# FINAL PERFORMANCE REPORT



**Federal Aid Grant No.  F17AP00203 (E-21-22)**

**Red-cockaded Woodpecker Recovery
on the McCurtain County Wilderness Area**

**Oklahoma Department of Wildlife Conservation**

**April 1, 2017 – March 31, 2019**

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**State:** Oklahoma                                          **Grant Number:** F17AP00203 (E-21-22)

**Grant Program:** Endangered Species Act Section 6

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**Project Leader**: Matt Fullerton, Oklahoma Department of Wildlife Conservation

## A. ABSTRACT:

Recovery efforts were conducted for the Red-cockaded Woodpecker (RCW) population on the McCurtain County Wilderness Area (MCWA) in accordance with the 1991 MCWA Management Plan and the U.S. Fish and Wildlife Service Red-cockaded Woodpecker Recovery Plan (USFWS 2003).  The number of active clusters occupied by Red-cockaded Woodpeckers on the MCWA was 13, which has remained unchanged since 2015. Similarly, the single active cluster on the adjacent Broken Bow Unit of the Ouachita National Forest remained active during the period. No budding was observed during the 2017 – 2018 period, thus the total number of active clusters in Oklahoma is 14. The number of potential breeding groups (PBGs), as well as clusters that attempted to nest was 14 during both the 2017 and 2018 seasons.

Active clusters were monitored at an interval of approximately 8 weeks throughout the year and more frequently during the nesting season.  During the 2017 nesting season, 11 nesting attempts were documented, with 31 eggs laid and 23 hatched. Fourteen nestlings successfully fledged (2 males, 10 females, and 2 unknown). Due to personnel constraints, trapping of adult and hatch year RCWs was extremely limited in 2017; two birds were captured at cluster C2, an adult male on 09/12/17 and an adult female on 09/14/17. During the 2018 season, 39 eggs were laid of which 24 hatched, with 16 nestlings banded. A total of 11 nestlings successfully fledged in 2018 (4 males, 6 females, 1 unknown). For the 2018 nesting season, 11 PBGs attempted to nest, with 40 eggs laid collectively, 16 nestlings banded, and 11 nestlings successfully fledging.

As part of a study measuring ecological constraints for RCWs in the Ouachita Mountains, we obtained various measurements from 63 occupied (active) and 337 unused, nearby trees from both the McCurtain County Wilderness Area and Ouachita National Forest. Ten different metrics were analyzed to determine which attributes could best predict RCW selection for cavity excavation. Two models were strongly supported and collectively contained two variables: canopy openness at 0.5 meters and crown area. Both variables were positively correlated with RCW suitability.

## B. BACKGROUND:

In Oklahoma, the last known population of Red-cockaded Woodpeckers (RCWs) resides within both the state-owned McCurtain County Wilderness Area (MCWA) and an adjacent tract of the Ouachita National Forest that borders the western edge of the MCWA.  The narrow range of suitable habitat for this species is limited to mature pine woodlands and savannahs.  In the Ouachita Mountains, which comprise the northwestern most extension of its range, the RCW is

found in mature shortleaf pine woodlands with a grassy understory dominated by bluestem species (*Andropogon* sp.).  Over the past century, the RCW population in the Ouachita Mountains has declined as a result of habitat degradation.  Widespread logging in the early part of the twentieth century eliminated many of the mature pine stands which supported RCW clusters.  Through the rest of the century, the remaining pockets of mature pine habitat declined in quality as a result of fire suppression and the subsequent increase in mid-story vegetation.  The population on the MCWA declined from approximately 28 active clusters in 1977 (Wood 1977) to 15 in 1990 (Kelly et al. 1994).  Since 1992, the Oklahoma Department of Wildlife Conservation has been implementing a management plan to recover the Red-cockaded Woodpecker population on the area and the surrounding portions of the Broken Bow Unit of the Ouachita National Forest.

Despite intensive population management and habitat restoration, population growth has been a recurring issue in Oklahoma. Throughout its range, several studies have determined that the RCWs require living, mature (>60 years of age) pine trees infected with Red Heart fungus for cavity excavation (Jones & Ott 1973, Jackson 1977, Conner & O'Halloran 1987). While a sufficient number of suitable trees appear to be present on the MCWA, other constraining factors may exist that limit population growth and expansion. Research is needed to determine the limiting factors acting on this population. In addition to population monitoring and habitat restoration, ODWC is examining occupied vs. unoccupied trees on both the MCWA and nearby Oklahoma, Poteau, and Cold Springs Districts of the Ouachita National Forest as they relate to habitat selection of RCWs in the northwest edge of their occupied range. Results of such analyses could greatly inform management and recovery for this species in the Ouachita Mountains ecoregion.

## C. OBJECTIVES:

1) A Red-cockaded Woodpecker Potential Breeding Group (PBG) is composed of at least 1 male and 1 female, regardless of age or breeding status (PBGs can also include helper birds that assist with the raising of broods). During this grant segment, we hope to achieve the goal of one new PBG within the Oklahoma RCW population, bringing the total number of PBGs in Oklahoma from 13 to 14, by the end of the grant segment.

2) Mechanical thinning of hardwood trees throughout the McCurtain Co. Wilderness Area is required to supplement prescribed fire. This maintains an open midstory habitat, allowing mature pines to dominate the landscape, both of which are requirements for the Red-cockaded Woodpecker population to expand.

3) Research has shown that Red-cockaded Woodpeckers typically select for the most mature pine trees possible that have been infected with red heart fungus for cavity excavation. However, it is unknown how woodpeckers select for suitable habitat within an area where old-growth trees (>150 years old) are not a limiting factor. Within this objective, individual occupied cavity trees will be measured to determine their characteristics (diameter at breast height, height at top of crown, age, etc.); unoccupied shortleaf pines will also be measured for comparison.

## D. PROCEDURES:

Monitoring
New cavity trees, when located, are tagged and mapped. The status of cavity trees and clusters are determined at least twice annually, including immediately prior to each nesting period.  Adult Red-cockaded Woodpeckers and nestlings are banded to obtain data on production changes,

dispersal, and mortality and to aid in identification of single bird clusters that may be suitable for future augmentations.

Cluster Stand Management
The density of hardwood mid-story and understory trees is reduced as needed within a 10-acre block surrounding each active cluster.  Hardwood mid-story trees within each cluster stand are controlled by both mechanical cutting and prescribed fire (prescribed burns were conducted under a separate grant funded through the Wildlife Restoration Act program).

Recruitment Stand Management
Recruitment clusters are developed and maintained in portions of the Wilderness Area within 1/4 mile to one mile of active clusters, and each recruitment stand is provisioned with at least three artificial cavity inserts.  Recruitment stand locations are in areas where the habitat within and surrounding each recruitment stand is as similar as possible to the habitat found at the active clusters**.**

Corridors
Where needed and feasible, corridors are developed and maintained between clusters and recruitment stands.

Restrictors and Predator Guards
Restrictor plates are placed on Red-cockaded Woodpecker cavities to prevent enlargement by other woodpecker species (e.g. Pileated) and to rehabilitate previously enlarged cavities.  Predator guards are installed and maintained on all active cavity trees.  Southern Flying Squirrels (*Glaucomys volans*) and other species that may usurp RCW cavities are removed as they are discovered during bi-monthly cavity checks.

Artificial Cavities
Cavity inserts are installed in active cluster stands to provide at least five usable cavities at each site.  Each recruitment cluster contains a minimum of three artificial inserts; upon activation by dispersing Red-cockaded Woodpeckers, two or three additional inserts are installed.

Augmentation
Translocations are implemented to both help bolster small populations of Red-cockaded Woodpeckers and maintain genetic diversity. Single bird clusters are identified and birds from donor populations may be translocated to complete pairs at those clusters; however, this is contingent upon both the availability of suitable birds in donor populations and U.S. Fish and Wildlife Service approval.  Juvenile pairs may also be translocated to the MCWA when population conditions (such as population declines) warrant and when RCWs are available to move from donor populations.

Future translocations, however, may become logistically challenging.  As a result of administrative and financial changes within the U.S. Forest Service, two donor population sites on National Forests in Arkansas and Texas may no longer be eligible to donate birds because of the lapse in banding and monitoring of the population for one or more years. Since a monitoring gap exists, cluster composition and identification of suitable birds for translocation is unknown.  According to U.S. Fish and Wildlife Service guidelines, birds to be translocated must be subadults; if birds are not outfitted with bands, neither age nor sex can be determined.

Cavity Tree Selection Study
In collaboration with Oklahoma State University, a research project was initiated in 2017 to

determine what attributes of shortleaf pines (*Pinus echinata*) influence selection for cavity excavation by RCWs. We visited all active RCW clusters throughout the year to confirm that cavity trees were being occupied by woodpeckers based on the presence of an appropriate-sized cavity entrance and visible resin flow above and below the cavity entrance (Ligon 1970).

A total of ten different forestry measurements were obtained from both active (occupied) and nearby, used trees; these included diameter at breast height (dbh), diameter at average cavity height, age, total height, height-to-live-crown, crown area, percent canopy cover, surrounding basal area of pine trees, surrounding basal area of deciduous hardwood trees, and surrounding total basal area of all trees. To calculate crown area, we measured canopy diameter at the base of the tree from north to south and east to west, and then used the formula for an ellipse ($A = \pi ab$). Additional measurements obtained for RCW-occupied trees included cavity height and cavity directional orientation. For all diameter measurements, we used a pair of 500mm forestry calipers. Height measurements were taken using a laser hypsometer, while crown diameter was measured using metric tape. To estimate age of individual trees, we used an increment borer to extract tree cores.

Among the 400 trees used in the study, 63 were active natural cavity trees and 337 were unused, randomly selected trees that were measured for comparison. All locations of measured trees were marked with a GPS unit to be later mapped out using ArcGIS software. Percent canopy cover was obtained by analyzing canopy photos through WinScanopy Pro 2006 (Regent Instruments, Quebec City, Quebec), a program designed to extract measurements from such images (Fig. 5).

For the statistical analysis, we created binomial Generalized Linear Mixed Models (GLMMs) in the program R (R Core Team 2017). We set "status" (active or random) as the response and treated "cluster" as a random effect. We conducted pairwise correlation tests among all ten of the above-described predictor variables. Following elimination of correlated variables, we constructed candidate models for each individual response variable. We then used a model comparison approach using Akaike Information Criterion (AIC, Burnham, Anderson 2002) to determine which tree variable(s) had the strongest statistical effect on predicting RCW use.

To characterize active cavity trees, we used descriptive statistics (i.e. mean, range, standard deviation) and also performed a chi-square goodness-of-fit test to determine if cavity orientation was equally distributed across four directional compass bearings (Northeast, Southeast, Southwest, Northwest).

## E. RESULTS AND DISCUSSION:

I. RESULTS

Population Monitoring
Fourteen clusters, including the active cluster adjacent to the McCurtain County Wilderness Area on the Broken Bow Unit of the Ouachita National Forest (ONF), were active during the 2017 - 2018 reporting period. During the 2017 nesting season, 11 nesting attempts at 11 clusters resulted in 31 eggs of which 23 hatched. No nesting activity was detected at clusters C210, C1201, or CE1. A total brood loss occurred at cluster C112. We were unable to determine the cause for this nest failure. Eight nesting attempts were successful and 14 young (2 males, 10 females, and 2 of unknown sex) were fledged. For 2018, 11 PBGs attempted to nest (see Fig. 3, Appendix). A total of 40 eggs were laid, with 24 hatching. Sixteen (16) nestlings were banded at 7 days of age and 11 survived to fledging for the 2018 nesting season.

In previous years, attempts have been made to capture every individual RCW and record its capture and condition.  Fledged birds from that year's breeding season are outfitted with a unique set of color bands on each leg, with a unique color combination of bands chosen each year by ODWC personnel (Fig. 12).  Due to personnel constraints, trapping of adult RCWs during fall was extremely limited during the grant segment. Two birds were captured at cluster C2, an adult male on 09/12/17 and an adult female on 09/14/17.

Cluster Stand Management
During the two year reporting period, the total number of active clusters was 14 (Fig. 2). In 2018, 26 of the 39 natural cavities at active clusters were active, while only 10 of the 57 inserts were used. All usable natural cavities at active and inactive clusters have been restricted at the cavity entrances with metal plates that prevent destruction of entrances by species such as Pileated Woodpeckers. Active cavity trees are also outfitted with 2-3 foot sections of aluminum flashing that serve as predator guards to protect against climbing species such as ratsnakes (*Pantherophis* sp.).  During the reporting period, metal predator flashing was added to a new natural cavity tree at cluster C210.  In addition, a new restrictor was installed at a newly discovered natural cavity tree in C111. Cavity inserts were maintained at both currently active and unoccupied recruitment stands in preparation for future RCW territorial establishment via natural dispersal (Fig. 3).

A natural cavity tree was destroyed during the reporting period by a lightning strike in cluster C202.  An older, inactive natural cavity tree was also lost in cluster C37, presumably from a severe weather event.

Habitat Management

- *Hardwood Mid-story Thinning and Corridors*
  No additional corridors to connect clusters and recruitment stands were developed during this grant period. Mechanical thinning of mid-story hardwood vegetation continued as a supplement to prescribed fire treatment on the MCWA. Approximately 233 acres were re-thinned during the 2017 - 2018 reporting period. No large-scale mid-story hardwood thinning occurred during 2018 – 2019, though selective removal of trees occurred in and around active cavity trees and recruitment stands.

- *Prescribed Burning*
  Approximately 7,190 total acres were burned during March 2018 through a prescribed fire conducted jointly between ODWC and the U.S. Forest Service, with 5,790 acres on the MCWA and 1,400 on the Ouachita National Forest (Fig. 8, Appendix). Efforts were focused on the south portion of the MCWA and adjoining national forest lands. The costs associated with the burn were paid outside of this grant, but the burn is worthy of mention due to its importance in maintaining a suitable forest structure for RCWs.

Translocation
In October 2018, 5 pairs of hatch year RCWs were translocated from the Kisatchie National Forest in Louisiana to the MCWA and adjacent Oklahoma District of the ONF. Assistance was provided by Louisiana Department of Wildlife and Fisheries and the USFS. A table of each translocated bird and respective leg band numbers can be viewed in Fig. 13 of the Appendix.

Cavity Tree Selection Study
Out of all variables tested, only two were statistically significant and performed better than the null model. However, only the model with percent canopy openness at 0.5 m had a ΔAIC < 2.

Both variables were positively associated with predicted RCW use, with increased canopy openness and larger canopy area being more suitable for RCWs (Fig.1 a-c). Tree age was not a significant predictor for RCW suitability, which could simply be a reflection of habitat quality at the stand level. In addition, both ODWC and USFS have been managing habitat for RCWs for over two decades, and trees of suitable age (60+ years) are now adequately available.

Canopy openness at 0.5 meters captures the density of the understory at the base of the tree, and previous research has demonstrated that deciduous, woody shrubs and trees in and around cavity trees have a negative effect on RCWs. Less canopy openness could equate to excessive deciduous hardwood growth or regrowth in the understory.

a)
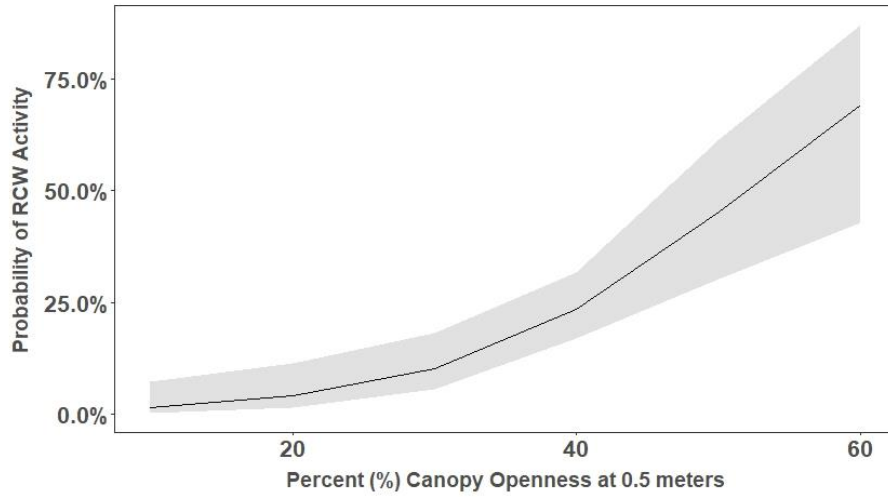
b)



c)
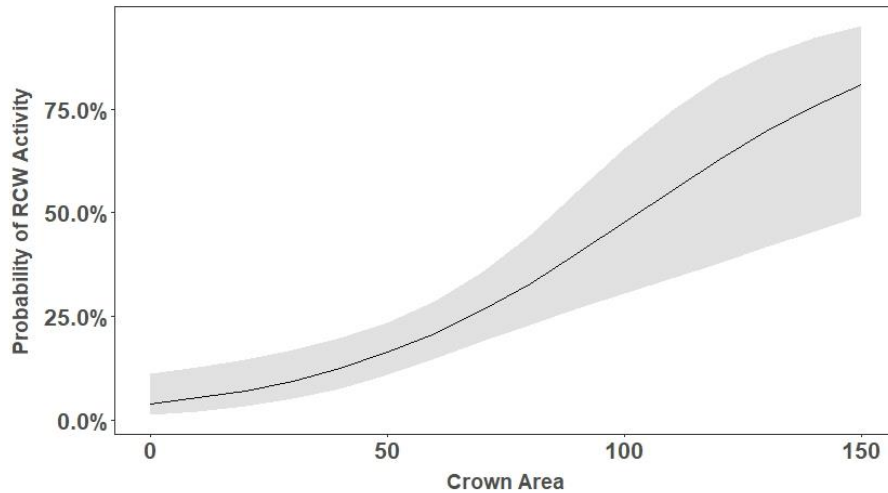
| Model | Variables | β | SE | Lower 95% CI | Upper 95% CI | ΔAIC | AIC Wt |
|---|---|---|---|---|---|---|---|
| "Percent Openness" Model | Percent Openness, 0.5 m | 0.104 | 0.026 | 0.055 | 0.159 | 0.00 | 0.926 |
| "Crown Area" Model | Crown Area (m²) | 0.030 | 0.008 | 0.014 | 0.047 | 5.1 | 0.073 |
| Null | Intercept | -1.33 | 0.198 | -1.73 | -0.953 | 18.1 | <0.001 |

**Figure 1.** Predicted effects of percent openness (a) and crown area (b) of shortleaf pines in the Ouachita Mountains ecoregion, with list of top-performing models and associated coefficients (c).

A summary of descriptive statistics for RCW active cavity trees, including mean ($\bar{x}$,) median, and standard deviation (σ), is presented in Fig. 2. For cavity orientation, we determined that directional bearings were not equally distributed among occupied trees. Of 63 trees, 32 faced in a northwestern direction. The result of the chi-square goodness-of-fit test was significant ($p < 0.05$),

indicating that the null hypothesis (orientations were equally distributed) was false. This result is similar to what was found by Wood (1983) for cavity trees at one of our study sites almost forty (40) years ago.

| Trait | $\bar{x}$ | Median | σ |
|---|---|---|---|
| Dbh (cm) | 44.6 | 44.2 | 7.06 |
| Diameter at Cavity Height (cm) | 41.9 | 41.3 | 5.95 |
| Cavity Height (m) | 9.38 | 9.3 | 2.41 |
| Diameter at Average Cavity Height (cm) | 40.9 | 41 | 6.21 |
| Height to Live Crown (m) | 14.4 | 14.3 | 2.77 |
| Total Height (m) | 25.6 | 25.2 | 3.24 |
| Age (years), *n = 33* | 101 | 90 | 27.8 |
| Crown Area (m²) | 60.3 | 55.64 | 26.01 |

**Figure 2.** Descriptive statistics for occupied (active) RCW cavity trees in the Ouachita Mountains ecoregion.


## C. RECOMMENDATIONS

Due to the high ODWC prioritization of recovery efforts for Red-cockaded Woodpeckers, this project will likely continue beyond the current grant segment until such time as the population attains the MCWA management plan goal of 45 active clusters. Even if the population goal of 45 territories is achieved, continued habitat management and population monitoring will be required in perpetuity if RCWs are to persist on the MCWA and surrounding Oklahoma Ranger District of the Ouachita National Forest.

## D. SIGNIFICANT DEVIATIONS:

No significant deviations.


**E.**     **Prepared by**:     Matt Fullerton, Endangered Species Biologist
Oklahoma Department of Wildlife Conservation

       **Date:**     May 22, 2019


       **Approved by:**     _____
Wildlife Division Administration
Oklahoma Department of Wildlife Conservation


       **Approved by:**     _____
Andrea Crews, Federal Aid Coordinator
Oklahoma Department of Wildlife Conservation

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**APPENDIX**

| Cluster | Nest Initiation Date | Clutch Size | Nestlings Banded | Nestlings Fledged |
|---------|----------------------|-------------|------------------|-------------------|

| | | | | |
|---|---|---|---|---|
| **2** | 5/5/18 | 3 | 2 | 0 |
| **5** | 5/9/18 | 4 | 3 | 3 |
| **16** | 5/7/18 | 4 | 1 | 0 |
| **20** | 5/7/18 | 4 | 0 | 0 |
| **37** | 5/29/18 | 4 | 2 | 2 |
| **109** | 5/19/18 | 3 | 2 | 2 |
| **111** | 4/27/28 | 5 | 3 | 2 |
| **112** | N/A | N/A | N/A | N/A |
| **202** | N/A | N/A | N/A | N/A |
| **205** | 5/8/18 | 3 | 0 | 0 |
| **210** | N/A | N/A | N/A | N/A |
| **1201** | 5/14/18 | 3 | 1 | 1 |
| **NF4** | 5/17/18 | 4 | 1 | 0 |
| **E1** | 5/18/18 | 3 | 1 | 1 |

**Figure 3.** 2018 Red-cockaded Woodpecker Nesting Season Summary, McCurtain Co., Oklahoma.

| Stand Type | Stand Number | Year Available |
|---|---|---|
| **AC** | 24 | 2013 |
| **AC** | 25 | 2003 |
| **AC** | 31 | 2013 |
| **AC** | 32 | 2009 |
| **AC** | 105 | 2013 |
| **AC** | 137 | 1992 |
| **AC** | 107 | 1993 |

| | | |
|---|---|---|
| **R** | 300 | 2018 |
| **R** | 301 | 2018 |
| **R** | 302 | 2018 |
| **R** | 4 | 1993 |
| **R** | 11 | 1993 |
| **R** | 18 | 1996 |
| **R** | 19 | 1996 |
| **R** | 22 | 1998 |
| **R** | 23 | 1998 |
| **R** | 200 | 2005 |
| **R** | 201 | 2005 |
| **R** | 203 | 2005 |
| **R** | 204 | 2005 |
| **R** | 211 | 2007 |
| **R** | 212 | 2009 |
| **R** | 213 | 2009 |
| **R** | 1202 | 2012 |
| **R** | 1203 | 2012 |

R = Recruitment
AC = Abandoned Clusters

**Figure 4.** Summary of available stands (clusters) for both natural RCW dispersal and potential release via translocations on the McCurtain Co. Wilderness Area, Oklahoma (as of March 2019).

**Figure 5.** Adult Red-cockaded Woodpecker (*Dryobates borealis*) on a cavity tree on the McCurtain County Wilderness Area. (*Credit: Tom Wipple, w/permission)*
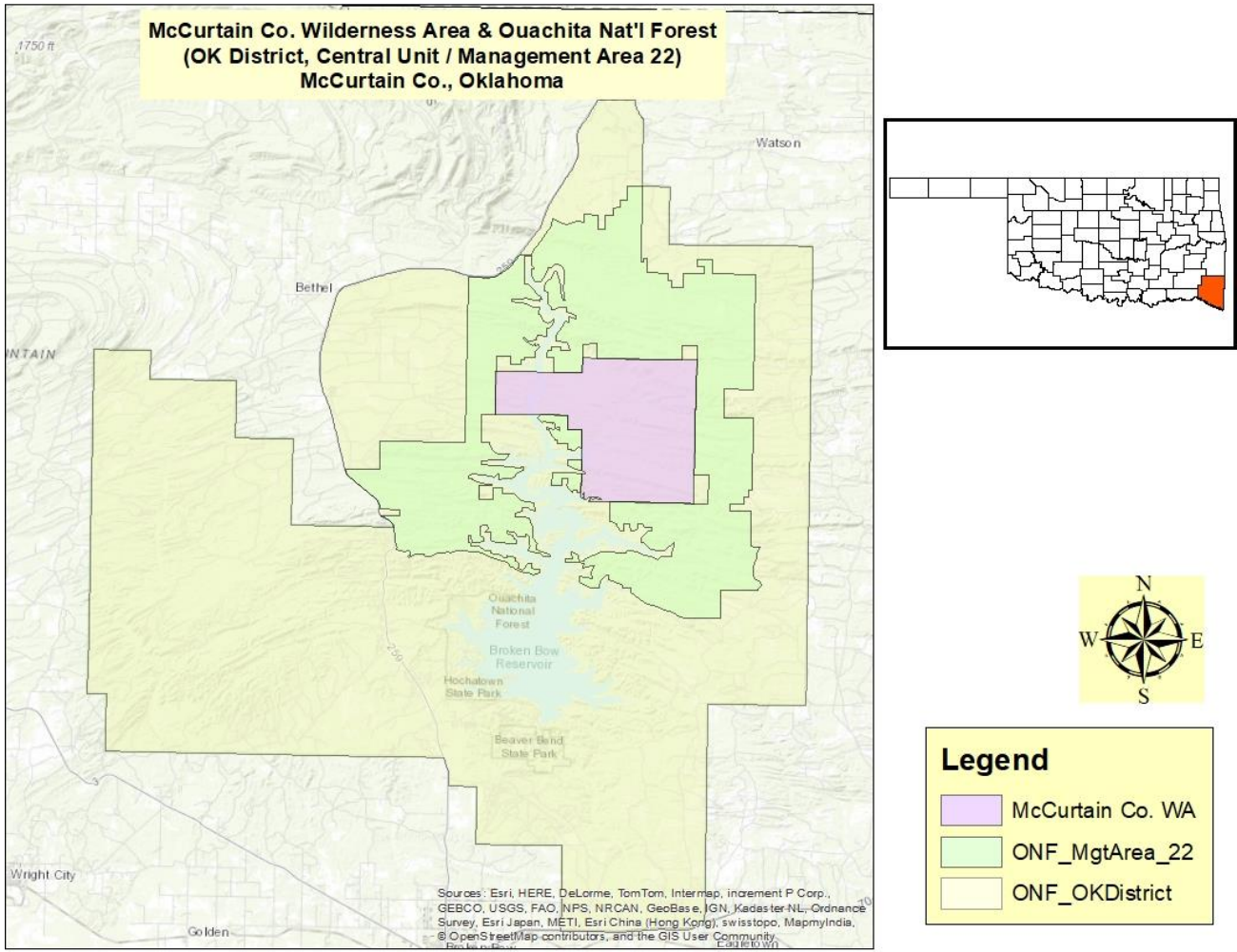
**Figure 6.** Map of the McCurtain Co. Wilderness Area (owned by ODWC) and surrounding Oklahoma Ranger District of the Ouachita National Forest.
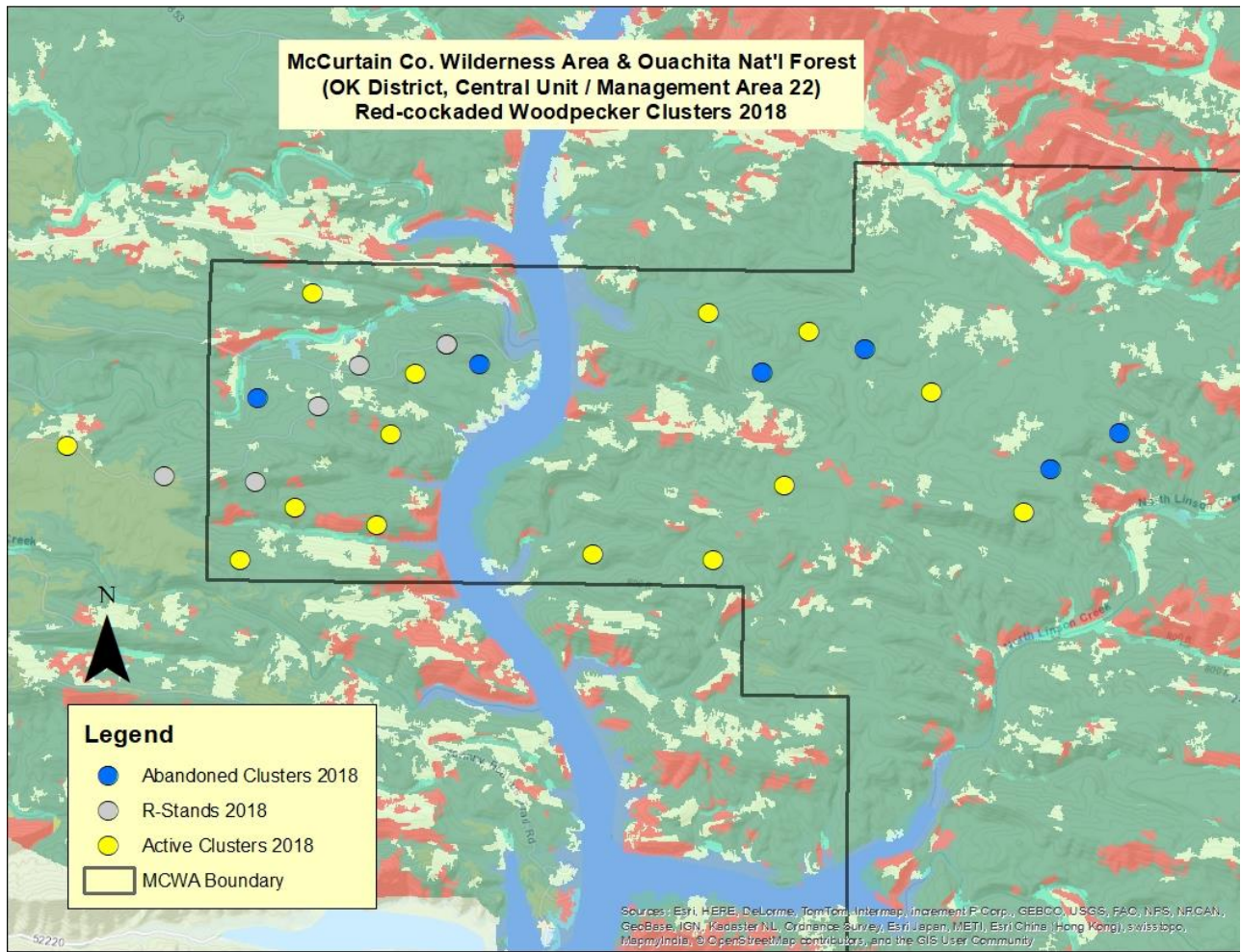
**Figure 7.** Active Red-cockaded Woodpecker cluster locations (including currently active clusters and recruitment stands) in Oklahoma. R-stand locations are where translocated RCWs were released in 2018.
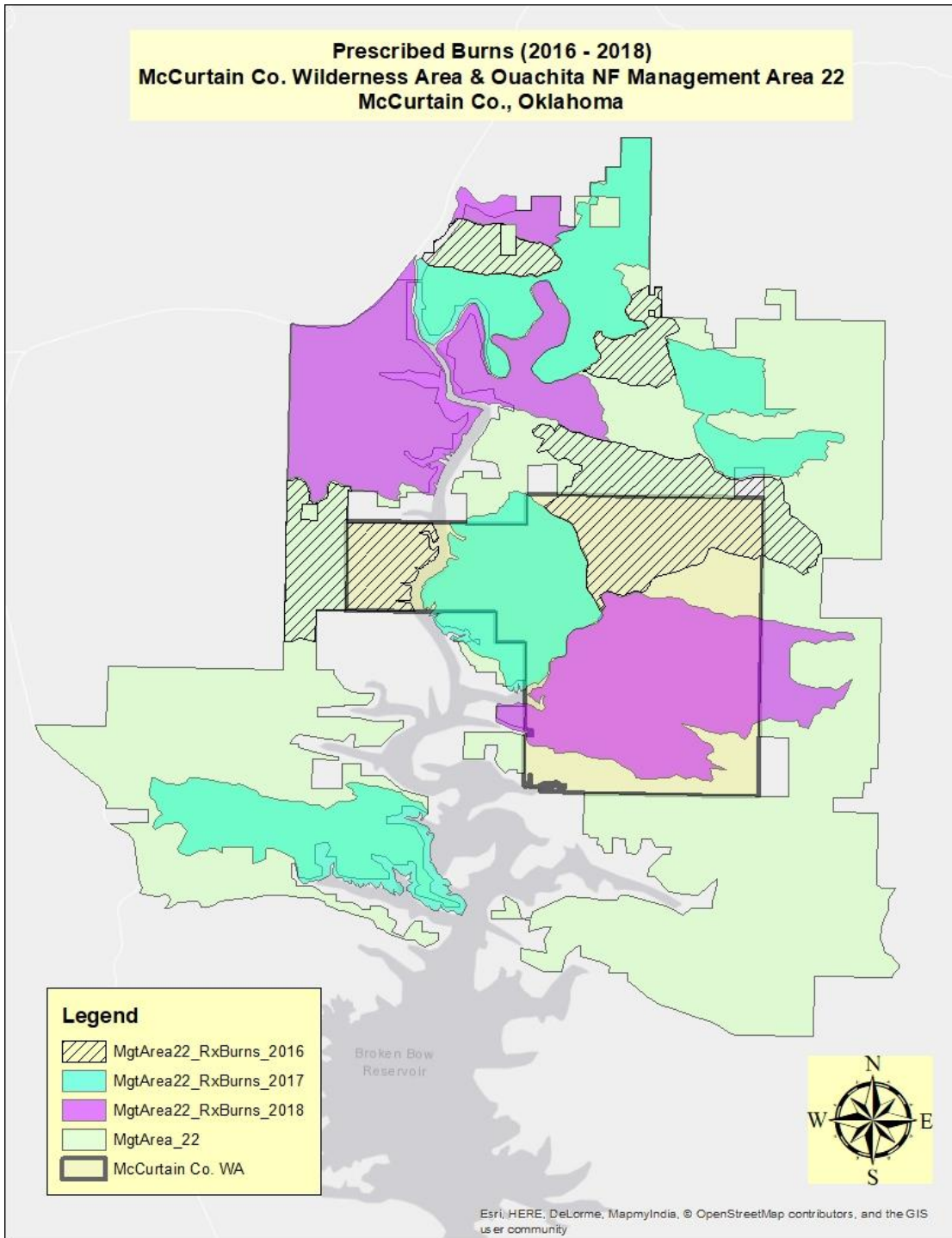
**Figure 8.** Prescribed burns conducted on the McCurtain Co. Wilderness Area and adjacent Oklahoma Ranger District of the Ouachita National Forest from 2016 – 2018 (*Area burned in 2017 was also burned in March 2019).

**Figure 9.** Oklahoma Department of Wildlife Conservation personnel preparing cavities in March for the upcoming nesting season; condition of each cavity (both natural and artificial) is assessed and Southern Flying Squirrels, if present, are removed accordingly. *(Credit: Matt Fullerton/ODWC)*

**Figure 10.** Metal flashing ("Snake Excluder Devices") installed at the base of occupied (active) RCW cavity trees to prevent rat snakes from climbing trunks and depredating on nests. *(Credit: M. Fullerton/ODWC)*



**Figure 11.** Recruitment stand ("R-stand") with four (4) artificial nest boxes (inserts) installed. R-stands are maintained for eventual colonization of dispersing RCWs as well as translocation release sites. *(Credit: M. Fullerton/ODWC)*

**Figure 12.** Adult Red-cockaded Woodpecker trapped in late summer/early fall; during fall trapping, fledglings are captured and outfitted with colored bands. *(Credit: Matt Fullerton/ODWC)*

| Year | USGS Band Number | Band Color | | Date of Move | Site of Origin | Recruit. Year | Sex | Release / Cluster Site |
|------|------------------|------------|------|--------------|----------------|---------------|-----|------------------------|
| | | Left | Right | | | | | |
| 2018 | 2701-46381 | AL/OR | DG/YL/DB | 10/22/2018 | Kisatchie NF, LA | 2018 | F | R25 |
| | 2701-46360 | AL/OR | LB/YL/MA | 10/22/2018 | Kisatchie NF, LA | 2018 | M | R25 |
| | 2701-46323 | / | / | 10/22/2018 | Kisatchie NF, LA | 2018 | F | NF5 |
| | 2701-46395 | AL/OR | OR/OR/DG | 10/22/2018 | Kisatchie NF, LA | 2018 | M | NF5 |
| | 2701-46334 | AL/OR | DB/LB/PU | 10/22/2018 | Kisatchie NF, LA | 2018 | F | R300 |
| | 2701-46316 | AL/OR | DG/YL/LG | 10/22/2018 | Kisatchie NF, LA | 2018 | M | R300 |
| | 2701-46312 | / | / | 10/22/2018 | Kisatchie NF, LA | 2018 | F | R301 |
| | 2701-46337 | AL/OR | MG/DB/LB | 10/22/2018 | Kisatchie NF, LA | 2018 | M | R301 |
| | 2701-46329 | / | / | 10/22/2018 | Kisatchie NF, LA | 2018 | F | R302 |
| | 2651-60197 | AL/OR | WH/YL/DG | 10/22/2018 | Kisatchie NF, LA | 2018 | M | R302 |

**Figure 13.** Red-cockaded Woodpeckers translocated from the Kisatchie National Forest, Louisiana to McCurtain Co., Oklahoma in 2018.

**Figure 14.** Photo obtained via a "fish eye" lens of the sky to measure percent canopy cover near Red-cockaded Woodpecker cavity trees. (*Credit: Matt Fullerton/ODWC*)