

# Breeding birds in cedar stands in the Great Dismal Swamp

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THE GREAT DISMAL SWAMP, located on the coastal plain on the Virginia-North Carolina border, has long been recognized as a vegetationally distinctive region with many unusual geological and biological features. Formerly at least twice the currently estimated size of 85,000 hectares (Carter 1979), the Great Dismal Swamp is still shrinking because of a dropping water table caused by more than 200 years of logging, ditching, and other human activities. In 1973, the Union Camp Corporation donated a 19,871-hectare tract located near Suffolk, Virginia, to The Nature Conservancy, which transferred the land to the U.S. Fish and Wildlife Service. This parcel, all in Virginia and including the 1255-hectare Lake Drummond, became the core of the Great Dismal Swamp National Wildlife Refuge (hereafter, G.D.S.N.W.R.), established in 1974. The G.D.S.N.W.R. is still growing in size by the acquisition of land by purchase or by gift; by the end of 1980, it was 41,026 hectares, with 24 per cent (9866 hectares) in North Carolina.

Much of the history, lore, and scientific investigations of the Great Dismal Swamp have been summarized by Kirk (1979), the results of a symposium held in 1974. In reality, few studies of the Dismal Swamp biota have been attempted. Earliest reports of wildlife were probably greatly exaggerated as an inducement for people to settle there (Handley 1979). The first descriptions of the non-game wildlife were made in a United States Geological Survey report (Shaler 1890). Later, the United States (USDA) Bureau of Biological Surveys sent collecting parties into the Swamp for a total

of 23 weeks of fieldwork between 1895 and 1898. Fisher (1895), in the first description of birdlife in the Swamp, reported the first Swainson's Warbler (*Lymnolthypis swainsonii*) for the region. Palmer and Bartsch of the U.S. National Museum also conducted their faunal surveys during this period, and Pearson, who later became director of the National Audubon Society, conducted an unsuccessful search for the Ivory-billed Woodpecker (*Campephilus principalis*) then.

Little more was written about Dismal Swamp birds until the 1930s, when Murray (1932) reported Virginia's first Wayne's (Black-throated Green) Warbler (*Dendroica virens waynei*) from the Swamp. Meanley has made the greatest contribution to an understanding of Dismal Swamp birds with his monograph on Swainson's Warbler (1971), annual Breeding Bird Surveys, and other notes and reports (1968, 1969, 1973, 1976, 1979). More recently, Breeding Bird Censuses in the dominant Swamp habitat, Red Maple (*Acer rubrum*) and Black-gum (*Nyssa sylvatica*) forest, have been made by Schwab (1979), Schwab and Gwynn (1980), and Gwynn (1981), and lists of birds breeding in stands of Atlantic White-cedar (*Chamaecyparis thyoides*) have been reported by Terwilliger (1981a, 1981b, 1982a, 1982b). This report gives details of the breeding birds in two cedar stands and compares them to results of a three-year study of the birds that breed in a stand of the dominant maple-gum forest of the Swamp. During two years of study, seven species of birds were found to nest in cedar that did not use the maple-gum site. These species, however, were recorded in the

annual Breeding Bird Surveys of Meanley in the Swamp.

## MATERIALS AND METHODS

TWO CEDAR STANDS THAT differed in age, size, and location were selected for study. Site 1, called the Camp Site, was a 7-hectare patch of cedars surrounded by maple-gum forest and located in Virginia. It survived the most recent logging operation and is best described as being an overmature (= past prime-timber growth) stand with an encroaching hardwood midstory and a dense evergreen shrub understory (Fig. 1). This island of century-old trees is surrounded by



Figure 1. The Camp site. Photo/Stephen D Mallette.

an expanse of evergreen shrub and maple-gum forest. Site 2, the Forest Line Site, was a sample 7-hectare plot located in the center of a dense 80-hectare stand of mature (70-year-old) timber with little or no midstory and a dense evergreen shrub layer. This site, located in North Carolina, is in a section of the Swamp with some of the largest stands of uncut Atlantic White-cedar left in the United States. A third locality, the Maple-gum Site, was used by Schwab and Gwynn, and has been described in detail by Schwab (1979); it was censused in this study for comparative purposes.

Censuses were conducted between 0700 and 1100 hours from the first week in April through the second week in June, using the Williams Spot Map method (International Bird Census Committee 1970). To establish the territory of any breeding bird, this method recommends a minimum of nine visits during which sight or sound contacts ("registrations") are recorded for each bird. In order to span the breeding seasons of birds known to nest in the Swamp, each cedar site was visited twice weekly during the 11-week study period. During each visit, all territorial birds, their nests, aggressive encounters, and simultaneous registrations were recorded on a map for each species. In addition, the location, height at which it was observed, and general activity of each bird were recorded for each visit. Information on height, activity, and density of the breeding birds will be reported elsewhere (Terwilliger and Rose, *in prep.*).

## RESULTS

ON THE CAMP SITE, 23 and 20 species of birds were recorded as breeding in 1980 and 1981, respectively, compared to 17 and 16 at the Forest Line Site (Table 1) For the Maple-gum Site, 22, 16, and 19 species were recorded as breeding during the period 1978 to 1980 (Table 1).

The cedar stands were dominated by warblers (Table 1), with Prairie, Prothonotary, Hooded and Worm-eating warblers, Ovenbirds, and Common Yellowthroats comprising 74 to 78 per cent of the breeding birds on both sites during both years. Interestingly, two warblers showed reciprocal densities during both years; Prothonotary Warblers were far more numerous on the older Camp Site and Common Yellowthroats predominated in the younger, more dense Forest Line Site. Consequently, the four most common species differed between the

two cedar stands, and these differences were consistent between years (Table 1). Besides parulids, 11 families representing four orders were recorded as breeding within stands of Atlantic White-cedar (Table 2).

By contrast, on the Maple-gum Site, Prairie and Worm-eating warblers were not recorded during any year of study, and the above-mentioned four species of parulids comprised 44 to 52 per cent of the breeding birds during each year. To an extent, these two warblers may have been replaced by the Louisiana Waterthrush and Blue-gray Gnatcatchers. Besides the warblers, there were 13 families from six orders that nested in the maple-gum forest (Table 2).

## DISCUSSION

The Maple-gum Site supported nine species not seen in the cedar stands (Table 1) and the cedar sites had seven species that did not occur in the maple-gum forest. In the cedar stands only two of these seven birds belong to the same family; the rest are a diverse group, over half of which are shared by both cedar sites.

The cedar community not only supported a higher number of nesting species, but also a much higher density. In the three years of study in the maple-gum forest, the densities of 593/km<sup>2</sup> in 1978, 623/km<sup>2</sup> in 1979, and 613/km<sup>2</sup> in 1980 were about half the densities from the cedar sites. The cedar stand values were

**Table 1. Species and number of breeding birds observed on two cedar and one maple-gum forest study sites, based on the number of territorial birds, rounded to the nearest 0.5 territory. For marginal territories having less than 25 per cent of the territory within the study site, a "+" was assigned. A "\*" refers to species found only in cedar; "\*\*" refers to species found only in maple-gum.**

	Cedar Stands				Maple-gum Stand		
	Site 1		Site 2		Site 3		
	1980	1981	1980	1981	1978	1979	1980
Red-shouldered Hawk	+	+			+		
Mourning Dove	2	+	+	+	1		1
Yellow-billed Cuckoo**					3	2	2
Barred Owl**					+		+
Downy Woodpecker**					+	2	2
Hairy Woodpecker**						+	+
N. Flicker			1			+	
Pileated Woodpecker	1	1	+		+	+	+
E. Wood-Pewee	+					4	3
Acadian Flycatcher*	1	2		1			
Great Crested Flycatcher	2	2	3	2	2	7	4
Blue Jay*	1	1	2	1			
Carolina Chickadee	3	2	4	3	3	1	3
Tufted Titmouse*	3	1	2	1			
Carolina Wren	+		1		4	4	3
Blue-gray Gnatcatcher**					1		
Gray Catbird*	1	1	3	2			
Wood Thrush	2	1	5	3	6	6	6
White-eyed Vireo	2	2.5					2
Red-eyed Vireo	3	3			3	4	3
Pine Warbler**					1		
Prairie Warbler*	18	17	19	15			
Prothonotary Warbler	18	15	4	3	13	10	11
Worm-eating Warbler*	5	2	5	4			
Swainson's Warbler	1				+		
Ovenbird	8	7	11	8	5	7	7
Louisiana Waterthrush**					5	5	4
Com. Yellowthroat	3	2.5	19	16	8	5	6
Hooded Warbler	13	10.5	12	12	5	6	5
Summer Tanager**					+		
N. Cardinal*	1	1					
Rufous-sided Towhee	+	2	4	2	+		+
Chipping Sparrow**					+		
Total No. Species	23	20	17	16	22	16	19
Total No. Individuals	88	73.5	95	74	60	63	62
Density per km <sup>2</sup>	1256	1035	1369	1042	593	623	613

**Table 2. Breeding birds of the Dismal Swamp, grouped by order and family. For definitions of “+”, “\*\*” and “\*\*\*”, see Table 1.**

	Cedar Stands				Maple-gum Stand		
	Site 1		Site 2		Site 3		
	1980	1981	1980	1981	1978	1979	1980
Falconiformes							
Buteoninae	+	+			+		
Columbiformes							
Columbidae	2	+	+	+	1		1
Cuculiformes**							
Cuculidae					3	2	2
Strigiformes**							
Strigidae					+		+
Piciformes							
Picidae	1	1	1			2	2
Passiformes							
Tyrannidae	3	4	3	3	2	11	7
Corvidae*	1	1	2	1			
Paridae	6	3	6	4	3	1	3
Troglodytidae	+		1		4	4	3
Mimidae*	1	1	3	2			
Turdidae	2	1	5	3	6	6	6
Sylviidae**					1		
Vireonidae	5	5.5		1	3	4	5
Parulidae	66	54	70	58	37	33	33
Thraupidae**					+		
Fringillidae	1	3	4	2	+		+
Totals	88	73.5	95	74	60	63	62

over 1000/km<sup>2</sup> during both years (Table 1) and had an average value of 1175/km<sup>2</sup>. Thus, the cedar stands are valuable resources for birds nesting in the Dismal Swamp because they not only accommodate a number of species that apparently do not breed in the maple-gum forest, but because they also support nearly twice the density of birds found in the maple-gum forest. In 1981, the average density of the two cedar stands, 1312/km<sup>2</sup>, was the highest value recorded for the birds nesting in 12 eastern coniferous forest habitats (Van Velzen 1981). In fact, in 1981 the density of nesting birds in the Dismal Swamp cedar stands (1312/km<sup>2</sup>) was 2.57 times greater than the average densities (510/km<sup>2</sup>) on the other 10 coniferous forest studies (Van Velzen 1981). The causes of these high densities may be related to differences in habitat structure, to be evaluated in detail in Terwilliger and Rose (*in prep.*).

The older and isolated stand (Camp Site) had more species than were present on the Forest Line Site. Whether this larger number is due to the deterioration of the 100-year-old trees and the resulting large number of holes, fallen trees and tangled snags, to a better developed mid-story due to later encroachment of deciduous trees, or to a large and beneficial edge effect cannot be determined without

replicated studies. Nevertheless, it is clear that small patches of overmature cedar surrounded by maple-gum forest provide habitat that is as valuable for cedar-nesting birds as the interior of a large cedar stand.

It is also clear that the loss of cedar as a habitat type will almost certainly influence the distribution and numbers of some species presently nesting within the Swamp. Almost certainly Prairie Warblers would disappear as breeding birds from the interior Swamp forests, although they would likely remain along ditch edges and in the early regeneration areas where they presently breed. However, the Worm-eating Warbler would be even more markedly affected, since they have not been reported elsewhere within the Swamp except in small patches of mesic hardwoods (Meanley *pers. comm.*). Except for the Gray Catbird and Tufted Titmouse, which also breed in cedar but apparently not in maple-gum, the other species were present at a frequency of one breeding pair or less per year for each 7-hectare plot. These species have been shown to breed at low densities elsewhere in the Dismal Swamp according to the annual Breeding Bird Surveys of Meanley, but not in the censuses of Schwab and Gwynn in the single maple-gum site (1979, 1980, 1981).

It is unclear why Prairie Warblers should be breeding, and at such high densities, in the closed forest of the Dismal Swamp. Prairie Warblers are normally associated with “open-country places having high ground and few trees” (James 1971). In a monograph on the species, Nolan (1978) reported the highest densities from such habitats. He also reported that the Dismal Swamp is one of the few locations in which the species has been recorded in closed habitat.

One possible explanation for the presence of breeding Prairie Warblers in Dismal Swamp forests lies in the history of the species. Kendeigh (1961) believed that the species, whose center of distribution is in the Gulf and Atlantic States, was originally associated with the southeastern pine or magnolia-oak forests and their seral stages. Mengel (1964) associated this species with the Madro-tertiary sclerophyllous woodlands and pine forests. Both authors agree that the dispersal of Prairie Warblers into, and adaptation to, forest-edge and deciduous communities probably occurred during the Pleistocene. Man's activities in the past 200 years have resulted in a dramatic change in the vegetation of the Dismal Swamp, and today large areas of cane, Baldcypress, and cedar are becoming increasingly rare. In 1980, an estimated 500 hectares of pure and mixed cedar forest remain within the G.D.S.N.W.R. boundaries. Red Maple-Blackgum, now overwhelmingly dominant in the Swamp, is favored by the drier conditions created by a lowered water table.

This study has revealed that the cedar community supports a much greater avifauna than previously believed, at least in the Dismal Swamp. In letters dated March 3, 1980 and April 24, 1981, Meanley (*pers. comm.*) predicted “a sparse birdlife with low diversity” in the dense cedar stands. Instead, cedar stands in the G.D.S.N.W.R. support the highest densities reported for any coniferous forest censused in eastern North America during 1981, and nearly twice the density of birds in the maple-gum forest. Seven species appear to prefer the cedar sites to the maple-gum sites for breeding, implying that at least some of these might be affected if Atlantic White-cedar vanishes as a habitat type in the G.D.S.N.W.R. The U.S. Fish and Wildlife Service and the Refuge recognized that the cedar community may be a distinctive resource to wildlife, and that any management plan for the cedar stands ultimately also would affect the wildlife there.

The primary objective of this study, then, was to determine the status of breeding birds in the cedar stands, not only the density of such birds but the possible kinds of birds that breed only in cedar stands. This information will permit an assessment of the cost (to wildlife resources in the Refuge) of losing cedar stands. The findings of this study support the need for an effective management plan for cedar stands in the Refuge. In particular, this research has shown the value of both mature and overmature cedar stands to breeding birds. In consideration of the demonstrated value of Atlantic White-cedar to breeding birds, a tentative forest management plan for the G D S.N.W.R. has emphasized the importance of an age-class diversity. Furthermore, the tentative plan calls for the preservation of old-growth stands (over 100 years of age) to comprise at least 10 per cent of the total area of cedar as a means of providing "age class diversity, higher bird species diversity, research natural areas, greater aesthetic and public use value, and study areas for observing the natural successional patterns" (A. Carter *pers. comm.*). Harvesting in strips has been recommended in preference to harvesting in large blocks, because strips provide the greater edge-to-area ratio that will benefit breeding birds. However, in small cedar stands, blocks of small size (less than 15 hectares) would be retained. These two harvesting methods would provide the seed trees for the potential regeneration of the cedar that had been harvested on nearby plots. If successful, this plan will permit the probable retention of cedar as a resource within the G D S.N.W.R., and help to maintain Prairie Warblers, Worm-eating Warblers, and several other species of birds that seem to breed in higher numbers in cedar stands than in the maple-gum forest

One might ask why any of the cedar in the Refuge must be harvested, in view of its demonstrated value to breeding birds. The fact is that cedar is a fire sub-climax species, and will eventually be replaced in the normal course of biological succession, probably by southern evergreen shrubs, with Red Bay (*Persea borbonia*) being one of the dominants. But more to the point, in the Dismal Swamp where the water table has been dropping for decades, cedar stands will be replaced by maple and gum trees, such as is happening on the 100-year-old Camp Site now. Consequently, a forest management plan that calls for the preservation of existing

cedar stands will only ensure that 100 years from now the current 500 hectares of cedar will be a part, perhaps even an indistinguishable part, of the maple-gum forest that is coming to dominate the Dismal Swamp. Doing nothing is the same as condemning the cedar stands to a rapid decline. If the tentative forest management plan can be implemented, and if the burns in the cut stands are successful, it will be possible for other investigators to learn why stands of Atlantic White-cedar support such high densities of nesting birds, and why Prairie Warblers nest in these interior forests of the Dismal Swamp.

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