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Breeding birds of the forested portions of Cedarburg Bog

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BREEDING BIRDS OF THE FORESTED PORTIONS OF CEDARBURG BOG

In 1971 the Wisconsin Scientific Areas Preservation Council inaugurated a program of annual breeding bird surveys in the various state scientific areas, carried out by members of the Wisconsin Society for Ornithology and coordinated by Mrs. Evelyn Warner. The object is to provide documented quantitative data for assessment of bird population trends, specifically as an index to possible environmental deterioration.

The upland deciduous (maple-beech) woods at the UW–M Field Station and a large part of the adjacent Cedarburg Bog are included in the scientific areas system, destined for preservation with minimal management for scientific research and education. As part of the program mentioned above I conducted breeding bird surveys in the bog in 1971, 1972 and 1973 and in the upland woods in 1971, while Dennis Gustafson conducted surveys in the upland woods in 1972 and 1973.

VEGETATION TYPES CENSUSED

The vegetation and phytosociology of the upland deciduous forest have been described by Dunnum (1972). It consists of fairly mature hardwood forest (Southern Mesic Forest according to the nomenclature of Curtis, 1959) dominated by sugar maple (*Acer saccharum*) and beech (*Fagus grandifolia*), lying on a ridge with fairly rough kettle moraine topography. The entire patch of forest covers over 100 acres; the censused area was the 50-52 acres on UW–M Field Station property. One side of the study area was bordered by field, old-field thickets and swamp hardwood forest. Some birds of these areas extended their territories into the forest and were included in the upland forest census.

The vegetation of Cedarburg Bog is extremely complex due to the large size, irregular shape and uneven depth of the bog basin. Grittinger (1969) described the vegetation as a successional continuum grading from open water of the bog lakes through sedge marsh, bog shrub, tamarack-cedar forest, to swamp hardwood forest near the periphery of the basin and upland hardwood forest in the adjacent areas. In addition, and not fitting directly into this successional sequence, a large central portion of the basin is occupied by string bog, a unique community not found in other Wisconsin bogs.

Much of the bog is very difficult of access during the summer and not all vegetation types were included in the bird census. Three of the more extensive types were censused as follows:

1) Bog Conifer Forest (Northern Wet Forest of Curtis, 1959). This consists of closed canopy forest dominated by tall tamaracks (*Larix laricina*) and white cedar (*Thuja occidentalis*). White birch (*Betula papyrifera*), yellow birch (*B. lutea*) and poison sumac (*Rhus vernix*) are also abundant along with varying proportions of black ash (*Fraxinus nigra*), red maple (*Acer rubrum*) and elm (*Ulmus americana*) as the forest grades toward swamp hardwood. This forest has frequently been disturbed by selective tree-cutting and recently by the death of elms from Dutch elm disease, resulting in a patchwork of younger and more mature areas.

2) Dead Bog Conifer Forest. For reasons that are not clear some large areas of former bog forest have been killed and are occupied by a dense tangle of standing and fallen dead tree stubs and shrubby growth. The present vegetation is not uniform. In some areas the disturbance was sufficient to set the succession back to a very early stage of sedges and cattails; in other places willows (*Salix spp.*), dogwood (*Cornus stolonifera*) and ash or red maple dominate the new community, while in still others bog shrubs and young cedar and tamarack are quickly replicating the former forest. In general the vegetation could be classed as a wet shrub or thicket type.

3) String Bog. This is an area in which open meadows of fine-leafed sedge and other low bog plants are intricately interlaced with rows or "strings" of low stunted tamaracks and cedars and an occasional black spruce (*Picea mariana*). Scattered here and there are rounded clumps of taller cedar and tamarack, with very few deciduous trees present. A zone of similar, nearly pure tamarack and cedar forms the boundary of the string bog area. String bogs are common in northern bog areas of Canada. This one in Cedarburg Bog seems to be the southernmost example of this bog type.

CENSUS METHODS

Dennis Gustafson has been doing a thorough study of the breeding birds of the upland deciduous woods using two different census techniques. The data

presented here for the upland forest are preliminary figures derived from a territory-mapping method.

In the bog the technique used was a variant of that employed in the Breeding Bird Survey conducted nationwide each year by the U.S. Fish and Wildlife Service. In each of the vegetation types described above a number of sampling points were chosen in as nearly a random way as possible considering the difficulties of human locomotion in the bog. The sampling points were not the same each year. At each point all birds detected during a 5-minute period, by song, call or sighting 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 specie The basic data then consisted of the number of pairs of birds of each species detected within about 300 feet of the sampling point during a 5-minute period.

However, different species of birds are not equally detectable. Some are loud, frequent singers or make themselves conspicuous in other ways while others sing softly or infrequently or only during part of the breeding season. Still others are so secretive that they are only seen when flushed by the close approach of the observer. Kendeigh (1956) and Emlen (1971) have considered this problem and have developed coefficients of detectability for certain species in certain habitats. Deriving such coefficients is a difficult time -consuming process which was not attempted in this study. However, using the figures provided by Kendeigh and Emlen as guidelines, arbitrary coefficients of detectability ranging from 0.25 to 1.00 were assigned to the species involved here. A coefficient of 0.50 for a given species would mean that in the long run only half the pairs actually present would be detected or to put it the other way around the true abundance would be twice the recorded value. The use of arbitrary rather than measured coefficients of detectability might obviously be a source of considerable error. Therefore the results given in this paper must be regarded as rough approximations rather than accurately measured values.

At this point what we have is a population index showing the relative abundance of each species in terms of number of pairs per sampling point. Ordinarily it would not be possible to convert these figures to absolute abundance, i.e., population density. In this case however we have an accurate census by other means of one of the bird species, the Black-capped Chickadee, which can be used as a reference point for making such a conversion.

The Chickadee population density was determined as part of an intensive study of the population dynamics of that species. Nearly all the Chickadees in the Field Station and adjacent areas have been trapped and color-banded for individual recognition (Weise, 1971). During the breeding season large areas of all the major vegetation types are systematically and repeatedly searched for Chickadee territories, employing such tools as the playback of tape-recorded songs and calls. During each year about 110 acres of upland deciduous forest, 170 acres of bog conifer forest, and 140 acres of string bog are censused in this way. Since the birds can be identified as individuals it is possible to map the territories and determine the population density with some confidence.

Knowing the absolute density of this species and the abundance of each of the other species relative to it, we can calculate the density for each species in number of pairs per 100 acres from the proportion:

$$\frac{\text{Chickadee: no. of pairs/sampling point}}{\text{Species x: no. of pairs/sampling point}} = \frac{\text{Chickadee: no. of pairs/100 acres}}{\text{Species x: no. of pairs/100 acres}}$$

RESULTS

The results are shown in Table 1. Included are several species indicated by *, that could not be censused effectively by the methods used here, but were present and recorded during the sampling. Most of these are large, far-ranging species like hawks and owls whose density would be very low. Some, however, like the Cowbird, Cedar Waxwing and Goldfinch are numerically important in the bird communities of these areas and it is unfortunate that they were not censused by some means.

In general the calculated densities for the bog areas seem to be in the right order of magnitude as judged by previous experience in measuring bird populations and by the reported densities in similar vegetation types recorded in the ornithological literature. An exception is the 1971 census of the dead bog forest area which seems to be much too high for nearly all species. This area was very difficult to census due to its near impenetrability and its heterogeneity, as described previously.

Coefficients of community similarity were computed for all possible pair combinations of the twelve censuses (4 areas x 3 years) shown in Table 1. Such coefficients can vary from 0 when the species lists are completely different to 1.00 when the species and abundances are identical, In reality, in complex samples like those involved here, coefficients of 0.80-.85 are as high as can be expected.

Comparing the censuses for different years within each study area we find that in the string bog coefficients vary from .71 to .77; in bog conifer forest, from .74 to .76; and in upland deciduous forest from .63 to .74. These indicate a high degree of consistency from year to year, the population changes being relatively small. In the dead bog forest the consistency was much lower, the coefficients varying from .44 to .57.

A full comparison of the four areas with each other would require an elaborate ordination or cluster analysis. For the sake of showing some general relationships in a simple way the coefficients of similarity have been combined thus:

Upland dec. forest vs. bog conifer forest	:	.30
Upland dec. forest vs. dead bog forest	:	.17
Upland dec. forest vs. string bog	:	.15
Bog conifer forest vs. dead bog forest	:	.45
Bog conifer forest vs. string bog	:	.34
Dead bog forest vs. string bog	:	.55

It can be seen that the dead bog forest is fairly similar in bird species composition to both string bog and bog conifer forest, in other words more or less transitional as might be expected. The bog conifer forest has some similarity to the string bog in one direction and to the upland deciduous forest in the other. The upland forest is decidedly different from both the string bog and dead bog forest.

CEDARBURG BOG AS A RELICT OF BOREAL CONIFEROUS FOREST

Bogs are often considered left-overs or relicts of the boreal coniferous forest that occupied this region for a time subsequent to the glacial ages. Brewer (1967) has disputed this insofar as birds are concerned by showing that in two bogs in southwestern Michigan there were only three boreal species of regular occurrence, plus two others that were present in some years. Together these made up only a small fraction of the total bird population. In general the bird populations of the two bogs were similar to those of surrounding upland vegetation.

In the Cedarburg Bog area, only slightly farther north than the Michigan bogs, the picture is far different. Table 1 includes designations of the species that are classified on zoogeographic grounds as belonging to the boreal fauna (Udvardy, 1963). Several other species with definite boreal affinities are also designated, although otherwise classified by Udvardy. In the string bog these boreal species make up 55-61% (depending on the year) of the total bird population; in dead bog forest, 31-52%; in bog conifer forest, 40-43%; and in upland deciduous forest, 4-8%.

This boreal character can be examined more precisely by looking at the five most abundant species in each area. In the string bog the White-throated Sparrow was the most abundant species each year, comprising about 20% of the population. The ranks of the other four species varied slightly from year to year but on the average were: Nashville Warbler (13%), Yellowthroat (11%), Swamp Sparrow (10%), Song Sparrow (10%). Three of these are boreal species. The other two, Yellowthroat and Song Sparrow, are widely distributed species found in almost any wet forest-edge situation.

In the bog conifer forest the average rankings and percentages of the total bird population were: Veery (11%), Black-capped Chickadee (10%), Northern Waterthrush (9%), Blue Jay (8%), and Rose-breasted Grosbeak (7%). The first three are boreal. In the dead bog forest area the rankings varied considerably from year to year due to the inadequacy of the sampling.

In the upland deciduous forest, which is the current climax community type in this area and repesents the prevalent or most typical bird community, the figures are: Ovenbird (19%), Red-eyed Vireo (18%), Wood Thrush (8%), Wood Pewee (8%), Great Crested Flycatcher (5%). All of these are listed by Udvardy (*op. cit.*) in the Eastern Deciduous Forest Fauna.

Table 1. Approximations of Breeding Bird Density

Number of pairs per 100 acres

Species[1]	Coef. of Detect-ability	String Bog			Dead Bog Forest			Bog Conifer Forest			Upland Deciduous Forest		
		1971	1972	1973	1971	1972	1973	1971	1972	1973	1971	1972	1973
Green Heron						+			+	+			
Mallard							+						
Wood Duck											+		+
Red-shouldered Hawk					+			+		+	+	+	+
Ruffed Grouse	.25				+			8	5	11			
American Woodcock				+				+	+	+			
Common Snipe			+										
Mourning Dove	.75	5	4	6	13	3	5	3	5	1			
Yellow-billed Cuckoo	.25								5				
Black-billed Cuckoo	.25										3	2	3
Great Horned Owl											+		
Barred Owl								+	+	+	+	+	+
Ruby-throated Hummingbird											+		+
Common Flicker	.75	5	2	2	6	3	5	1		5	1	4	6
Red-bellied Woodpecker	.50										3	2	2
Red-headed Woodpecker	.50									2	1	6	2
Hairy Woodpecker	.50		7					4	5	9	5	4	6
Downy Woodpecker	.50		7	3	10		8	3	8	7	8	6	6
Eastern Kingbird	1.00						5						
Great Crested Flycatcher	.75	5		4	6	6	11	5	10	10	13	8	16
*Yellow-bellied Flycatcher	.50					1							
Acadian Flycatcher	.50										3		2

*Willow Flycatcher	.50	4	10	3	29	13								
**Least Flycatcher	.50	1												
Eastern Wood Pewee	.50							3	3	4	4[2]	20	16	
Blue Jay	.50	31	10	17	29	13		15	20	18	14	10	8	
Common Crow		+			+			+		+	+	+	+	
*Black-capped Chickadee	1.00	16	19	17	15	22	16	18	22	20	11	13	8	
White-breasted Nuthatch	.50									4	13	6	10	
*Brown Creeper	.25				19			13	5	7			2	
House Wren	.75				13	9	11	8	8	7	3	4	2	
*Winter Wren	.75	3						2						
Gray Catbird	.50		3	6	39		33	8	3	2	5	2	2	
American Robin	.50	4		3		4	8	9	8	11	1	3	6	
Wood Thrush	.50									2	27	14	14	
**Veery	.50	8	17	6	78	13	8	22	22	26			2	
Eastern Bluebird	.50										3		2	
Cedar Waxwing	.50	+	+	+		+							4	
European Starling	.75										13	2	8	
Red-eyed Vireo	.75								3		56	22	52	
Black & White Warbler	.75		4	6	20	6	5	6	8	5			2	
Golden-winged Warbler	.50				20			1						
Blue-winged Warbler	.50					9						2		
**Nashville Warbler	.50	47	41	37	29	9	25	1	5					
Yellow Warbler	.50				10	4	8					1		
** Black-throated Green Warbler	.50								1					
Cerulean Warbler	.50										1	1	1	
**Chestnut-sided Warbler	.50											1		
Ovenbird	.75					3		2	3		48	44	42	
*Northern Waterthrush	.75			2		23	11	15	22	20				
*Mourning Warbler	.50						8	1	5	7		2	4	
Common Yellowthroat	.75	52	36	21	59	23	38	9	7	6		2	2	
**Canada Warbler	.50		3	6	20	9	8	3	3	11				

Species[1]	Coef. of Detect-ability	String Bog 1971	1972	1973	Dead Bog Forest 1971	1972	1973	Bog Conifer Forest 1971	1972	1973	Upland Deciduous Forest 1971	1972	1973
American Redstart	.50			3	20	4				4		1	
Red-winged Blackbird	.75		4		20								
Northern Oriole	.75						5		5		1		
Common Grackle	.75			+			+	+	+	+	+	+	+
Brownheaded Cowbird	.50	+	+				+	+	+		+	+	+
Scarlet Tanager	.50										11	6	18
Cardinal	.75	3			13	3	5	2	3	1	1	2	2
Rose-breasted Grosbeak	.75	3		11	39	9	11	13	12	17	3	4	2
Indigo Bunting	.75						5	1		1			4
American Goldfinch			+	+	+		+						
Rufous-sided Towhee	.50	8	10		20		8	3	5	2			4
*White-throated Sparrow	.75	70	77	53	26	35	11	3	5	2			
*Swamp Sparrow	.75	52	29	27	65	9	11	3					
Song Sparrow	.75	41	29	32	20	23	33	2	7	1		2	2
Total pairs/100 acres		358	312	265	639	255	302	187	223	223	252	195	262
No. of species		20	22	24	29	26	29	33	32	31	33	31	35
No. of sampling points		12	16	18	7	9	7	20	15	20	50 acres		

1 Standard vernacular names from AOU Checklist of North American Birds (1957) and from Thirty-second supplement to the AOU Checklist of North American Birds (1973).

2 Greatly underestimated as census was too early in season.

* Birds of Boreal Forest Faunal group (Udvardy, 1963).

** Birds listed by Udvardy (1963) in the Eastern Ecotone Fauna (between Coniferous Forest and Deciduous Forest) but which have strong ecological associations with boreal coniferous forest.

In summary it is evident that the bird communities of the forested portions of Cedarburg Bog do indeed have a strong boreal component, reaching the extreme in the string bog area. Perhaps the bog areas studied by Brewer (*op. cit.*) were too small to support viable populations of northern bird species even though boreal plants were well represented. In support of this are some observations in two small bogs that lie a short distance west of the main Cedarburg Bog. Floristically these are more boreal in character than Cedarburg Bog, each having a well developed black spruce zone. However, each bog is only a few acres in size. While I have no quantitative data my observation has been that there are few boreal species of birds there and none of the truly reliet species like White-throated Sparrow, Nashville Warbler, or Northern Waterthrush, that are so well represented in Cedarburg Bog.

This re-emphasizes the importance of Cedarburg Bog as a natural area well worth preserving for its unique features: the string bog, and its large size—large enough to support relict populations of boreal birds and mammals as well as plants.

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