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## BREEDING BIRD USE OF A MATURE STAND OF BRAZILIAN PEPPER

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**Abstract.**—Six species of birds were observed nesting in a mature stand of Brazilian pepper (*Schinus terebinthifolius*) in Everglades National Park, Florida. Densities for each of these breeding species ranged from 7 to 16 pairs/100 ha. Total breeding bird density for the study area was 73 pairs/100 ha. Results are compared with breeding bird densities reported for native pineland habitat (28 species, 113 + pairs/100 ha) and native forest-edge habitat (18 species, 255 + pairs/100 ha).

By removing or altering native vegetation over extensive areas man has had a major impact on the avifauna of southern Florida (Robertson and Kushlan 1974). Much of the native pine forest and surrounding prairies of Dade County have been replaced by suburban development and agriculture and ornamented with a plethora of exotic tropical plants (Robertson and Kushlan 1974). Through aggressive colonization, many of these exotics threaten the biotic diversity of natural ecosystems in the region (Loope and Dunevitz 1981).

Brazilian pepper (*Schinus terebinthifolius*), a native of South America, was first introduced into South Florida during the last half of the 19th century as an ornamental. By 1950, the species had become conspicuously dominant in many areas (Ewel et al. 1982). It has successfully colonized many native plant communities including the pinelands of the Miami Rock Ridge, tropical hardwood hammocks, and mangrove forests (Loope and Dunevitz 1981, Ewel et al. 1982). Areas that are disturbed by human activity are especially susceptible to colonization by this species (Koepp 1979). Established populations of Brazilian pepper in United States territory also are found in Hawaii, Puerto Rico, and the Virgin Islands (Ewel et al. 1982). The aggressive manner in which the

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Table 1. Strip-map census of the breeding bird community in *Schinus terebinthifolius*.

Species	Strip size				Territory Size (ha)	Singing males/100 ha	Frequency <sup>1</sup>	Status <sup>2</sup>
	Width (m)	Area (ha)	No. of terr.					
Northern Cardinal ( <i>Cardinalis cardinalis</i> )	129	74.7	12	4.1	16	1.00	B	
White-eyed Vireo ( <i>Vireo griseus</i> )	110	65.0	11	3.5	16	1.00	B	
Rufous-sided Towhee ( <i>Pipilo erythrophthalmus</i> )	92	52.8	6	5.0	11	.97	B	
Red-winged Blackbird ( <i>Agelaius phoeniceus</i> )	147	85.0	10	2.3	11	.94	B	
Common Yellowthroat ( <i>Geothlypis trichas</i> )	73	41.9	3	1.5	7	.91	B	
Carolina Wren ( <i>Thryothorus ludovicianus</i> )	129	74.7	9	3.7	12	.88	B	
Gray Catbird ( <i>Dumetella carolinensis</i> )	-	-	-	-	-	.64	W	
American Crow ( <i>Corvus brachyrhincus</i> )	-	-	-	-	-	.44	B	
Common Flicker ( <i>Colaptes auratus</i> )	-	-	-	-	-	.23	B	
Great Crested Flycatcher ( <i>Myiarchus crinitus</i> )	-	-	-	-	-	.20	B	
Brown Thrasher ( <i>Toxostoma rufum</i> )	-	-	-	-	-	.08	W	
Blue-gray Gnatcatcher ( <i>Poliophtila caerulea</i> )	-	-	-	-	-	.08	W	

White-winged Dove ( <i>Zenaidura macroura</i> )	-	-	-	-	.08	B
Black-and-white Warbler ( <i>Mniotilta varia</i> )	-	-	-	-	.08	W
American Robin ( <i>Turdus migratorius</i> )	-	-	-	-	.05	W
Ovenbird ( <i>Seiurus aurocapillus</i> )	-	-	-	-	.05	W
Red-shouldered Hawk ( <i>Buteo lineatus</i> )	-	-	-	-	.02	B
Chuck-will's-widow ( <i>Caprimulgus carolinensis</i> )	-	-	-	-	.02	B
Northern Mockingbird ( <i>Mimus polyglottos</i> )	-	-	-	-	.02	B
Prairie Warbler ( <i>Dendroica discolor</i> )	-	-	-	-	.02	W/M
American Redstart ( <i>Steophaga ruticilla</i> )	-	-	-	-	.02	M

<sup>1</sup>Frequency—samples with at least one contact/total no. of samples (n = 34).

<sup>2</sup>Status: B = breeds in ENP, W = winter resident, M = fall/spring migrant.

species colonizes disturbed areas, the difficulty of controlling its spread, and its long-term domination of an area, once it is established (Loope and Dunevitz 1981), suggest that this exotic has become an important element in the natural landscape of southern North America. Therefore, it is important to understand how this new habitat is utilized by native fauna.

This paper contains the results of a single-season, breeding-bird study conducted in a mature stand of Brazilian pepper in Everglades National Park. I compare the results with those of similar studies conducted in native vegetation types in the same region.

#### STUDY AREA AND BIOLOGY OF BRAZILIAN PEPPER

The incongruity of roughly 4,000 ha of farmland surrounded on all sides by the wilderness of the Everglades gave the "Hole-in-the-Donut" its name. The area, near the center of Everglades National Park, Dade County, Florida, remained in private hands long after the establishment of the park in 1947 (Ewel et al. 1982). During the 1950s and 1960s, 2000 ha of pinelands and marl glades were rockplowed—a technique of breaking up the limestone bedrock in order to create a more favorable substrate for crops. The National Park Service purchased the land, and farming was eliminated from the area gradually over a three-year period, ending in 1975 (Loope and Dunevitz 1981). The site of this study was actively farmed until 1975.

Ewel et al. (1982) described the structure of stands comparable to my study site as being dominated by Brazilian pepper with densities from 197 to 677 individuals per ha. Distribution is clumped. In closed stands, such as the site of this study, foliage is concentrated at the top of the canopy (about 10 m tall) and the understory is sparse. Other tree species present included myrsine (*Myrsine floridana*), wax myrtle (*Myrica cerifera*), red-bay (*Persea borbonia*), dahoon (*Ilex cassine*), lancewood (*Nectandra coriacea*), and guava (*Psidium guajava*).

Reproductive phenology of Brazilian pepper peaks in October. The flowers are insect pollinated, with the main pollinator being a syrphid fly (*Palpada vinetorum*). Fruit ripens during December through February (Ewel et al. 1982). Gogue et al. (1974) suspects Brazilian pepper is allelopathic—secreting a toxic substance into its surroundings to inhibit the growth of competing plants.

#### METHODS

I used Emlen's (1984) strip-map method for censusing songbird communities in this study. I censused birds from a transect 1.2 km in length, placed roughly in the center of a 5.7 km<sup>2</sup> stand of mature Brazilian pepper. I walked the transect on 34 mornings (commencing at sunrise) from 1 March 1988 to 3 June 1988, an average of 2.4 mornings per week (range 1-4). Weather conditions were noted and the location of each bird detected was marked on a field map as was the type of detection (visual, calling, or singing). Daily field maps were compiled into species-specific 1-week and 1-month maps as the study progressed. Clusters of detection points on the 1-month maps were interpreted as territories of singing males. When the territories of all of the singing males became well-defined on the 1-month maps, I stopped collecting data.

Strip width was determined for each species by doubling the greatest perpendicular distance recorded between the transect and the bird, ignoring the highest 3% of the values. Area of coverage was determined by multiplying the strip length by the species-specific strip width (Table 1).

## RESULTS

I observed 22 species of birds during the study (Table 1). Of these, six species nested in the Brazilian pepper stand. Nine species that breed elsewhere in Everglades National Park were observed in the study area, but were assumed to be using it for purposes other than nesting because little or no territorial behavior was detected. Of six species of winter residents, only the Gray Catbird (*Dumetella carolinensis*) was common. Only one spring migrant, the American Redstart (*Setophaga ruticilla*), was observed in the study area.

Densities of breeding species ranged from 7 pairs/100 ha, for the Common Yellowthroat (*Geothlypis trichas*), to 16 pairs/100 ha for both the Northern Cardinal (*Cardinalis cardinalis*) and White-eyed Vireo (*Vireo griseus*) (Table 1). Total breeding bird density for the study area was 73 pairs/100 ha.

## DISCUSSION

Results of my study show that a nearly monospecific stand of Brazilian pepper was utilized to some extent for feeding and breeding by the native avifauna. However, both total population density and species diversity were much lower in the forest of Brazilian pepper than in the native pineland and forest-edge habitats it has replaced. Robertson (1955), using the Williams territory-mapping technique (Williams 1936) for his study of the breeding birds of tropical Florida, recorded 28 species of breeding birds in pinelands of Everglades National Park, with an average population density of 113+ pairs/100 ha. In the forest-edge habitat he found 18 breeding species with total population densities of 255+ pairs/100 ha (Table 2). This compares with only six breeding species with a total density of 73 pairs/100 ha in my study area.

The recently established Brazilian pepper habitat appears to benefit two breeding species, the Red-winged Blackbird (*Agelaius phoeniceus*) and the Common Yellowthroat (neither was found in native pineland nor forest-edge habitats). The remaining four species nesting in the Brazilian pepper also were found nesting in the forest-edge. With the exception of the Rufous-sided Towhee (*Pipilo erythrophthalmus*), these species showed three to five times higher density in native forest-edge habitat.

Native pineland communities in southern Florida contain more than 200 species of vascular plants and native prairies contain more than 100 species (Loope and Dunevitz 1981). When these biologically diverse habitats are replaced by one that is much less species-rich, a decline in avian species diversity would be expected. Robertson and Kushlan (1984) report that some pineland species [i.e., Blue Jay (*Cyanocitta cristata*), Common Grackle (*Quisculus quisculus*)] primarily became birds of sub-

**Table 2. Comparison of species breeding populations (pairs/100 ha) found in mature Brazilian pepper with those found in south Florida pineland and forest-edge habitats by Robertson (1955).**

Species	Brazilian pepper	Pinelands <sup>1</sup>	Forest- edge <sup>2</sup>
Northern Bobwhite ( <i>Colinus virginianus</i> )		13	2.5
Ground Dove ( <i>Columbina passerina</i> )			7.5
Yellow-billed Cuckoo ( <i>Coccyzus americanus</i> )		+ <sup>3</sup>	9.5
Common Flicker ( <i>Colaptes auratus</i> )	+	6.2	4.4
Red-bellied Woodpecker ( <i>Melanerpes carolinus</i> )		20.3	40
Hairy Woodpecker ( <i>Picoides villosus</i> )		2.5	
Downy Woodpecker ( <i>Picoides pubescens</i> )		2.5	2.5
Eastern Kingbird ( <i>Tyrannus tyrannus</i> )		7.5	2.5
Great-crested Flycatcher ( <i>Myiarchus crinitus</i> )	+	+	18.2
Blue Jay ( <i>Cyanocitta cristata</i> )	+	10	12.5
Carolina Wren ( <i>Thryothorus ludovicianus</i> )	12		42.5
Northern Mockingbird ( <i>Mimus polyglottos</i> )	+	11.5	
Eastern Bluebird ( <i>Sialia sialis</i> )		8.8	
Loggerhead Shrike ( <i>Lanius ludovicianus</i> )		7.5	2.5
White-eyed Vireo ( <i>Vireo griseus</i> )	16	+	58.8
Black-whiskered Vireo ( <i>Vireo altiloquus</i> )			5
Pine Warbler ( <i>Dendroica pinus</i> )		22.5	31.2
Common Yellowthroat ( <i>Geothlypis trichas</i> )	7		
Red-winged Blackbird ( <i>Agelaius phoeniceus</i> )	11		
Eastern Meadowlark ( <i>Sturnella magna</i> )		12.5	2.5
Common Grackle ( <i>Quiscalus quisculus</i> )		10	+
Northern Cardinal ( <i>Cardinalis cardinalis</i> )	16	+	85.8

Table 2. (continued).

Species	Brazilian pepper	Pinelands <sup>1</sup>	Forest- edge <sup>2</sup>
Rufous-sided Towhee ( <i>Pipilo erythrophthalmus</i> )	11	+	7.5

<sup>1</sup>Average abundance from 4 samples.

<sup>2</sup>Average abundance from 6 samples.

<sup>3</sup>+ species present, abundance not determined.

urban habitats when the pines were removed; however, many other species [i.e., raptors, Chuck-Wills-Widow (*Caprimulgus carolinensis*), Hairy Woodpecker (*Picoides villosus*)] have largely disappeared.

This study shows the importance and urgency of protecting the remnants of our native ecosystems from biological pollution. With 85% of its original extent eliminated by urban expansion and agriculture, the Miami Rock Ridge pineland is one of the most endangered ecosystems in the United States (Shaw 1975). Loope and Dunevitz (1981) suggest that remaining isolated stands of this ecosystem outside Everglades National Park may be eliminated by the year 2000 due primarily to uncontrolled invasion by Brazilian pepper. Long term studies are needed in a variety of habitat types to better understand the role exotic plants will play in the future of native bird species.

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