THE RELATIONSHIP OF UNDERSTORY VEGETATION TO RED-COCKADED WOODPECKER ACTIVITY.[a]

JILL B. VAN BALEN, Department of Zoology, North Carolina State University, Raleigh, N.C. 27650
PHILLIP D. DOERR, Department of Zoology, North Carolina State University, Raleigh, N.C. 27650

Abstract: The relationship between understory vegetation and actual and potential red-cockaded woodpecker (*Picoides borealis*) cavities was measured in the North Carolina Sandhills. Understory measurements were made in a 0.01 ha circular quadrat around each of 60 red-cockaded woodpecker cavity trees and 60 randomly selected potential cavity trees. The height, basal area, species, and quarter number of each understory stem were recorded. Red-cockaded woodpeckers on our areas preferred excavating cavities in trees around which there were significantly fewer woody stems and a lower understory basal area than around random trees. Trees utilized by woodpeckers also had a lower occurrence of tall hardwood stems than random trees. Turkey and blackjack oaks (*Quercus laevis* and *Q. marilandica*), persimmon (*Diospyros virginiana*), longleaf pine (*Pinus palustris*) were common understory species around red-cockaded woodpecker cavity trees.

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The red-cockaded woodpecker is endangered (USDI 1968) due to a specialization for living in a disappearing habitat (Jackson 1971, Carter 1974). Evidence suggests that the red-cockaded woodpecker evolved in the southeastern pine forests where natural fires were frequent (Jackson 1971). Such fires opened the understory, removed dead trees, and prevented the growth of most hardwoods (Vogl 1973). Thus, in an open pine savanna type habitat, these birds developed a dependence on living pines. Due to active fire prevention programs throughout the region, dense understory has developed in many areas that formerly provided suitable habitat.

Although red-cockaded woodpeckers build cavities only in mature, living pines, the surrounding vegetation is also important. The vegetative characteristics of stands adjacent to red-cockaded colonies have been measured and analyzed (Lay and russell 1970, Crosby 1971, Hopkins and Lynn 1971, Thompson and Baker 1971). Similarly the understody characteristics near cavity trees have been recorded, but few quantitative measurements have been made.

This study was designed to make quantitative measurements of the understory vegetation surrounding cavity trees and to investigate the relationship of understory characteristics and red-cockaded woodpecker activity.

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STUDY AREAS

Three study areas subjected to different forest managment policies were located in the Sandhills region of south-central North Carolina. This region contains the greatest number of red-cockaded woodpeckers in the state (Carter 1974). Once an open longleaf pine savanah, the area is now composed mainly of a longleaf pine-scrub oak community. Turkey oaks occur on drier soils, while soils containing more clay support blackjack oak, bluejack oak (*Q. incana*), and dwarf post oak (*Q. margaretta*). Oak-hickory forests are

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replacing pines on the best sites. A few of the most common herbaceous and low woody plants encountered in this study (May and June 1976) were wiregrass (*Aristida stricta*), dwarf huckleberry (*Gaylussacia dumosa*), goat's rue (*Tephrosia virginiana*), and poison oak (*Rhus toxicodendron*). Wells and Shunk (1931) and Carter (1974) described the Sandhills in more detail.

Weymouth Woods – Sandhills Nature Preserve (Moore County)

Weymouth Woods, a 161 ha State Parks natural area, was forested primarily by second-growth longleaf pine. Many of the remaining old-growth trees are suppressed; the dominants and codominants had been logged. Prior to a burning program initiated in 1974, no burning had occurred on this area for the previous 40 years.

Boyd Estate (Moore County)

The Boyd estate was an unmanaged, old-growth longleaf pine forest of less than 64 ha. The latter had reached an advanced state of development. The mechanical removal of some understory components was implemented after this study.

Fort Bragg Military Reservation (Hoke County)

Fort Bragg's 54,400 ha was predominantly composed of second-growth longleaf pine. All data were collected within a 250 ha area along the Moore-Hoke County boundary. The reservation is control-burned on a 5-year cycle. Nineteen of the 34 cavity trees sampled had been burned within the pat 3 years. Due to military activities, wildfires are fairly common and understory may be cut during troop maneuvers. Timber is harvested on a 10-year cycle. A red-cockaded woodpecker management program in which cavities are located, marked and buffer zones designated around each colony was initiated in 1974.

Methods

Understory characteristics were measured around 60 cavity trees containing active cavities or "cavity starts" and 60 randomly located "potential" cavity trees. Only areas around "active" cavities were sampled since the vegetation surrounding a currently used tree would at least be acceptable to the woodpeckers. Activity was determined by the presence of fresh chipping and fresh sap around the cavity entrance (Jackson 1977). All 6 active cavities in Weymouth Woods and 20 active cavities in the Boyd estate were sampled. In Fort Bragg, insufficient time was available to take data on all known active cavities. In addition several additional active cavities were found during the course of this study. Thus, 34 cavities were selected using a random numbers table (Snedecor and Cochran 1967). Equal numbers of random trees sites and cavity trees were used in each area. A random potential cavity tree was considered to be the closest longleaf pine to a random location on a aerial photograph, which had a basal area within 2 standard deviations of the longleaf cavity tree averages calculated from Carter's unpublished data (Mean DBH = 43.8 cm). Only old-growth pines, which are characterized by a flattened crown (flattops), were used in Weymouth Woods and the Boyd estate since all cavities there were found in flattops. Due to logging activity on Fort Bragg, it was difficult to find flattops in some areas. Thus, in 10 of the 34 areas indicated by a random point, the oldest looking longleaf was selected because no flattops were found within a reasonable distance.

Around each tree a circle of 0.01 ha with the cavity tree as the center was defined and divided into pie-shaped quarters, with quarter I being centered around the activity. When more than 1 active cavity was present per tree, the most active cavity was used for centering. For random trees, quarter I was centered around the "potential cavity," located slightly south of the west side, the direction apparently preferred by red-cockaded woodpeckers (Baker 1971, Hopkins and Lynn 1971, Carter 1974). Within each quarter circle, the species, height and basal area were recorded for each stem. A 4.6 m pole and a

Suunto Clinometer were used to measure heights of the cavity, the cavity tree, and surrounding stems above 0.9 m. Vegetation which directly opposed the cavity, start, or "potential cavity" up to 7.6 m away was recorded. The "potential cavity" was located 7.0 m high (average cavity height in longleaf pines: Carter 1974) on the side preferred.

Pines within the 0.01 ha surrounding the central tree were omitted from analysis since the presence of the support stand was necessary for the birds, and our intention was to measure the understory. However, some hardwoods, particularly around the random trees, were much younger than the support stand pines, yet contributed to the canopy. To be consistent, understory hardwoods were defined as those shorter than 2 standard deviations above the average cavity height in longleaf pines, i.e., those less than 14.0 m (calculated from Carter's unpublished data). This was equivalent to 78.1% of the average longleaf cavity tree height.

We compared the number, size and height of understory stems around woodpecker cavity trees with similar trees available to the birds but which were not being used by them. We use chi-square analysis to compare the frequency of stems which occurred in quadrats around cavity trees with random trees. Chi-square was also used to compare stem frequency in the quarter centered on the cavity or potential cavity with stem frequency in the remaining three quarters. The distribution of stems among height classes was compared between study areas and cavity and random trees using the chi-square multinomial. Basal area comparisons were made using an analysis of variance.

RESULTS AND DISCUSSION

Size and Number of Stems

Average height and basal area were comparable for cavity and random trees (Table 1). Around cavity trees the number of stems in quater 1 was compared with the expected one-fourth of the number of stems in all four quarters (Table 2). In Weymouth Woods and the Boyd estate, the number of stems in the first quarter did not differ significantly from the expected ($X^2 = 1.84$ and 2.34 respectively, df. = 1). However, in Fort Bragg, there were significantly fewer stems in quarter 1 than would be expected from the number in the

Tablel. Average height (m) and basal area (cm^2) of woodpecker cavity trees and random potential cavity trees in 3 study areas in North Carolina.

	Height (SD)[a]		*Basal area (SD)*	
Area	*Cavity*	*Random*	*Cavity*	*Random*
Weymouth Woods	15.6 (3.2)	16.5 (2.3)	1,662.8 (676.6)	1,386.8(439.9)
Fort Bragg	18.6(3.2)	17.9(2.8)	1,707.3(611.5)	1,448.7(408.3)
Boyd	23.6(2.3)	21.4(3.0)	2,173.0(610.2)	2,025.9(441.2)
All areas	19.9 (4.0)	18.9(3.3)	1,855.6(646.3)	1,631.9(499.9)

[a]Standard deviation

other quarters ($X^2 = 6.26$, df. = 7, $p < .05$). This was probably because many cavities face the numerous roads and firebreaks in Fort Bragg. Unfortunately, it is not known whether the cavities or roads were present first. Beckett (1971) suggested that cavity excavation facing old roads is preferred by woodpeckers due to root damage to the cavity tree.

The number of hardwood stems around cavity trees were compared with the number around random trees. In both Weymouth Woods and Fort Bragg, there were significantly more ($p < .01$) stems around random trees than around cavity trees (Table 2). However, in the Boyd estate, the number of stems around cavity and random trees were almost equal. It appeared that in the first 2 areas red-cockaded woodpeckers preferred the more open

Table 2. Number of stems around cavity trees and random trees, chi-square values of their comparison, and number of stems per tree of each type in 3 study areas in North Carolina.[a]

	Weymouth Woods *N = 6*		*Boyd Estate* *N = 20*		*Fort Bragg* *N = 34*	
	quarter 1	*total quadrat*	*quarter 1*	*total quadrat*	*quarter 1*	*total quadrat*
Stems around cavity trees	22	113	277	1,023	238.3	1,097
stems around random trees	57	191	272	1,044	370	1,424
chi-square	15.5[a] ($p < .01$)	20.0[a] ($p < .01$)	0.04 ($p = .86$)	0.02 ($p = .68$)	28.5[b] ($p < .01$)	42.4[b] ($p < .01$)
stems per cavity tree	3.7	18.8	13.9	51.1	7.0	32.3
stems per random tree	9.5	31.8	13.6	52.2	10.9	41.9

[a]Denotes statistically significant chi-square value.

[b]Excludes hardwoods over 14.0 m. On each area an equal number of cavity and random trees were sampled.

areas with fewer stems. Most of the Boyd estate included dense vegetation, and many of the more open areas were where the hardwoods had grown tall enough to shade out many of the lower stems. Some of the random trees were in these areas, which could account for a comparable number of stems in this category as compared to cavity trees. Five hardwoods taller than 14.0 m were next to cavity trees, while 11 were next to random trees in the Boyd estate. In the other areas only 1 hardwood over 14.0 m was found next to a Fort Bragg random tree. The number of stems around cavity trees in each study area was different ($p < .01$) from the number in each other area. The Boyd estate had more stems than expected in comparison with Fort Bragg (quarter 1, $x^2 = 61.7$; total quadrat, $x^2 = 114.4$), while Fort Bragg had more stems than expected when compared with Weymouth Woods (quarter l, $x^2 = 8.8$; total quadrat, $x^2 = 30.4$). These results were not surprising since fire has been excluded from the Boyd estate for many years. Many of the stems at Fort Bragg were short, and a large number may be basal sprouts resulting from frequent fires.

Height Classes

All stems were put into their corresponding height class: 0.9-1.5 m, 1.6-3.0 m, 3.1-4.6 m. 4.7-6.1 m, 6.2-7.6 m, and 7.7 m and up, and the distribution of height classes around cavity trees was compared with that around random trees (Tables 3 and 4). The chi-square value for Weymouth Woods quadrat 1 ($x^2 = .16$, df. $= 3$) was not significant while that for all quadrats was significant ($p < .05$), but the sample size for quarter 1 is small. Of the total quadrat value ($x^2 = 12.5$, df. $= 5$) for Weymouth Woods, 52.3% was due to there being more stems over 7.6 m around random trees that around cavity trees, while 24.5% of the value is due to stems between 6.2 and 7.6 m high. In the Boyd estate, of the first quarter chi-square

Table 3. Percentage of understory stems per height class in .01 ha circles around cavity and random trees in 3 North Carolina study areas.

	Weymouth Woods		*Boyd Estate*		*Fort Bragg*	
Height class (m)	*Cavity*	*Random*	*Cavity*	*Random*	*Cavity*	*Random*
0.9 - 1.5	5	4	19	18	34	19
1.6 - 3.0	20	19	34	32	46	41
3.1 - 4.6	40	37	22	19	13	19
4.7 - 6.1	27	18	15	16	5	8
6.2 - 7.6	7	14	7	7	1	2
7.7 –	1	8	3	8	0	1
Chi-square	12.5[a]		23.5[a]		39.4[a]	

[a]Denotes statistically significant chi-square value.

Table 4. Percentage of understory stems per height class in the quarter centered on the cavity or potential cavity of cavity and random trees in 3 North Carolina study areas.

	Weymouth Woods		*Boyd Estate*		*Fort Bragg*	
Height class (m)	*Cavity*	*Random*	*Cavity*	*Random*	*Cavity*	*Random*
0.9 - 1.5	5	3	16	17	33	25
1.6 - 3.0	18	21	34	27	46	43
3.1 - 4.6	41	37	19	22	17	23
4.7 - 6.1	18	18	19	14	3	6
6.2 - 7.6	13	9	10	8	1	2
7.7 –	5	12	2	12	0	1
Chi-square	0.16		24.8[a]		11.8[a]	

[a]Denotes statistically significant chi-square value.

value ($x^2 = 24.8$, $p < .01$) 19.8 or 79.8% is due to the larger number of stems over 7.6 m near random trees. Of the total quadrat value ($x^2 = 23.5$, $p < .01$), 19.1 or 81.5% was due to the same reason. In these 2 areas it appeared that woodpeckers selected cavity trees with a small proportion of tall understory trees. The contributions to the chi-square values in Fort Bragg were not as clear ($x^2 = 11.8$, $p < .05$, for quarter 1; $x^2 = 39.4$, $p < .01$, for total quadrat). In the first quarter 39.2% of the chi-square value was due to more stems 4.7 - 6.1 m high near random trees than cavity trees, while 29% was due to more stems 0.9 - 1.5 m high near cavity than random trees. Stems above 6.1 m only contributed 8.5% probably because there are so few of them. The main contributions to the total quadrat chi-square for Fort Bragg were from the 0.9 - 1.5 m class (15.8%), the 3.1 - 4.6 m class (36.2%), the 4.7

- 6.1 m class (18.4%), and the class of 7.7 m and up (15.9%). All the classes higher than 3.0 m had more stems near random trees than expected. It appeared that since the high stems were not very numerous on Fort Bragg, woodpeckers selected cavity trees with surrounding vegetation characterized by a few stems of moderate height.

Chi-square tests were also done to determine whether there was a difference in height class distribution between study areas. Near both cavity and random trees in Weymouth Woods and near cavity trees in Boyd, there were fewer stems than expected below 3.0 m and more than expected above 3.0 m. Without exception there were fewer stems below 4.6 m and more above 4.6 m than expected near the Boyd random trees. Apparently the tall vegetation shaded out some of the stems below 3 m in Weymouth Woods and in the part of the Boyd estate where the woodpeckers were found. However, in other parts of the Boyd estate trees between 3.1 and 4.6 m were shaded out also, implying a taller understory. On the other hand, in Fort Bragg there were more stems below 3.0 m and fewer above 3.0 m than expected in every case. This is probably a result of the burning program which kills some of the young hardwoods, thus producing basal sprouts. It seems that the differences between study areas was due mainly to the large number of stems below 3.0 m in Fort Bragg and the numerous stems above 4.6 m in the Boyd estate.

Basal Area

An analysis of variance was used to compare the basal area of the understory around cavity trees and random trees and between areas. In quarter 1 and in all quarters the F values were significant ($p < .01$) for the variance between areas (quarter 1, $F = 37.4$; total quadrat, $F = 40.4$ and between cavity trees and random trees, (quarter 1, $F = 11.1$; total quadrat, $F = 11.5$). From the mean basal area (Table 5) it is clear that the basal area around random trees was larger than around cavity trees (119.3 $cm^2 >$ 11.53 cm^2 and 701.6 $cm^2 >$ 461.2 cm^2). Least significant difference tests were done to determine which areas had differences. The average basal area for Weymouth Woods was smaller than that for Boyd, but the difference was not significant. Mean basal area of stems in both Weymouth Woods and the Boyd estate was significantly larger than those of Fort Bragg. The F-test for the interaction between type and area was not significant (quarter 1, $F = 2.7$; total quadrat, $F = 1.2$). Thus, it appears that in all study areas red-cockaded woodpeckers preferred trees with an understory of a low basal area. A low basal area goes hand in hand with fewer stems and low understory height preferred by these birds.

Table 5. Mean total basal area (cm^2) of understory stems in .01 ha quadrats near cavity and random trees in three North Carolina study areas.

	Quarter 1			*Total quadrat*		
	cavity	*random*	*all quadrats*	*cavity*	*random*	*all quadrats*
Weymouth Woods	87.1	315.4	201.2	450.2	931.4	590.8
Boyd	243.2	359.3	301.2	846.9	1,161.0	1004.3
Fort Bragg	45.2	85.1	65.1	236.7	390.9	313.5
All areas	115.3	199.3	157.4	461.2	701.6	581.1

Correlation of Cavity Heights

Simple correlation tests were made to discover if there were any relationships between the cavity height and the cavity tree height or average understory height of the total quadrats. Crosby (1971) suggested the height of redheart infection in the trunk quadrats. Crosby (1971) suggested the height of redheart infection in the trunk and understory height and density as possible factors influencing the cavity height. Hopkins and Lynn (1971) also cited redheart availability as influencing cavity height and listed cavity tree height as an additional factor. Their data showed that average tree heights decreased by species in the following order: loblolly, longleaf, pond, and shortleaf, while the average cavity height for each species decreased in the same order. In the present study mean cavity tree height decreased in the following order: Boyd estate, Fort Bragg, Weymouth Woods, and the mean cavity heights per acre decreased similarly (Table 6). A highly significant positive correlation ($r = 0.61$, df. = 58) was found between tree heights and cavity heights. About 36% ($r^2 = 0.36$) of the variation in cavity heights was due to the tree heights. Average understory height (Table 6) did not decrease in the same order as the cavity heights since Fort Bragg contains the lowest average understory. However, average understory height was also shown to have a relationship with cavity height ($r = .515$, df. = 58). About 25% ($r^2 = 0.25$) of the cavity height ($r = 0.515$, df = 58). About 25% ($r^2 = 0.25$) of the cavity height variation was related to average understory height. We feel that average height was not an accurate measurement to use to determine the importance of the understory since it does not take into account the density or position of understory trees. An average height of 5 m might represent 30 trees of 5 m in front of the cavity hole or a 7 m and a 3 m stem behind the cavity. Also, while the cavity remains the same height after excavation, the understory continues to grow. This vegetation may still be acceptable, though not preferred by the woodpeckers.

Position of Hardwood Trees

There were not sufficient data to test the difference between stems directly in front of cavities or starts with those in front of "potential cavities." Of the 60 cavity trees in this study 2 had a stem in front of an active cavity. Both stems were more than 6 m away from the cavity. One was in the Boyd estate, the other in Fort Bragg. Of the 60 random trees 30 stems were in front of 19 of the "potential cavities." This was the case with 65% of the Boyd random trees, 50% of the Weymouth Woods trees, and 8.8% of those at Fort Bragg. Of the Weymouth Woods stems, all were more than 4.5 m from the "potential cavity." Of the Boyd stems, 9 were closer than 1.5 m to the "potential cavity." Thus, the Boyd estate offered the least open areas for future woodpecker cavities, while Fort Bragg offered the most. Naturally, a woodpecker could excavate a cavity on an open side of the tree rather than the west side, or above the average cavity height. These data do suggest that open access to cavities was preferred.

Understory Species

In the 60 quadrats used in analysis, 33 understory species were recorded (Table 7). The species occurring with the highest frequency was turkey oak followed by blackjack oak and persimmon. Longleaf pine occurred in many plots, but often only one stem was present per plot, and many were support stand pines. Some species, such as blackjack oak, mockernut hickory (*Carya tomentosa*), dwarf post oak and black oak (*Q. velutina*) tended to occur more often around random trees. Turkey oak, persimmon, and longleaf pine trees tended to be more common near cavity trees. Bluejack oak was only found in Fort Bragg, while species such as mockernut hickory, dogwood (*Cornus florida*), black oak, sassafras (*Sassafras albidum*), grape vines (*Vitis* spp.), and black gum (*Nyssa sylvatica*) were most common in the Boyd estate.

Understory species composition in woodpecker habitat shows considerable variation. For example, in Virginia, Steirly (1957) found the most common understory species to be black gum, red maple (*Acer rubrum*), sweet gum (*Liquidambar styraciflua*),

Table 6. Mean height (m) of red-cockaded woodpecker cavities, cavity trees, and associated understory on 3 North Carolina study areas.

Area	*Tree*	*Cavity*	*Understory (total quadrat)*
Weymouth Woods	15.6	5.6	3.2
Fort Bragg	18.6	6.4	2.0
Boyd	23.6	11.6	3.6
All areas	19.9	8.0	2.7

oak, wax myrtle (*Myrica cerifera*), holly (*Ilex* sp.), dogwood, huckleberry (*Vaccinium corymbosum*), and sweet pepperbush (*Clethra alnifolia*). In Florida, Crosby (1971) found saw palmetto (*Seranoa repens*) to be the most common understory species followed by gallberry (*Ilex glabra*), wiregrass (*Aristida* sp.), and wax myrtle. Usually these species were shorter than 1 m. Carter (1974) found bluejack oaks along with turkey oaks to be the msot common scrub oaks in the North Carolina Sandhills. Except for the greater frequency of bluejack oaks, his common understory species generally agreed with those found in this study.

In 2 studies (Hopkins and Lynn 1971, Thompson and Baker 1971) the actual species were not recorded, only the type of understory in woodpecker colonies (e.g. grass, shrubs, scrub oaks, etc.). Grass was the most common type in both studies.

It seems reasonable to suppose that the structure of the understory, rather than its species composition is important to the woodpeckers. From the previous paragraphs it is clear that a wide variety of species are common in different woodpecker areas. Even when common understory species were reported in a study (Steirly 1957, Crosby 1971, Carter 1974) the discussion did not include the possibility that species influenced the presence of the woodpeckers. Only the height and/or density was mentioned as a possible factor in influencing the bird's activity. This approach seems justified by the birds wide tolerance of understory species composition.

While Steirly (1957) reported that in southeastern Virginia red-cockaded woodpeckers were usually found in areas with dense understory, most authors reported open habitats. Crosby (1971) found that 80% of his sample plots in Florida contained ground cover less than 1 m tall; areas with ground cover over 1.5 m tall had been protected from fire. Crosby (1971) found woodpeckers feeding in areas with impenetrable understory 10 to 15 feet high, but never observed than feeding below the understory. Beckett (1971) reported that red-cockaded woodpeckers may cut new cavities higher in the same trees as the understory develops. Hopkins and Lynn (1971) made a subjective survey, recording the cavity understory as open, light, or dense, and also noted its type. The density was open under 61.8% of the cavities and light under 27.5%. Grass was found 48.0% of the time. They suggested the results may have been due to the fact that the total area was predominantly grass rather than due to a preference by the woodpeckers. Thompson and Baker (1971) reported that the understory in red-cockaded woodpecker colonies was usually less than 1.8 m apparently due to fire, and it was rarely higher than "half the average clear stem height of a timber stand." Carter (1974) felt that understory growth and logging were the leading causes for loss of the bird's habitat in southcentral North Carolina. He found few active cavities where access was hindered by the height or density of the understory. After Carter (pers. comm.) cleared the understory from an abandoned cavity, red-cockaded woodpeckers returned to it.

Table 7. Frequency of occurrence of species in random and cavity tree plots and in plots of 3 North Carolina study areas.

	frequency of occurrence in each study area			*occurrence in each type*		
Species[b]	*Weymouth Woods N = 12*	*Boyd N = 40*	*Fort Bragg N = 68*	*cavity N = 60*	*random N = 60*	*Total plots N = 120*
Q. laevis	7	31	50	48	40	88
Q marilandica	5	18	42	26	39	65
D. virginiana	4	28	31	34	29	63
P. palustris	12	23	25	34	26	60
C. tomentosa	3	32	16	17	34	51
Q. margaretta	2	20	25	14	33	47
C. florida	2	25	7	15	19	34
Q. velutina	1	19	9	9	20	29
S. albidum	1	19	4	13	11	24
Vitis spp.	0	22	2	11	13	24
N. sylvatica	2	19	0	9	12	21
Q. incana	0	0	15	7	8	15

[a]The following species occurred in less than 10 of the 120 plots: *Rhus copallina, Oxydendron arboreum, Prunus* spp., *P. taeda, Liquidambar styraciflua, Simplocus tinctoria, Viburnum nudum, Acer rubrum, Juniperus virginiana, Ilex vomitoria, Myrica heterophylla, Vaccinium* sp., *Amelanchier* sp., *Crataegus* sp., *Eleagnus* sp., Mimosa sp. *Mimosa* sp.

[b]Scientific names are from Radford et al. (1968).

CONCLUSIONS

This paper quantifies red-cockaded woodpecker preferences for open areas with few stems, a low proportion of tall hardwood trees, a low understory basal area, and lacking trees which block cavity access. The commonly found species near cavity trees in North Carolina were turkey and blackjack oaks, persimmon, and longleaf pine.

The study area most representative of these preferences was Fort Bragg Military Reservation. Fire was the principal factor that maintained these physical characteristics of the understory and prevented a hardwood succession. A limiting factor in Fort Bragg might seem to be the low number of old-growth trees. However, at least some of the woodpeckers appeared to be adapting by building cavities in younger trees (Carter 1974). The Boyd estate had many old-growth trees, but the physical characteristics of the vegetation were least like the preferences listed above. A program of burning and mechanical cutting of hardwoods, when necessary, is recommended in such cases to preserve the red-cockaded woodpeckers. Such a program is being employed at Weymouth Woods. At the time of the study cavity tree areas in Weymouth Woods had been recently control-burned, while not all random tree areas had been burned. This could have accounted for some differences between cavity and random tree understories, however, differences were clear in Fort Bragg and the Boyd estate where this had not occurred.

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