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Joseph C. Neal
Arkansas Cooperative Fish and Wildlife Research Unit

Warren G. Montague
Ouachita National Forest

PAST AND PRESENT DISTRIBUTION OF THE RED-COCKADED WOODPECKER *PICOIDES BOREALIS* AND ITS HABITAT IN THE OUACHITA MOUNTAINS, ARKANSAS

JOSEPH C. NEAL
Arkansas Cooperative Fish and
Wildlife Research Unit
SCEN 632, University of Arkansas
Fayetteville, AR 72701

WARREN G. MONTAGUE
Ouachita National Forest
Poteau Ranger District
P.O. Box 2255
Waldron, AR 72958

ABSTRACT

Within the past 15 years, at least 41 and probably more active cavity tree clusters (or colonies) of Red-cockaded Woodpeckers *(Picoides borealis)* have existed in remnant, mature shortleaf pine *(Pinus echinata)* woodlands in the Ouachita Mountains of Arkansas. These clusters were located on both private timberlands and in the Ouachita National Forest. Fewer than half of this number were still active in early 1991, and none remained on private timberlands. The species is presently restricted to the xeric, western margins of the Ouachitas in Scott and Polk counties within the confines of the Ouachita National Forest where it receives protection of the Endangered Species Act. The decline of *P. borealis* in the Ouachitas resulted from intense logging of old growth pine forests during the timber boom period, ca. 1910-1950, and from the suppression of natural fires, which subsequently allowed hardwoods to invade former pine woodlands.

INTRODUCTION

The Red-cockaded Woodpecker *(Picoides borealis)* is an endemic species of mature pine forests in the southeastern United States (Jackson, 1971; USFWS, 1985). Adult pairs, which typically remain in the same territories throughout the year, are called clans or groups. The cluster of cavity trees used by the group has been termed a colony or colony site (Ligon, 1970; USFWS, 1985), but some authors prefer the term cluster because colony has a different and well-established meaning in ornithological literature (Walters *et al.*, 1988).

P. borealis was listed as an endangered species in 1970 (35 Federal Register 16047) due to a significant rangewide decline in numbers which resulted from decreased in quality and quantity of mature pine woodlands (Jackson, 1971; Lennartz *et al.*, 1983). A remnant population of Red-cockaded Woodpeckers still occurs on public lands in the western Ouachita Mountains of Arkansas and Oklahoma where habitat is managed to favor the species (USFWS, 1985; ODWC, 1991).

The question of the occurrence of this species, and the nature of its essential open pine woodland habitat, is potentially controversial because of a larger controversy about management of the Ouachita National Forest. This controversy involves advocates of clearcutting or even-age forest management and those who favor single-tree-selection or uneven-age forest management (Griffee, 1989; Arkansas Democrat, 1989). A basic element of this controversy concerns historical questions about vegetation composition and condition of forest stands in the Ouachitas and how these stands should be managed today. These questions have a direct bearing on present and future techniques of habitat management for the Red-cockaded Woodpecker (ONF, 1990; Anon., 1989).

STUDY AREA

The Ouachita Mountains (and the Ozark Plateaus to the north) comprise the Interior Highlands, which are the only extensive mountainous topography at the Arkansas latitude between the Appalachian Mountains to the east and the Rocky Mountains to the west (Fenneman, 1938; Foti, 1974; James and Neal, 1986). The Ouachitas are approximately 97 km (60 miles) in width and approximately 400 km (250 miles) in length, extending from Little Rock, Arkansas, westward to Atoka, Oklahoma (Fenneman, 1938). The total extent of the Ouachitas in Arkansas and Oklahoma is estimated at about 2.9 million ha (11,000 square miles) (Smith, 1986b) of which 648,000 ha (1.6 million acres) is included within the boundaries of the Ouachita National Forest.

The climax vegetation of the Interior Highlands is the Oak-Hickory Forest. On some sites within this forest, shortleaf pine is codominant with oak-hickory. Pure pine stands occur on sites unfavorable for growth of hardwoods as a result of a variety of factors (Mattoon, 1915; Little and Olmstead, 1931; Turner, 1935; Braun, 1967). The presence of pine in the Oak-Hickory Forest represents a subclimax maintained by fires (Odum, 1959) which have long been a feature of the Ouachitas (Little and Olmstead, 1931; Deaderick, 1938; Albert, 1981; Foti and Glenn, 1991).

The mountain-forming processes in the Ouachitas produced a series of directional folds evident as east-west ridges which cross the region. These ridges produce a variety of microclimates on the north-facing and south-facing slopes. The more protected north slopes have a climate most conducive to hardwoods. The south slopes are exposed to summer sun and hot, dry summer winds that produce desiccating conditions unfavorable to shortleaf pine or mixed forest types (Mattoon, 1915; Foti, 1974; Braun, 1967). In the Ouachitas, these conditions fostered what has been called the greatest shortleaf pine forest in the world (Smith, 1986a,b) and provided habitat suitable for Red-cockaded Woodpeckers and other species adapted to the fire subclimax.

METHODS

During 1989 and 1990 we surveyed all known Red-cockaded Woodpecker cavity tree clusters on the Poteau, Cold Springs, Mena, and Fourche Ranger Districts of the Ouachita National Forest in western Arkansas. We also checked inactive clusters further east in the Ouachita National Forest. Area searches were undertaken to discover new cavity trees as well as new woodpecker groups. A determination was made about whether or not cavity trees within each cluster were active or inactive (Jackson, 1977).

In spring 1990, prior to the Red-cockaded Woodpecker breeding season, a cooperative effort involving personnel from the Ouachita National Forest, University of Arkansas (including the Arkansas Cooperative Fish and Wildlife Research Unit and personnel from the Department of Zoology), Arkansas Natural Heritage Commission, Arkansas Audubon Society, Nature Conservancy, Arkansas Game & Fish Commission, U.S. Fish and Wildlife Service, and Forest Service volunteers surveyed all known active cavity tree clusters. All known Red-cockaded Woodpeckers in the forest were subsequently trapped and banded.

Literature searches (Jackson, 1978; James, *et al.*, 1981; James and Neal, 1986, 1989; unpub. data from Ouachita National Forest ranger districts) provided data about woodpecker distribution within the Arkansas Ouachitas. We queried the Arkansas Natural Heritage Commission's Inventory Research files of the Arkansas Ouachitas. Bird records maintained on file cards by the Arkansas Audubon Society provided data about Red-cockaded Woodpecker sightings. We conducted telephone interviews with personnel from the Ouachita National Forest, Weyerhaeuser Company, and members of the Arkansas Audubon Society.

In order to understand historical habitat conditions potentially suitable for Red-cockaded Woodpeckers, we searched literature for specific details and references about occurrences of fires that would have produced open pine woodlands in the Ouachitas. Literature concerning commercial logging of the Ouachitas was consulted since extensive logging would indicate former abundance of pine habitat.

RESULTS

In Tables 1and 2 we present a listing of past and present distribution of the endangered Red-cockaded Woodpecker in the Ouachita Mountains of Arkansas. This updates several previous reports about this woodpecker's status in the Arkansas Ouachitas (James, *et al.*, 1981; Burnside, 1983; James and Neal, 1986, 1989). Regrettably, no information is available about this species in the Arkansas Ouachitas predating a few Arkansas Audubon Society file reports in the 1960s. Private timber company records which might better document earlier occurrences in the eastern Ouachitas probably no longer exist (Tony Melchiors, pers. comm.). The Ouachita National Forest has very few records of Red-cockaded Woodpeckers before the 1960s (John McLemore, pers. comm.). Hence the decrease of Red-cockaded Woodpecker numbers we document here reflects only part of the decline of the species in the Arkansas Ouachitas.

Table 1. Formerly active cavity tree clusters of Red-cockaded Woodpeckers in the Ouachita Mountains, Arkansas.

1. Saline Co. T2N R18W. Active 1981 (JHB).
2. Saline Co. T1N R18W. Active 1981 (JHB).
3. Perry Co.* T2N R21W S3 (C654). Active 1981 (JHB, TM).
4. Perry Co.* T3N R19W S28 (C1424). Active 1981 (JHB, TM).
5. Perry Co. T3N R20W S22. Active 1981 (JHB).
6. Montgomery Co. T1N R23W S30. Inactive 1981 (DS).
7. Montgomery Co. T1S R24W S18. Active ca. 1976 (JD).
8. Yell Co. T2N R22W S23 (C634). Inactive 1981 (JHB).
9. Yell Co. T2N R24W S24. Inactive 1981 (JHB).
10. Yell Co. T1N R23W S9. Inactive 1980 (DS).
11. Yell Co. T2N R23W S21 (C605). Inactive 1980 (DS).
12. Yell Co. T2N R23W S21/22 (C606)**. Inactive 1980 (DS).
13. Yell Co. T1S R21W S4 (C647). Inactive 1980 (DS).
14. Clark Co. T7S R22W. Inactive 1981 (JHB).
15. Polk Co. T1S R32W S20. Inactive 1981 (JHB).
16. Polk Co. T1S R30W S23. Inactive 1981 (JHB).
17. Scott Co. T1N R27W S13/14. Inactive 1976 (JD).
18. Scott Co. T1N R31W S14 (C821). Inactive Jan. 1989 (JM).
19. Scott Co. T1N R32W S1 (C1282 S38). Active 1988 (WM).
20. Scott Co. T2N R31W S21 (C1265 S12). Active 1981 (WM).
21. Scott Co. T2N R30W S20 (C1251 S12). Inactive 1990 (WM).
22. Scott Co. T2N R30W S27 (C 1260 S30/6). Active 1982 (WM).
23. Scott Co.* T2N R32W S24 (C1254). Inactive 1979 (WM).
24. Scott Co. T2N R32W S26 (C1261 S5). Active May 1979 (WM).
25. Scott Co. T2N R32W S26 (C1267 S5). Inactive 1979 (WM).
26. Scott Co. T2N R33W S24 (C1267 S14). Inactive 1979 (WM).
27. Scott Co. T2N R32W S30 (C1266 S14). Inactive 1979 (WM).
28. Scott Co. T2N R31W S20 (C1253 S7). Active May 1981 (WM).
29. Scott Co. T2N R31W S8 (C1243 S5). Inactive 1978 (WM).
30. Scott Co. T2N R31W S15 (C1244 S11). Active 1979 (WM).
31. Scott Co. T2N R31W S14 (C1244 S5). Inactive 1979 (WM).
32. Scott Co. T2N R30W S31 (C1274 S13). Inactive 1978 (WM).
33. Scott Co. T2N R30W S29 (C1261 S23). Active May 1980 (WM).
34. Scott Co. T2N R30W S20 (C1261 S1). Inactive 1978 (WM).
35. Scott Co. T2N R30W S35 (C1273 S10). Inactive 1978 (WM).
36. Scott Co. T2N R29W S22 (C1256 S5). Inactive 1979 (WM).
37. Scott Co. T1N R28W S5 (C1293 S20). Active May 1979 (WM).
38. Scott Co. T1N R25W S6 (C1294 S10). Active 1979 (WM).
39. Scott Co. T2N R29W S29 (C1257 S21). Active 1979 (WM).
40. Scott Co. T1N R30W S13 (C1305 S11). Inactive 1980 (WM).
41. Scott Co. T3N R28W S33 (C294). Inactive 1979 (WM).

Location includes county, legal description and Forest Service compartment (C) and stand (S) numbers where appropriate (or where available) followed by last known date when the site was active or known to have become inactive. JHB=James, Hart and Burnside 1981; WM=Warren Montague; DS=Dave Saugey; JM=Jim Mawk; TM=Tony Melchiors; JB=Joe Dabney. *=cavity tree cluster on private land **=May have been two clusters rather than one.

Table 2. Locations of active Red-cockaded Woodpecker cavity tree clusters as of March 1991 in the Ouachita Mountains, Arkansas.

1. Scott Co. T2N R29W S20. (C1257 S28)*
2. Scott Co. T2N R29W S20. (C1257 S20)*
3. Scott Co. T2N R29W S20. (C1259 S14)*
4. Scott Co. T2N R30W S28. (C1261 S7)*,*****
5. Scott Co. T2N R30W S27. (C1261 S8)*
6. Scott Co. T2N R31W S20. (C1253 S5)*
7. Scott Co. T2N R31W S10. (C1244 S12)*
8. Scott Co. T2N R31W S22. (C1252 S25)*
9. Scott Co. T2N R31W S36. (C1274 S9)*
10. Scott Co. T2N R28W S10. (C323 S23)*
11. Scott Co. T2N R28W S10. (C323 S13)*
12. Scott Co. T2N R28W S8. (C326 S14)*
13. Scott Co. T2N R29W S29. (C1257 S22)**
14. Scott Co. T2N R28W S3 (C323 S14)*** (discovered 24 Jan. 1991)
15. Scott Co. T2N R30W S29 (C1262 S12)****
16. Polk Co. T1S R29W S19 (C862 S25)*** (discovered December 1990)

All active clusters were located within the boundaries of the Ouachita National Forest. Location includes legal description, plus Forest Service compartment (C) and stand (S) designations. *=clan nested in 1990; **=clan did not nest in 1990; ***=new clan December 1990; ****=single female captured and moved (16 March 1990), cluster now inactive; *****=cluster apparently became inactive after 14 November 1990.

Table 1 lists 41 inactive cavity tree clusters in the Arkansas Ouachitas which are either: (1) inactive with no evidence of former Red-cockaded Woodpecker activity; or (2) inactive at present, but having at least some evidence of former Red-cockaded Woodpecker activity. Last known date of activity is provided. Some sites, especially those in the eastern Ouachitas, were active for a few years longer, but no documentation exists to this effect. Activity in Red-cockaded Woodpecker cavity tree clusters in the western Ouachitas has been well-documented since the late 1970s.

Surveys of Red-cockaded Woodpecker cavity tree clusters from June 1990 to March 1991 in the Ouachita National Forest of western Arkansas documented 16 clusters with 15 of the associated groups having a minimum of a male-female pair (Table 2). Of these 16 clusters, 12 had nesting pairs in the 1990 season. An unpaired female in one cluster was captured and moved into another cluster where there were two males but no female. While this caused the loss of one active site, it resulted in egg laying in another site when the female paired with one of two bachelor males. By March 1991, two new groups had been discovered and one formerly active cluster had apparently become inactive. All active clusters of cavity trees are in Scott or Polk counties, Arkansas.

Our literature searches showed that a number of writers in the past have described habitat in the Ouachita Mountains that would now be recognized as fire subclimax woodlands suitable for Red-cockaded Woodpeckers. They reported extensive pine stands (Nuttall, 1821; Mattoon, 1915; Bruner, 1931; Deaderick, 1938; Smith, 1986 a,b) and frequently referred to natural fires. We also found eyewitness references to pure pine stands (Mattoon, 1915; Bruner, 1931; Turner, 1935) which are clear indications that this classical Red-cockaded Woodpecker habitat existed in past years in the Ouachitas.

DISCUSSION

The original decline of the Red-cockaded Woodpecker probably resulted from logging booms that virtually eliminated virgin pine stands in the Southeast by the 1930s (Smith 1986 a,b; Jackson, 1988). Suppression of fire, which naturally maintained pine dominance in certain stands, permitted widespread development of hardwood midstories and eventual replacement of pine stands by hardwoods (Mattoon, 1915; Bruner, 1931; Liming, 1946). Modern timber management practices, which favor short rotation periods, have further reduced the once extensive mature pine woodland (Mattoon, 1915; James and Neal 1986, 1989; Jackson, 1988).

Fire is a key natural feature in the evolution of the Red-cockaded Woodpecker and its habitat (Jackson, 1971, 1988). Fires in the Southeast are often set by lightning (Komarek, 1973). Fires that sweep through these forests naturally exclude development of hardwood understories and midstories, thereby maintaining the open stands of fire-resistant large pines

(Odum, 1959) required by this woodpecker (USFWS, 1985; Jackson, 1988). A notable feature of this fire subclimax forest is a Pleistocene relict grassland of characteristic grasses, herbs, and legumes present in regularly burned pine forests throughout the Southeast (Komarek, 1968). The term savanna has been applied to these open canopy forests with graminoid-dominated understories maintained in a subclimax condition by fire (Penfound and Watkins, 1937; Penfound, 1962; Christensen, 1988), but the term woodland is more appropriate in the forest-like situations of the Ouachitas (D. James, pers. comm.). The adaptation of the Red-cockaded Woodpecker to this fire subclimax regime makes it a unique indicator of the system (Jackson, 1987).

Studies of the development of forests in the western Ouachitas have established that pine became a notable feature of the Oak-Hickory Forest approximately 1600 years ago (Albert, 1981; Albert and Wyckoff, 1984). Charcoal deposits in the western Ouachitas provide evidence of periodic widespread fires which favored the spread of both oak and pine woodlands. In the era before modern fire suppression, researchers estimated that from one-third to three-fourths of the Oklahoma Ouachitas were burned annually (Little and Olmstead, 1931). There is good documentation of the frequent occurrence of fire on a study site in Hot Springs National Park, ca. 1800 (Foti and Glenn, 1991). Fire seems to have occurred there at an interval of about 27 years per hectare; the mean fire-return interval from 1788-1817 was 7.25 years, based upon fire scars on an old shortleaf pine tree. Foti and Glenn (1991) conclude that shortleaf pine was ubiquitous in the pre-settlement forests of the Ouachitas, with most pines occurring on south aspects and intermediate slopes, but also with a surprising number on northwest slopes. Hardwoods, primarily oaks, were also a major component of most sites.

Fire may have created the pine stands seen by early travelers like Thomas Nuttall (1821) who saw "pine hills," "lofty pine hills," and "hills in this cove, which abound with pine" in the Kiamichi region of southeastern Oklahoma. Other natural agents were also at work in shaping the forest community. Mattoon (1915) described the destructive path of a tornado near Womble in Montgomery County, Arkansas, that flattened an area 14 miles long by one-half mile wide; it eventually regrew as an even-age pine stand. Turner (1935) also described pure pine stands in Howard County, Arkansas, that resulted from wind damage. Bruner (1931) described basically pure stands of pine, with trees 10-15 inches in diameter in even-aged stands. Deaderick (1938), a student of the Ouachita's avifauna, wrote that almost the entire Hot Springs area was covered with second growth shortleaf pine and that 75% of Garland County was once pine forest. He also noted that fires occurred often enough "to sweep the ground cover of the pine woods clean."

In a treatise about shortleaf pine based upon data drawn extensively from the Arkansas Ouachitas, Mattoon (1915:4) notes that,

> Shortleaf is very well adapted for growth in pure stands, and it occurs extensively in this form of forest. The stands are usually not continuous over large areas, but are separated by mixed stands of pines and hardwoods. Stands of pure shortleaf pine once covered a much larger area than at present. It should be doubtful whether shortleaf is now found in pure type on more than from 20 to 40 percent of its former range.

Based upon logging records, Smith (1986b) estimates that approximately 1.3 million ha (5000 square miles) of the 2.9 million ha (11,000 square miles) of the Ouachita Mountains were probably cut over during the logging boom. Photographs of log yards and log trains published by Smith (1986a) show massive pines with the darkened heartwood typical of mature pines infected with the heartwood decaying fungus *Phellinus pini*. Such trees are frequently selected by Red-cockaded Woodpeckers for cavity construction (Conner and Locke, 1982). Smith (1986b) states that photographs from the period 1900 to 1948 show pine logs ranging from 12 to 28 inches in diameter. A report written for the Weyerhaeuser Company concerning the history of Ouachita logging operations it acquired from the Dierks Company indicates that trees less than 30 cm (12 inches) in diameter at breast height were not cut during logging of the virgin forest (Anon., ca. 1970). Mattoon (1915) notes that about 11% of virgin shortleaf pine logs were infected with heart rot, and that these trees ranged from 60 to 180 years in age, with some being over 200. These old trees would have been suitable for Red-cockaded Woodpeckers and some of the smaller trees that survived the first cut eventually provided replacement cavity trees for the remnant population of woodpeckers.

We infer that when natural disasters occurred on southern aspects, it was likely that the new openings in the forest were colonized by shortleaf pine, probably as even-age stands as discussed by Turner (1935). The fire adaptation of shortleaf pine (Mattoon, 1915) meant that fire-created openings were reestablished as pure stands of pine. Therefore, while the total amount of suitable habitat for a once more widespread and numerous population of Red-cockaded Woodpeckers isn't known, stands of pure pine or pine woodlands existed historically and within recent times. Wood's (1977) documentation of 29 active Red-cockaded Woodpecker clans and cavity tree clusters on 3,795 ha of virgin pine-oak forest in the McCurtain County Wilderness Area suggests how dense the population of woodpeckers may have been prior to the logging boom and the suppression of fire in the Ouachitas.

When the Arkansas (later renamed Ouachita) National Forest was established in 1907, both public and private lands were included within its boundaries. Much of the public land included the core areas of the Ouachitas, especially mountain ridges, narrow canyons, and some wide valleys with difficult access (Smith, 1986a). We hypothesize that the inaccessibility of some of these areas inhibited timber removal during the original logging boom. Remaining trees were most likely older suppressed trees with small diameters that were common in this forest (Mattoon, 1915). Many of these suppressed trees were bypassed in the cutting. Removal of the dominant trees released these suppressed trees for renewed growth. As these once suppressed trees grew larger, they became available as Red-cockaded Woodpecker cavity trees.

The eastern region of the Ouachitas is poorly represented by records of Red-cockaded Woodpeckers. Historically, however, the species was widespread to the west, south, and southeast of the Arkansas Ouachitas (Hooper *et al.*, 1980; James and Neal, 1986). The large-scale railroad map presented by Smith (1986a) illustrates that many areas in the eastern and central Ouachitas were accessed by an extensive web of railroad lines which carried pine logs to mills. Habitat of the woodpecker was rapidly cut. The situation in the western Ouachitas may have been somewhat different. Active clusters remain only in that section of the Ouachitas called the Fourche Mountains in Arkansas and the Kiamichi Mountains in Oklahoma (Fenneman, 1938). The Fourche-Kiamichi comprises the region's highest and most massive mountains and includes those sections of McCurtain County, Oklahoma, and Scott and Polk counties, Arkansas, where active clusters remain. We hypothesize that this rugged terrain may have hindered logging such that isolated pockets of habitat and scattered suppressed trees survived, thus providing habitat for a remnant population of woodpeckers. The preservation of the McCurtain County Wilderness Area in 1917 (Masters *et al.*, 1989) and its associated virgin pine and pine-oak forest, explains survival of the species there.

Prescribed fires in the Ouachita National Forest are used routinely for Red-cockaded Woodpecker habitat management. Fire suppression in the McCurtain County Wilderness area led to development of dense hardwood midstories and probable loss of half of the Red-cockaded Woodpecker groups (Wood, 1977; Masters *et al.*, 1989). Prescribed fire is being incorporated into future management plans (Oklahoma DWC, 1991). Retention of the current population of Red-cockaded Woodpeckers in the Ouachitas will require continued special attention to habitat management in this 3-county area which straddles the Arkansas-Oklahoma border. Forest management which replicates the open pine woodland condition of the past will be the most effective way of promoting recovery expansion of the Red-cockaded Woodpecker.

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