

**2017 American Burying Beetle (*Nicrophorus americanus*) Survey on Pond Creek
National Wildlife Refuge (Sevier County, Arkansas)**



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Project ID: FY17-IM

Report Date: October 2017



U.S. Fish and Wildlife Service

Southeast Region Inventory and Monitoring Branch

I&M RFP Final Report

2017 American Burying Beetle (*Nicrophorus americanus*) Survey on Pond Creek National Wildlife Refuge (Sevier County, Arkansas)

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ABSTRACT:

Historically, the geographic range of the endangered American burying beetle (ABB; *Nicrophorus americanus*) included southwest Arkansas and southeast Oklahoma. Presence/absence surveys for ABB have not been conducted in this region of Arkansas in over nine years. A presence/absence survey for ABB was conducted at Pond Creek National Wildlife Refuge during the 2017 active season. No ABB were found on the refuge; other *Nicrophorus* species were captured.

INTRODUCTION

Pond Creek National Wildlife Refuge (PCNWR) is located in Sevier County in southwest Arkansas. The endangered American burying beetle (*Nicrophorus americanus*) is known to occur in nearby Hempstead County (historically) and in McCurtain County, Oklahoma to the west (Figure 1). Presence/absence surveys for ABB were conducted on PCNWR in 2004, with no ABB captured. Prior to the PCNWR 2017 effort, no presence/absence surveys have been conducted in Sevier or surrounding Little River and Hempstead counties since 2008. This survey was conducted to assist PCNWR in the process of developing a 15 year Inventory and Monitoring Plan.

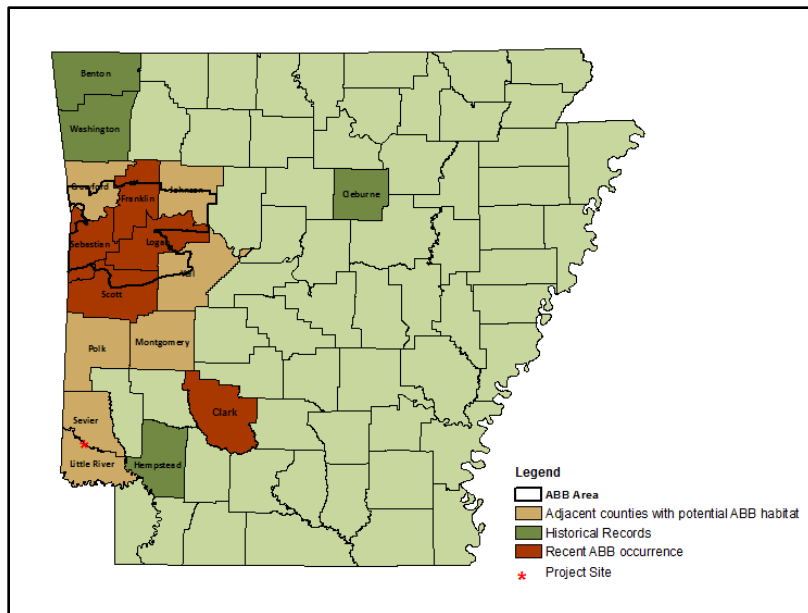


Figure 1. Historical and current ABB range in Arkansas.

STUDY AREA

Pond Creek National Wildlife Refuge is located between the Little and Cossatot rivers to the south and east, respectively. PCNWR encompasses approximately 27,300 acres located within the South Central Plains ecosystem and is characterized by an extensive wetland complex comprised of the forested overflow bottoms and riparian forests of the Little and Cossatot rivers. The vegetative community is comprised of bottomland hardwoods characteristic of floodplain habitat with loblolly pine scattered throughout.

METHODS

U.S. Fish and Wildlife Service (Service) Ecological Services staff surveyed a total of seven sites between July 23 and July 29, 2017, at PCNWR following the 2015 Presence/Absence Survey Guidelines for ABB with a single baited above-ground bucket trap at each location (Table 1). A total of five valid bucket-nights were completed during the ABB survey.

Trapping procedures used for baited above-ground 5-gallon bucket traps (Service 2015) with wooden trap covers based on the design by Leasure et al. (2012b). Above-ground bucket traps are comparable to transects of standard pitfall traps used in previous ABB surveys (Leasure et al. 2012). Site photos were taken at each sample site and data recorded on field data sheets.

Each trap was made from a 5-gallon bucket, with drainage and ventilation holes, staked to the ground with driven rebar. The bucket lid had a 7-inch hole cut out of the center with a funnel secured to the underside of the lid with zip ties to prevent beetles trapped in the bucket from flying out. Trap covers were constructed from 5/16-inch thick plywood to form a landing pad and rain cover for the trap. Each trap contained a wetted sponge to provide moisture and cover to trapped beetles.

Traps were surveyed for six nights (five valid trap nights) at all sites (July 23-29, 2017). Each trap was initially baited with an aged chicken drumstick and checked every morning (July 24-29, 2017) with replacement of bait as necessary to prevent desiccation or consumption by maggots. Traps were checked each morning between 0600 CDT and 0900 CDT in an effort to prevent trap mortalities that may occur when beetles remain trapped for prolonged periods. All sites were accessible by road or trail with the farthest walking distance being about 20 yards.

Seven sites (Table 1 and Figure 2) on PCNWR were selected as trap locations based on several factors correlated to ABB occurrence and abundance: soil type as characterized by the USGS NRCS soil survey (Soil Survey Staff 2017), forested wetlands as categorized in the National Wetlands Inventory (NWI) (Service 2014), National Land Cover Database 2011 (Homer et al. 2015), and vegetation as observed in preliminary surveys of habitat condition. Habitat analysis for ABB at PCNWR using these factors determined most suitable habitat occurs primarily on northern and western areas of the refuge (Figure 2).

Table 1. Site coordinates of traps in 2017 Pond Creek NWR ABB survey. Coordinates are in NAD 83 Geographic Coordinate System.

Site	County	longitude	latitude
PC1	Sevier	33.90733	-94.37037
PC2	Sevier	33.91357	-94.35160
PC3	Sevier	33.85998	-94.22887
PC4	Sevier	33.85057	-94.20705
PC5	Sevier	33.87833	-94.23290
PC6	Sevier	33.89534	-94.23587
PC7	Sevier	33.89023	-94.21118

Trap sites were located in areas with silt loam soils, avoiding soils with a clay component (unfavorable soils). Silt and sandy loam soils (favorable soils) are present at PCNWR and are the predominant general soil types. Forested/shrub wetlands, freshwater emergent wetlands, and open water were considered unfavorable ABB habitat for trap site selection purposes. Areas adjacent to wetlands and/or riparian areas could be suitable for ABB, as they may be important for ABBs seeking moist soils during dry conditions (Service 2015). No other NWI categorized wetland types occur at PCNWR. National Land Cover Database areas categorized as deciduous forest, evergreen forest, mixed forest, grassland/herbaceous, and pasture/hay were considered as potential suitable habitat for ABB and were included in the potential trap sites. The potentially suitable sites were assessed on the ground. Areas with a strong understory component were considered less suitable for ABB and eliminated as trap sites (i.e., central PCNWR). Each above-ground 5-gallon bucket trap has a 0.5 mi effective radius and were placed within PCNWR boundaries to provide coverage of suitable habitat both on and off-refuge properties (Figure 2). Field notes taken at each site describe vegetation and soil type.

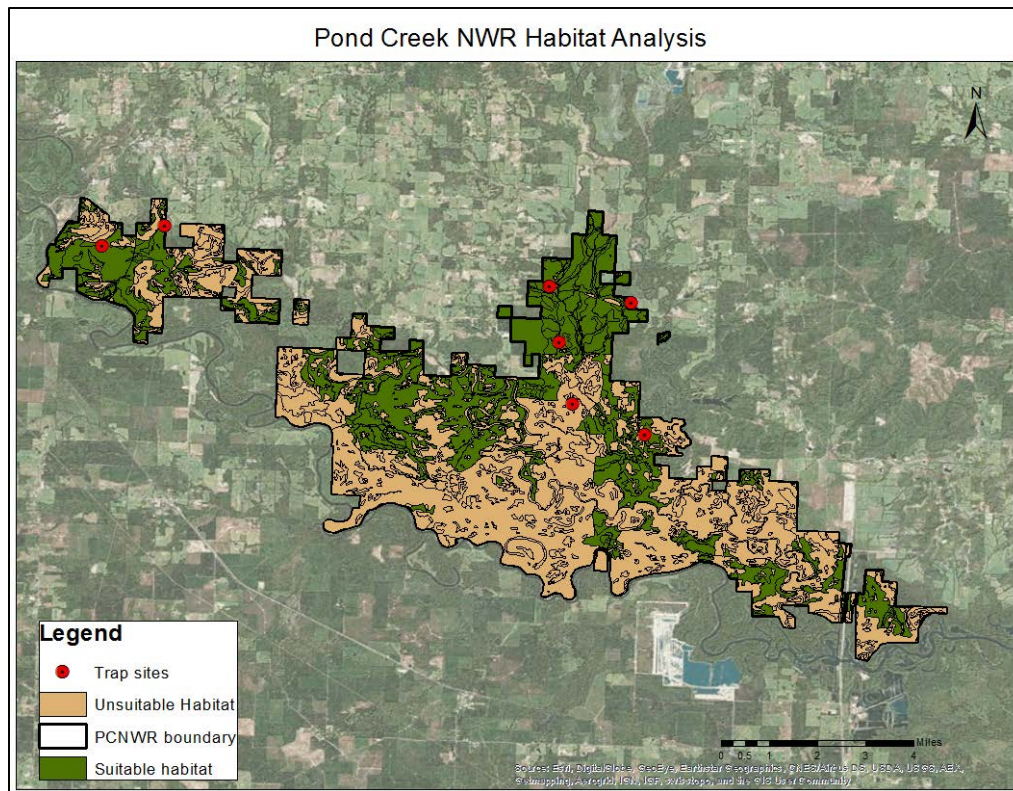


Figure 2. Habitat analysis for ABB at PCNWR including presence of wetlands, vegetation types, and soil types.

The seven sites may be characterized individually as bottomland hardwood, mature mixed deciduous forest with a minimal pine component, and mixed deciduous forests having moderate understory. Habitat management of forested areas at PCNWR is minimal, but includes occasional prescribed fire. Ongoing maintenance of roads and right-of-way areas at PCNWR includes bush-hogging.

Captured carrion beetles and bycatch were removed from each trap daily. All beetles were released within 10 feet of the trap location.

RESULTS

A total of two congener species were found in the PCNWR survey area. No ABBs were captured during the 2017 survey. A total of 61 individual beetles, representing two species of carrion beetles in the *Nicrophorus* genus, *N. orbicollis* (N=38) and *N. pustulatus* (N=23), were captured (Figure 3). Other carrion beetles including *Necrophila americanus* and *Necrodes surinamensis* were also captured. *N. marginatus*, a grassland specialist congener, was not captured during the study. The two congener species captured are habitat generalists and could represent competition for resources with ABB.

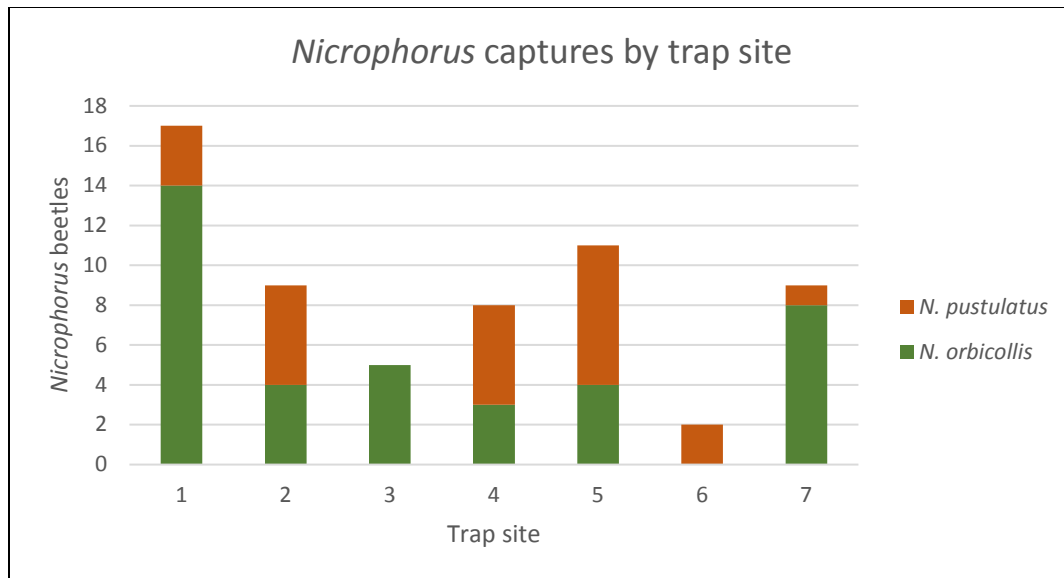


Figure 3. *Nicrophorus* species captured at Pond Creek National Wildlife Refuge in 2017.

The highest daytime temperature noted during the 2017 study period at PCNWR was 92° F; the minimum nighttime temperature was 71° F. Rainfall was reported during the first night of the study period, but was not heavy (defined as 1.97 inches) between the hours of 9 p.m. and 4 a.m. Wind exceeded 10 mph during more than 20 percent of the same time period during the first night of the study (July 23), invalidating that night of trapping.

DISCUSSION

Species Captured: Ecology and Behavior

Like other carrion beetles in the Silphidae family, the *Nicrophorus* species collected during this survey depend on carcasses of various sized animals for reproduction. For ABB, the size of the carcass determines if reproduction is attempted and also may limit brood size (Kozol et al. 1988, Trumbo 1992).



Habitat or vegetation changes can affect the abundance and diversity of competing congeners. For example, *N. orbicollis* is a relatively large congener that can compete with ABB for carrion (Trumbo 1994). *N. orbicollis* is a forest specialist and *N. pustulatus* is often captured in prairie-forest border or edge habitat (Lomolino et al. 1995, Lomolino and Creighton 1996, Backlund and Marrone 1997). Succession and invasion of woody vegetation has been documented in many areas of the ABB range (attributed largely to fire suppression) and would favor the expansion of *N. orbicollis*.

The PCNWR project area and surrounding landscape are characterized by a heterogeneous complex of habitat types including predominantly forest, some grassland and pasture, and a limited agricultural component. *N. orbicollis* was the

most abundant congener captured on the 2017 survey. This congener uses habitats in mid-succession that are less suitable for the larger ABB and this species may outcompete ABB on PCNWR in current and recent past habitat conditions.

Effect of management activities and prescribed fire

Habitat management activities, including timber harvest and prescribed fire, are implemented as appropriate by PCNWR to achieve desired habitat conditions. Approximately 6,255 acres of loblolly pine were planted in the 1970s and 1980s at PCNWR. Historically, the Refuge was dominated by bottomland and upland hardwood forests. In 2004, PCNWR began harvesting the pine to allow natural hardwood regeneration to occur, restoring these pine stands to a hardwood forest.

Fire was likely an occasional component of the bottomland hardwood ecosystem historically, but is considered an excellent management tool for ABB habitat. The removal of understory fuels, opening of the canopy, and resulting herbaceous growth implicates fire as a possible tool for creating and maintaining *N. americanus* habitat (Leasure and Garner 2008).

On a larger scale, landscape level heterogeneity supports populations of several species as carrion for ABB reproduction (e.g., northern bobwhites (*Colinus virginianus*), eastern cottontails (*Sylvilagus floridanus*), and hispid cotton rat (*Sigmodon hispidus*). All these species have high reproductive rates and juvenile mortality and, thus, high potential for ABB carcass provision for reproduction throughout their breeding season. The overall prey base for carrion for reproduction is likely to be adequate for ABB reproduction.

Invasive Species

Feral hogs (any hog, including Russian and European wild boar) have been very successful in expanding their range and increasing their numbers. Feral hogs are found in large numbers on PCNWR and an active control program is in place. The species' success can be attributed to human introduction, water development in arid areas, improved range condition, and an ability to reproduce rapidly. Feral hogs compete with native wildlife for food, cover, water and space. They also cause significant soil disturbance and habitat degradation as a result of feeding and/or rooting. Rooting, if severe enough, can alter plant community successional sequences. The negative effects of a feral hog population may include soil erosion, consumption of native seed crops, competition with ABB in prey/carrion consumption, altered plant succession, and reduction of overall species diversity (Stevens 1996).

Soil correlation

Soil preference data indicates that ABBs may favor sandy loams that are well drained and at least moderately permeable. ABBs are not limited to habitats with deep soils (Lomolino et al. 1995). Soils that are not well drained, slowly permeable, or exist in floodplains are generally negatively correlated to ABB abundance. The ability of soil permeability and drainage to limit ABB abundance is presumably related to the mortality risk associated with inundation of the brood chamber. Trapping success of the ABB increases with higher percent of sand and decreases with

increased percentage of clay. This supports the finding that the ABB is most abundant in sandy loams, which are conducive to brood chamber excavation.

Sandy loams soils occur in very limited areas at PCNWR. Soil survey data for PCNWR project (Soil Survey Staff 2017) indicates silt loam soils on approximately 95.4 percent of the acreage and sandy loam soils on approximately 1.8 percent. Trapping sites in silty loam soils may contribute to the probable absence survey results in the 2017 survey. The frequent inundation experienced on PCNWR and associated soil types present likely precludes ABB occurrence on the refuge, although PCNWR would have value during drought years for ABB on lands near the refuge.

Summary

The negative results of the 2017 survey indicate ABB likely does not occur at PCNWR. No other ABB surveys have been conducted in southwest Arkansas (Little River, Sevier, and Hempstead counties) in the last nine years. The status of ABB in these counties is unknown. Management actions to benefit ABB are not recommended at PCNWR and further surveys for the species are not necessary.

ACKNOWLEDGMENTS

I thank the staff at Pond Creek National Wildlife Refuge for their assistance, support and hospitality during this survey. This project was funded through the U.S. Fish and Wildlife Region 4, Inventory and Monitoring Branch.

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DATA APPENDIX

Excel file (2017 survey forms) provides daily trap data for the 2017 ABB survey at Pond Creek National Wildlife Refuge (Night 1-Night 6) and summary data (Survey Summary Form).