82 \pm 1.65	0.87 \pm 1.40	-4.79	-19.25***	-0.1
European Starling (<i>Sturnus vulgaris</i>)	P		3.22 \pm 2.80		-1.54	-1.4***
Blue-winged Warbler (<i>Vermivora pinus</i>)	L	0.32 \pm 0.71		-2.69		-2.2
Nashville Warbler (<i>Vermivora ruficapilla</i>)	I	4.45 \pm 2.49		-1.22		+1.7*
Yellow Warbler (<i>Dendroica petechia</i>)	I	0.97 \pm 0.86		-1.97		+0.9
Cerulean Warbler (<i>Dendroica cerulea</i>)	L		0.47 \pm 0.76		+0.40	-10.1*
Black-and-white Warbler (<i>Mniotilta varia</i>)	I	2.03 \pm 1.48		-7.51*		+0.4
Ovenbird (<i>Seiurus aurocapilla</i>)	I		17.44 \pm 5.51		+1.09	+0.9***
Northern Waterthrush (<i>Seiurus noveboracensis</i>)	I	4.73 \pm 1.86		-0.32		-0.6
Mourning Warbler (<i>Oporornis philadelphia</i>)	L	0.34 \pm 0.44		-5.55		+3.1***
Common Yellowthroat (<i>Geothlypis trichas</i>)	I	13.40 \pm 3.40		+1.61*		+0.4*
Canada Warbler (<i>Wilsonia canadensis</i>)	L	2.67 \pm 1.30		+4.38**		+0.6
Scarlet Tanager (<i>Piranga olivacea</i>)	L		3.60 \pm 2.10		+2.70	+1.1*
Eastern Towhee (<i>Pipilo erythrophthalmus</i>)	S	0.44 \pm 0.69		-9.71**		-1.7
Song Sparrow (<i>Melospiza melodia</i>)	S	6.56 \pm 2.38		-0.82		+0.2
Swamp Sparrow (<i>Melospiza georgiana</i>)	S	7.57 \pm 2.66		-1.00		+1.2
White-throated Sparrow (<i>Zonotrichia albicollis</i>)	S	12.57 \pm 4.62		-1.60		+0.2
Northern Cardinal (<i>Cardinalis cardinalis</i>)	P	2.66 \pm 1.50	2.74 \pm 1.50	+6.71***	+3.35	+3.0***
Rose-breasted Grosbeak (<i>Pheucticus ludovicianus</i>)	L	2.39 \pm 2.29	0.67 \pm 0.66	-9.5**	-5.25	+0.2
Indigo Bunting (<i>Passerina cyanea</i>)	I		1.16 \pm 1.70		-11.55	-0.3
Red-winged Blackbird (<i>Agelaius phoeniceus</i>)	S	1.40 \pm 1.57		-1.76		-0.8
Long Distance Migrants		19.78 \pm 4.57	47.93 \pm 8.79	-0.90	+1.92**	
Short Distance Migrants		41.69 \pm 9.04	8.71 \pm 4.00	-1.39**	-5.46***	
Intermediate Migrants		28.07 \pm 6.01	24.99 \pm 5.06	-0.30	-0.90	
Permanent Residents		17.00 \pm 3.53	21.83 \pm 6.28	-0.50	+1.40	
All Species		106.56 \pm 17.38	103.46 \pm 12.85	-0.90*	+0.50	

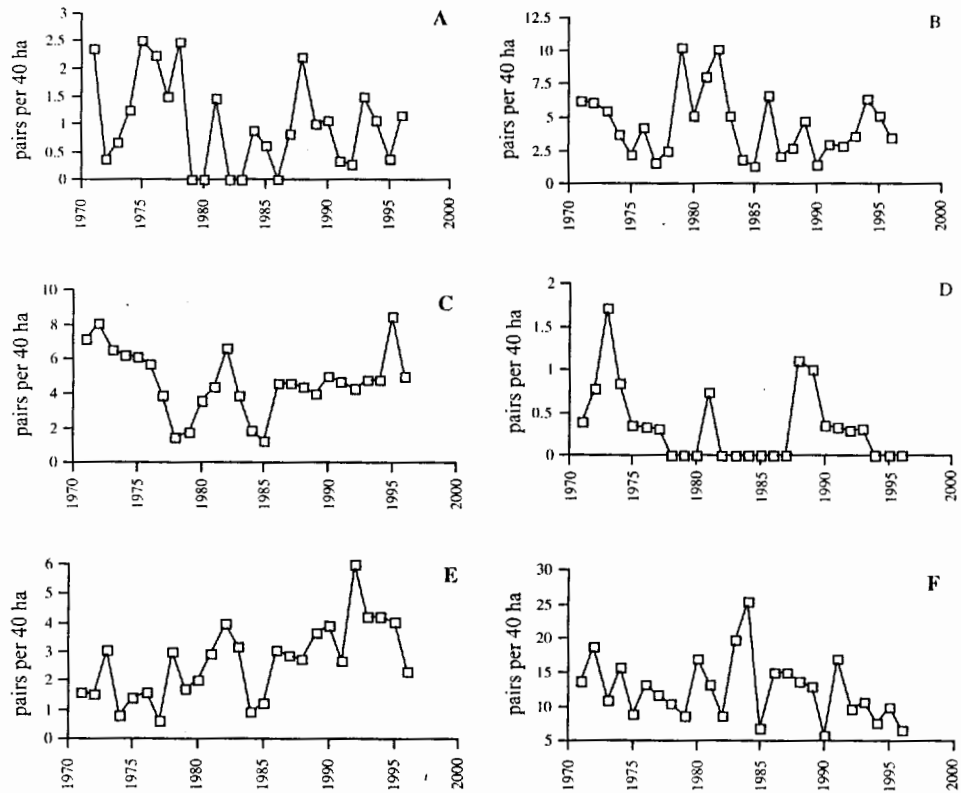


Figure 2. Trends over time for northern species breeding at the southern edge of their range in the Cedarburg Bog. A. Brown Creeper, B. Nashville Warbler, C. Northern Waterthrush, D. Mourning Warbler, E. Canada Warbler, F. White-throated Sparrow.

limit in the bog (Reinartz and Reinartz 1981, 1982), and populations of the red-backed vole (*Clethrionomys gapperi*), a boreal species that prefers coniferous forest (Kurta 1995), also are found in the bog. The Cedarburg Bog lies within the "tension zone" described by Curtis (1959), a zone where many northern and southern species reach their range boundaries and there is a high degree of mixing. In addition, the string bog in the Cedarburg Bog is typical of boreal regions and is not generally found so far south. The closest known string bog to

the Cedarburg Bog occurs almost 200 miles north near Seney, in the Upper Peninsula of Michigan, and even there string bogs are not common (Heinselman 1965, Grittinger 1970). The presence of northern vegetation and the large area of the bog make it a suitable breeding site for the boreal and transitional-forest birds, probably one of the southern-most in the state for these species (Idzikowski 1982).

Northern species breeding at the southern edge of their range might be expected to be particularly sensitive to warming climates. There is abundant

evidence that the earth is becoming warmer and that these changes are affecting plants and animals (McCarty 2001, Karl and Trenberth 2003). For example, long-term phenological records from Sauk County, WI (1936-1998) show that spring flowering is starting earlier and that some migratory birds are arriving sooner (Bradley et al. 1999). The boreal and transitional-forest birds surveyed in the Cedarburg Bog held their own over the study period. They generally showed small but non-significant declines in abundance over time, with the exception of the Canada Warbler which significantly increased over the study period (Table 1, Fig. 2E). This result is encouraging, and suggests that the unique boreal character of the bog is not yet strongly affected by warming temperatures. Recent work in Great Britain suggests that current warming trends are allowing southern species to extend their ranges north, but there was no evidence that northern species were retreating north from their southern range limits (Thomas and Lennon 1999). It remains to be seen what effects climate change will have on northern species at their southern range limits as warming continues.

Population trends for species with primarily southern distributions were also examined. Idzikowski (1982) lists several southern species that were considered to be marginal or localized summer residents at the Cedarburg Bog or Beech Woods at the time of his publication, although none of these were at the extreme edge of their range. These species, the Red-bellied Woodpecker (*Melanerpes carolinus*), Acadian Flycatcher, Blue-gray Gnatcatcher (*Poliophtila caerulea*), Yellow-

throated Vireo (*Vireo flavifrons*), and Blue-winged Warbler (*Vermivora pinus*), generally showed increases over time for both this survey and statewide (Table 1, Fig. 3, Fig. 1A for Acadian Flycatcher). The only exception was the Blue-winged Warbler, which declined somewhat in both the bog and statewide. The trend of increasing abundance is particularly striking for the Red-bellied Woodpecker. Idzikowski (1982) notes that one or two pairs were known to breed in the the Cedarburg Beech Woods since 1960, but the survey data presented here show a dramatic increase after the mid 1980s. The Yellowthroated Vireo was listed by Idzikowski (1982) as irregular. It was found for the first time on the survey reported here in 1986, and occurred sporadically after that. It was recorded again in the Beech Woods in 2000. Idzikowski (1982) noted that the Blue-gray Gnatcatcher "should be watched for in the upland woods"; it was recorded there on the survey reported here in 1982 and after then was commonly found, and was first detected in the bog a few years earlier.

These trends support the idea that climate warming has benefited more southern birds (e.g., Thomas and Lennon 1999). However, other factors have certainly influenced population trends for these birds. For example, southeastern Wisconsin experienced a severe ice storm in March 1976, near the start of the survey period. Up to five inches of glaze was formed on tree limbs and wires in some areas, and approximately 35% of the canopy was lost in the Cedarburg Beech Woods (Bruederle and Stearns 1985). The ice storm must have affected the birds. For example, Acadian flycatch-

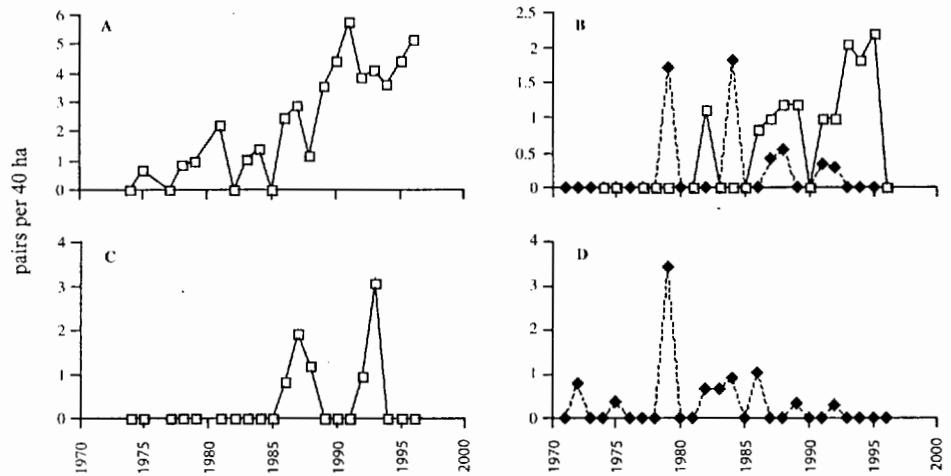


Figure 3. Trends over time for southern species in the Beech Woods (—□—), and the Bog (---◆---). A. Red-bellied Woodpecker, B. Blue-gray Gnatcatcher, C. Yellow-throated Vireo, D. Blue-winged Warbler.

ers had been regular breeders in the Beech Woods before the storm, but were noted to breed more erratically afterward (Reinartz 1986). Since the surveys in the Beech Woods presented here began in 1974, there is not much of a record of population sizes prior to the storm, and some part of the increase observed for this species could be recovery following the storm. Red-bellied woodpeckers may have benefited from the large volumes of dead wood that the ice storm created.

One species, the Red-headed Woodpecker (*Melanerpes erythrocephalus*), was lost from the Cedarburg Beech Woods over the period of the survey (Fig. 4). The Red-headed Woodpecker was recorded in 5 of the 7 years surveyed before 1983 and reached a maximum abundance of more than 3 pairs/40 ha in 1975 (Fig. 4). The data reported here represent relative abundances only, as they are

not corrected for detectability. Gustafson (1976), using two methods that allow for absolute population estimates, found that there were 7–13 birds/40 ha in 1972 and 6–10 birds/40 ha in 1973. The Red-headed Woodpecker was not recorded after 1982. This pattern matches a statewide trend of decline for this species (Mueller 2002), and it is currently listed as a species of special concern in Wisconsin (WDNR 2002). The reasons behind declining populations of Red-headed Woodpeckers in Wiscon-

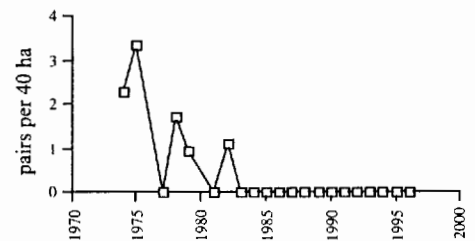


Figure 4. the decline and loss of the Red-headed Woodpecker in the Beech Woods.

sin are not fully understood. Competition with other cavity-nesting birds, such as starlings, has been suggested as a reason for Red-headed Woodpecker declines (Mueller 2002), although some recent studies do not support this idea (Smith et al. 2000). Starlings do nest in the Cedarburg Beech Woods but their populations did not show any strong changes over time (Table 1). While another potential competitor, the Red-bellied Woodpecker, did increase dramatically over the study period, it is not generally believed that competition with Red-bellied Woodpeckers can explain Red-headed Woodpecker declines (Mueller 2002). It is more likely that Red-bellied Woodpeckers simply responded to the decreases in Red-headed Woodpeckers, instead of being a causal factor. Other factors that may be important include habitat loss, collisions with automobiles, and changes in populations of elms (Mueller 2002).

Population trends were also examined for species grouped by migratory status, and for all species found in each site (Table 1). There was no evidence for concern over population trends in long-distance migrants: numbers of long-distance migrants actually showed a significant increase over time in the Beech Woods, while a declining trend in the Cedarburg Bog was small and non-significant. In contrast, short-distance migrants showed significant declines in both habitats. The reasons behind these population changes for short-distance migrants are not clear. Trends for both intermediate migrants and permanent residents were generally small and non-significant. The total number of birds for all species grouped together held

steady over time in the Beech Woods, but declined slightly in the bog (Table 1).

The results of this study demonstrate the importance of both the Cedarburg Bog and Cedarburg Beech Woods as significant state natural areas. The Cedarburg Bog is particularly valuable for its ability to support northern birds breeding at their southern range limits, while the Cedarburg Beech Woods offers habitat for birds dependent on mature forest and supports several state-threatened species. The long-term data presented here both reveal trends over time for many of the breeding birds of these two sites, as well as preserve a record of population sizes and trends for the period surveyed. This information will be important for monitoring these bird populations into the future, as the surrounding area develops and climate changes continue.

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