



# Bird Monitoring at Pea Ridge National Military Park, Arkansas

## *Status Report*

Natural Resource Data Series NPS/HTLN/NRDS—2017/1088



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Bird habitat at Pea Ridge National Military Park

Photograph courtesy of Heartland Inventory and Monitoring Network

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# **Bird Monitoring at Pea Ridge National Military Park, Arkansas**

## *Status Report*

Natural Resource Data Series NPS/HTLN/NRDS—2017/1088

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## **Abstract**

Breeding bird surveys were initiated on Pea Ridge National Military Park (PERI), Arkansas in 2008 to assess temporal changes in the species composition and abundance of birds on the park, and to improve our understanding of breeding bird – habitat relationships and the effects of management actions such as invasive plant species control on bird populations. Birds were sampled using point counts with 99 variable circular plots located on a systematic grid of 400 x 400 meter cells (originating from a random start point). All birds seen or heard on a plot during a 5-min sampling period were recorded. Since initiating our breeding bird survey, birds have been surveyed six out of the nine years on between 24 to 99 variable circular plots (depending on year), resulting in 453 plot visits. Surveys have yielded records for 105 different bird species. Eighty-eight of the species recorded are classified as permanent or summer residents to the area, eleven are classified as winter residents, five as transients, and one as a migrant through the area. Nine species recorded are considered species of conservation concern for the Central Hardwoods Bird Conservation Region, the bird conservation region PERI is located within. Eleven of the 88 resident species were recorded on PERI every year of the surveys.

## **Acknowledgments**

We would like to thank the staff of Pea Ridge National Military Park, Arkansas for allowing us access to the park during our site visits. We would also like to thank park staff and volunteers: Candice S. Canady, Gregg J. Wolcott, Vicky A. Olson, Nolan W. Moore, J. Mitch Cockrill, Lorraine Heartfield, Steve P. Munch, and Kristian A. Bolin who assisted with bird surveys on the park.

# Introduction

Birds are an important component of park ecosystems, as their high body temperature, rapid metabolism, and high ecological position in most food webs make them good indicators of the effects of local and regional changes in ecosystems. It has been suggested that management activities aimed at preserving habitat for bird populations, such as neotropical migrants, can have the added benefit of preserving entire ecosystems and their attendant ecosystem services (Karr 1991, Maurer 1993). Moreover, birds have a tremendous following among the public and many parks provide information on the status and trends of birds through their interpretive programs.

Pea Ridge National Military Park (PERI), Arkansas is located in the western edge of the Ozark Highland section of the Central Hardwoods Bird Conservation Region (Figure 1). The Central Hardwoods Bird Conservation Region is one of 67 regions identified in the North American Bird Conservation Initiative (NABCI). Started in 1999, the NABCI is a coalition of government agencies and private organizations in the United States working to ensure the long-term health of North America's native bird populations (NABCI 2012).

Topography of the area in and around PERI is dissected, with local relief over 100 meters common (Fitzgerald and Pashley 2000). However, broad flat ridges can be found throughout. The landscape historically contained a habitat of oak-hickory forest with a prairie grass understory in ravines and grass savanna habitat on ridges. Approximately 174 species of breeding birds can be found in the habitat of the area (James and Neal 1986). Widespread habitat loss to agriculture, as well as urban and industrial development, threaten the integrity of the area for birds.

Data collected during the U.S. Geological Survey's annual North American Breeding Bird Surveys (BBS) between 1966 and 2013 indicate that a number of bird species with potential to occur at PERI show evidence of population decline (Sauer et al. 2014). In fact, 45% of the species have populations reported to be in decline with species such as the Grasshopper Sparrow (*Ammodramus savannarum*), House Sparrow (*Passer domesticus*), Lark Sparrow (*Chondestes grammacus*), Loggerhead Shrike (*Lanius ludovicianus*), Northern Bobwhite (*Colinus virginianus*), and Yellow-billed Cuckoo (*Coccyzus americanus*) declining at alarming rates.

Long-term trends in community composition and abundance of breeding bird populations provide one measure for assessing the ecological integrity and sustainability of this system. We will use trends in the composition and abundance of bird populations as long-term indicators of ecosystem integrity on their habitat found at PERI. *Ecosystem integrity* is defined as the system's capability to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of the natural habitats of the region (Karr and Dudley 1981). Research has demonstrated that birds serve as good indicators of changes in ecosystems (Cairns et al. 2004, Mallory et al. 2006, Wood et al. 2006). Therefore, changes in the numbers and composition of bird communities may reflect the effectiveness of management in restoring and maintaining bird habitat at PERI.



**Figure 1.** Location of Pea Ridge National Military Park (PERI), Arkansas within the Central Hardwoods Bird Conservation Region.

There are three primary objectives for monitoring breeding birds at Pea Ridge National Military Park:

- Identify significant temporal changes in the species composition and abundance of bird communities that occur at PERI during the breeding season.
- Improve our understanding of breeding bird – habitat relationships and the effects of management actions such as stand thinning or prescribed fire on bird populations, by correlating changes in bird community composition and abundance with changes in specific habitat variables (e.g., vegetation structure, ground cover).
- Make bird monitoring datasets for PERI available to the avian conservation community and to the general public through the Avian Knowledge Network (AKN) and Data.Gov through the NPS Integrated Resource Management Applications (IRMA).

As a first step in meeting monitoring objectives, this report summarizes species composition and abundances for birds recorded during the six years of monitoring.

## Methods

### Site Selection

Permanent monitoring locations or 'plots' were selected by overlaying a systematic grid of 400 x 400 meter cells (originating from a random start point). The orientation of the grid was rotated 45 degrees to prevent monitoring sites from being influenced by man-made features (roads, fences, etc.) located along cardinal directions. We established 99 permanent plots on PERI for monitoring bird population sizes and community composition (Figure 2). Monitoring occurred on 24 to 99 sites in years surveys were undertaken (Table 1).

Starting in 2009 the breeding bird monitoring was conducted by PERI staff and volunteers, allowing data to be collected and HTLN to implement their modified sampling schedule for visiting the Memorial once every fourth year.

**Table 1.** Number of plots sampled and sampling dates for breeding bird surveys conducted at Pea Ridge National Military Park, Arkansas, by year. Also listed are observer(s) who conducted the surveys and whether or not habitat data were collected during the survey year.

| Year | Sampling Dates   | Number of Plots Sampled | Observer(s)                                            | Habitat Data Collected |
|------|------------------|-------------------------|--------------------------------------------------------|------------------------|
| 2008 | May 12 – May 18  | 99                      | D.G. Peitz*                                            | Yes                    |
| 2009 | May 20 – July 1  | 97                      | C.S. Canady, G.J. Wolcott, V. A. Olson, and N.W. Moore | No                     |
| 2010 | May 11 – June 4  | 36                      | J.M. Cockrill, L. Heartfield, and S.P. Munch           | No                     |
| 2012 | May 14 – May 23  | 98                      | D.G. Peitz*                                            | Yes                    |
| 2013 | June 6 – June 25 | 24                      | K.A. Bolin                                             | No                     |
| 2016 | May 16 – May 23  | 99                      | D.G. Peitz*                                            | Yes                    |

\*Heartland I&M Network staff.

During bird surveys in 2008 and 2012, monitoring plots were located using navigation waypoints (Peitz et al. 2008) in a Trimble Geo XT GPS unit and temporarily marked with 36-inch pin flags to aid in re-locating the plots for habitat assessment, eliminating the need for permanent plot markers. We collected pin flags from each plot once the habitat work was completed. During 2016 the habitat assessment crews worked independent of the birder and monitoring plots were located using a GPS unit but not marked with pin flags. During bird surveys in 2009, 2010 and 2013, years when habitat assessments were not conducted, monitoring plots were located using a GPS unit. However, plot locations were not marked with pin flags.

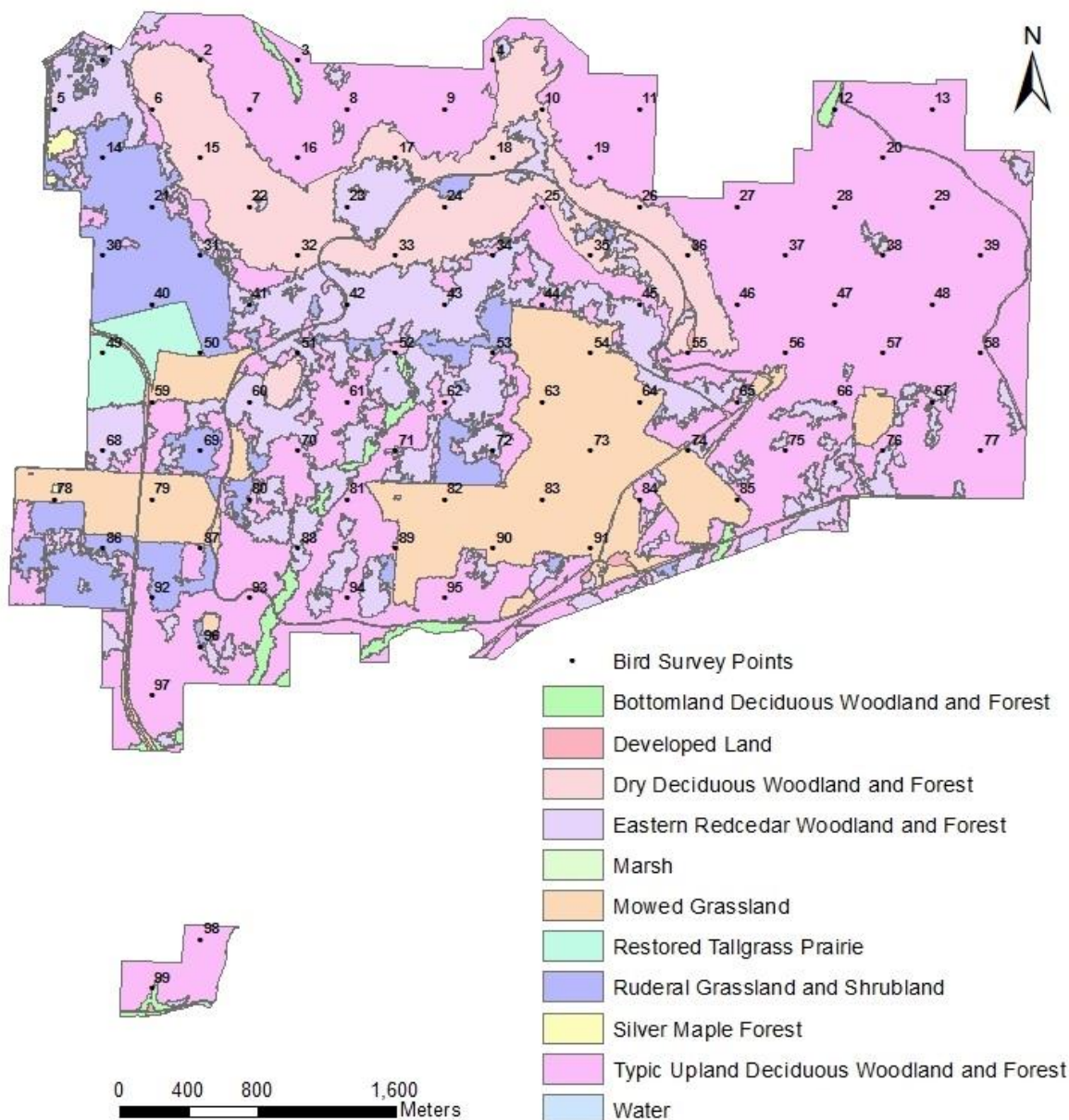


**Figure 2.** Bird plot locations on Pea Ridge National Military Park, Arkansas. Vegetation mapping and classification provided by Diamond et al. (2013).

## Bird Surveys

Bird surveys followed methods outlined in the bird monitoring protocol by Peitz et al. (2008) and summarized in this report. Variable circular plot counts, a point count methodology that incorporates a measure of detectability into population estimates, were used to survey birds present (Fancy 1997). All birds seen or heard at plots during 5-min sampling periods were recorded along with their corresponding distance from observer. For most species, we recorded each individual bird as a separate observation. For species that usually occur in clusters or flocks, the units recorded were cluster or flock size, and not the individual bird. During analysis, each individual in a cluster or flock

was treated as a separate observation. After completing a count at a plot and filling out the data sheet, the observer navigated to the next plot using a GPS unit. While traveling between plots, the observer was vigilant for the presence of species not recorded during timed surveys. These species help formulate a more complete species list for the park by identifying species missed during timed surveys. However, these observations were not included in any analysis as they did not directly relate to any individual plot. We sampled birds during a period when it was light enough to observe birds to four hours after sunrise.

Variable circular plot counts were conducted in an attempt to get an “instantaneous count” of all birds present. The observer recorded birds flushed from a plot when approached and the counts were started as soon as the observer reached plot center. We recorded all birds seen or heard, including flyovers, along with distance from the observer when possible. For this report, all birds seen or heard during the full 5-min are included.

### **Data Analysis**

Prior to summary analysis, the residency status (migrant, permanent resident, summer resident, transient, and winter resident) of each bird species recorded was determined. Identifying the residency of each species helps to exclude migrants, transients, and winter residents from analysis of breeding birds within PERI. The proportion of plots occupied by each bird species was calculated (total number of plots occupied by a species/plots surveyed) and reported in Appendix A and B. For species with greater than 60 observations recorded, Distance software (Distance 6.0 Release 2) was used to determine the park-wide abundance of each (Buckland et al. 2001). A central part of the analysis in Distance is the modeling of a detection function to account for individuals present but not observed before calculating species abundance. Four candidate functions plus series expansion; Half-normal + Cosine, Uniform + Cosine, Half-normal + Hermite polynomial, and Hazard-rate + Cosine were considered in determining the detection function of each species, and the most robust models were selected by Distance based on the lowest Akaike Information Criteria (AIC) values. The Hazard-rate + Cosine function was selected for seven species; Blue-gray Gnatcatcher, Eastern Wood-pewee, Indigo Bunting, Northern Parula, Red-eyed Vireo, Summer Tanager, and Yellow-throated Vireo. The Half-normal + Cosine function was selected for three species; Field Sparrow, Northern Cardinal, and Tufted Titmouse. Abundances for these species are reported in Appendix A. For species with fewer than 60 observations, park-wide abundance was calculated by first deriving a species density from observations recorded within a 200-m radius (12.57 ha) around each plot center and then calculating abundance based on average plot densities. Park-wide abundances for species with less than 60 observations are reported in Appendix B.

For this report we also obtained regional breeding bird trends for the Central Hardwoods Bird Conservation Region during the periods between 2008 and 2013 (Sauer et al. 2014), and reported these values for PERI in Appendix C for comparison with populations on the park. The period between 2008 and 2013 roughly coincides with our breeding bird monitoring efforts.

## Results

### Bird Surveys

Since initiating breeding bird surveys in 2008 on PERI, as many of the 99 variable circular plots as possible were sampled in years 2008-2010, 2012, 2013, and 2016, resulting in a total of 453 plot visits (Table 1). One hundred and five different bird species have been recorded during surveys (Table 2). Eighty-eight of the 105 species recorded are classified as permanent or summer residents to the area (James and Neal 1986). Eleven species--American Tree Sparrow (*Spizella arborea*), Brewer's Blackbird (*Euphagus cyanocephalus*), Brown Creeper (*Certhia americana*), Cedar Waxwing (*Bombycilla cedrorum*), Hermit Thrush (*Catharus guttatus*), Purple Finch (*Haemorhous purpureus*), Savannah Sparrow (*Passerculus sandwichensis*), Sharp-shinned Hawk (*Accipiter striatus*), Song Sparrow (*Melospiza melodia*), Yellow-bellied Sapsucker (*Sphyrapicus varius*), and Yellow-rumped Warbler (*Setophaga coronata*)--are classified as winter residents to the area; five species--Bobolink (*Dolichonyx oryzivorus*), Chestnut-sided Warbler (*Dendroica pensylvanica*), Henslow's Sparrow (*Ammodramus henslowii*), Swainson's Thrush (*Catharus ustulatus*), and Veery (*Catharus fuscescens*)--as transients to the area; and one species--Sora (*Porzana carolina*)--as a migrant through the area.

On PERI, nine species recorded--Bewick's Wren (*Thryomanes bewickii*), Blue-winged Warbler (*Vermivora pinus*), Henslow's Sparrow (*Ammodramus henslowii*), Kentucky Warbler (*Oporornis formosus*), Prairie Warbler (*Dendroica discolor*), Red-headed Woodpecker (*Melanerpes erythrocephalus*), Whip-poor-will (*Caprimulgus vociferous*), Wood Thrush (*Hylocichla mustelina*), and Worm-eating Warbler (*Helmitheros vermivorus*)--are considered species of conservation concern for the Central Hardwoods Bird Conservation Region (U.S. Fish and Wildlife Service 2008). Blue-gray Gnatcatcher (*Polioptila caerulea*), Indigo Bunting (*Passerina cyanea*), Northern Cardinal (*Cardinalis cardinalis*), and Tufted Titmouse (*Baeolophus bicolor*) are the most commonly encountered and widely distributed species on PERI during surveys (Appendix A). These four species along with the other six in Appendix A offer the best opportunities for monitoring the influence of changing habitats on bird species. For breeding species recorded on PERI their trends within the larger Central Hardwoods Bird Conservation Region are reported in Appendix C for the period roughly coinciding with the surveys.

**Table 2.** Bird species recorded during breeding bird surveys at Pea Ridge National Military Park, Arkansas in 2008-2010, 2012, 2013, and 2016. The American Ornithologists' Union Code (AOU code) and residency status of each species is given.

| Common name                | Species name                      | AOU code    | Residency <sup>1</sup> |
|----------------------------|-----------------------------------|-------------|------------------------|
| Acadian Flycatcher         | <i>Empidonax virescens</i>        | ACFL        | SR                     |
| American Crow              | <i>Corvus brachyrhynchos</i>      | AMCR        | R                      |
| American Goldfinch         | <i>Carduelis tristis</i>          | AMGO        | R                      |
| American Kestrel           | <i>Falco sparverius</i>           | AMKE        | R                      |
| American Redstart          | <i>Setophaga ruticilla</i>        | AMRE        | SR                     |
| American Robin             | <i>Turdus migratorius</i>         | AMRO        | R                      |
| American Tree Sparrow*     | <i>Spizella arborea</i>           | ATSP        | WR                     |
| American Woodcock          | <i>Scolopax minor</i>             | AMWO        | R                      |
| Baltimore Oriole           | <i>Icterus galbula</i>            | BAOR        | SR                     |
| Barn Swallow               | <i>Hirundo rustica</i>            | BARS        | SR                     |
| Barred Owl                 | <i>Strix varia</i>                | BDOW        | R                      |
| <b>Bewick's Wren</b>       | <b><i>Thryomanes bewickii</i></b> | <b>BEWR</b> | <b>R</b>               |
| Black-and-white Warbler    | <i>Mniotilta varia</i>            | BAWW        | SR                     |
| Black-billed Cuckoo        | <i>Coccyzus erythrophthalmus</i>  | BBCU        | SR                     |
| Black Vulture              | <i>Coragyps atratus</i>           | BLVU        | R                      |
| Blue-gray Gnatcatcher      | <i>Polioptila caerulea</i>        | BGGN        | SR                     |
| Blue Grosbeak              | <i>Passerina caerulea</i>         | BLGR        | SR                     |
| Blue Jay                   | <i>Cyanocitta cristata</i>        | BLJA        | R                      |
| <b>Blue-winged Warbler</b> | <b><i>Vermivora pinus</i></b>     | <b>BWWA</b> | <b>SR</b>              |
| Bobolink                   | <i>Dolichonyx oryzivorus</i>      | BOBO        | T                      |
| Brewer's Blackbird         | <i>Euphagus cyanocephalus</i>     | BRBL        | WR                     |
| Broad-winged Hawk*         | <i>Buteo platypterus</i>          | BWHA        | SR                     |
| Brown Creeper              | <i>Certhia americana</i>          | BRCR        | WR                     |
| Brown-headed Cowbird       | <i>Molothrus ater</i>             | BHCO        | R                      |
| Brown Thrasher             | <i>Toxostoma rufum</i>            | BRTH        | R                      |
| Carolina Chickadee         | <i>Parus carolinensis</i>         | CACH        | R                      |
| Carolina Wren              | <i>Thryothorus ludovicianus</i>   | CARW        | R                      |
| Cedar Waxwing              | <i>Bombycilla cedrorum</i>        | CEDW        | WR                     |
| Chestnut-sided Warbler     | <i>Dendroica pensylvanica</i>     | CSWA        | T                      |
| Chimney Swift              | <i>Chaetura pelagica</i>          | CHSW        | SR                     |
| Chipping Sparrow           | <i>Spizella passerine</i>         | CHSP        | SR                     |
| Cliff Swallow*             | <i>Petrochelidon pyrrhonota</i>   | CLSW        | SR                     |

\* Species recorded only while traveling between point transects or at other times outside of 5-min survey periods.

<sup>1</sup> Residency: M = migrant; R = year around resident; SR = summer resident; T = transient; WR = winter resident; According to James and Neal (1986).

Species names are valid and verified names taken from the Integrated Taxonomic Information System web site (ITIS 2016).

Bolded species names are those species considered of regional concern for the Central Hardwoods Bird Conservation Region (U.S. Fish and Wildlife Service 2008).

**Table 2 (continued).** Bird species recorded during breeding bird surveys at Pea Ridge National Military Park, Arkansas in 2008-2010, 2012, 2013, and 2016. The American Ornithologists' Union Code (AOU code) and residency status of each species is given.

| Common name              | Species name                       | AOU code    | Residency <sup>1</sup> |
|--------------------------|------------------------------------|-------------|------------------------|
| Common Grackle           | <i>Quiscalus quiscula</i>          | COGR        | R                      |
| Common Yellowthroat      | <i>Geothlypis trichas</i>          | COYE        | SR                     |
| Dickcissel               | <i>Spiza americana</i>             | DICK        | SR                     |
| Downy Woodpecker         | <i>Picoides pubescens</i>          | DOWO        | R                      |
| Eastern Bluebird         | <i>Sialia sialis</i>               | EABL        | R                      |
| Eastern Kingbird         | <i>Tyrannus tyrannus</i>           | EAKI        | SR                     |
| Eastern Meadowlark       | <i>Sturnella magna</i>             | EAME        | R                      |
| Eastern Phoebe           | <i>Sayornis phoebe</i>             | EAPH        | R                      |
| Eastern Towhee           | <i>Pipilo erythrophthalmus</i>     | EATO        | R                      |
| Eastern Wood-pewee       | <i>Contopus virens</i>             | EAWP        | SR                     |
| European Starling        | <i>Sturnus vulgaris</i>            | EUST        | R                      |
| Field Sparrow            | <i>Spizella pusilla</i>            | FISP        | R                      |
| Fish Crow                | <i>Corvus ossifragus</i>           | FICR        | SR                     |
| Grasshopper Sparrow      | <i>Ammodramus savannarum</i>       | GRSP        | SR                     |
| Gray Catbird             | <i>Dumetella carolinensis</i>      | GRCA        | SR                     |
| Great Blue Heron         | <i>Ardea herodias</i>              | GBHE        | R                      |
| Great Crested Flycatcher | <i>Myiarchus crinitus</i>          | GCFL        | SR                     |
| Great Horned Owl         | <i>Bubo virginianus</i>            | GHOW        | R                      |
| Hairy Woodpecker         | <i>Picoides villosus</i>           | HAWO        | R                      |
| <b>Henslow's Sparrow</b> | <b><i>Ammodramus henslowii</i></b> | <b>HESP</b> | <b>T</b>               |
| Hermit Thrush            | <i>Catharus guttatus</i>           | HETH        | WR                     |
| Horned Lark              | <i>Eremophila alpestris</i>        | HOLA        | R                      |
| House Sparrow            | <i>Passer domesticus</i>           | HOSP        | R                      |
| Indigo Bunting           | <i>Passerina cyanea</i>            | INBU        | SR                     |
| <b>Kentucky Warbler</b>  | <b><i>Oporornis formosus</i></b>   | <b>KEWA</b> | <b>SR</b>              |
| Killdeer                 | <i>Charadrius vociferus</i>        | KILL        | R                      |
| Lark Sparrow             | <i>Chondestes grammacus</i>        | LASP        | SR                     |
| Louisiana Waterthrush    | <i>Seiurus motacilla</i>           | LOWA        | SR                     |
| Mourning Dove            | <i>Zenaida macroura</i>            | MODO        | R                      |
| Northern Bobwhite        | <i>Colinus virginianus</i>         | NOBO        | R                      |
| Northern Cardinal        | <i>Cardinalis cardinalis</i>       | NOCA        | R                      |
| Northern Flicker         | <i>Colaptes auratus</i>            | YSFL        | R                      |

\* Species recorded only while traveling between point transects or at other times outside of 5-min survey periods.

<sup>1</sup> Residency: M = migrant; R = year around resident; SR = summer resident; T = transient; WR = winter resident; According to James and Neal (1986).

Species names are valid and verified names taken from the Integrated Taxonomic Information System web site (ITIS 2016).

Bolded species names are those species considered of regional concern for the Central Hardwoods Bird Conservation Region (U.S. Fish and Wildlife Service 2008).

**Table 2 (continued).** Bird species recorded during breeding bird surveys at Pea Ridge National Military Park, Arkansas in 2008-2010, 2012, 2013, and 2016. The American Ornithologists' Union Code (AOU code) and residency status of each species is given.

| Common name                  | Species name                             | AOU code    | Residency <sup>1</sup> |
|------------------------------|------------------------------------------|-------------|------------------------|
| Northern Mockingbird         | <i>Minus polyglottos</i>                 | NOMO        | R                      |
| Northern Parula              | <i>Parula americana</i>                  | NOPA        | SR                     |
| Orchard Oriole               | <i>Icterus spurius</i>                   | OROR        | SR                     |
| Ovenbird                     | <i>Seiurus aurocapillus</i>              | OVEN        | SR                     |
| Pileated Woodpecker          | <i>Dryocopus pileatus</i>                | PIWO        | R                      |
| <b>Prairie Warbler</b>       | <b><i>Dendrocia discolor</i></b>         | <b>PRAW</b> | <b>SR</b>              |
| Purple Finch*                | <i>Haemorhous purpureus</i>              | PUFI        | WR                     |
| Red-bellied Woodpecker       | <i>Melanerpes carolinus</i>              | RBWO        | R                      |
| Red-eyed Vireo               | <i>Vireo olivaceus</i>                   | REVI        | SR                     |
| <b>Red-headed Woodpecker</b> | <b><i>Melanerpes erythrocephalus</i></b> | <b>RHWO</b> | <b>R</b>               |
| Red-shouldered Hawk          | <i>Buteo lineatus</i>                    | RSHA        | R                      |
| Red-tailed Hawk              | <i>Buteo jamaicensis</i>                 | RTHA        | R                      |
| Red-winged Blackbird         | <i>Agelaius phoeniceus</i>               | RWBL        | R                      |
| Ruby-throated Hummingbird    | <i>Archilochus colubris</i>              | RTHU        | SR                     |
| Savannah Sparrow             | <i>Passerculus sandwichensis</i>         | SAVS        | WR                     |
| Scarlet Tanager              | <i>Piranga olivacea</i>                  | SCTA        | SR                     |
| Scissor-tailed Flycatcher    | <i>Tyrannus forficatus</i>               | STFL        | SR                     |
| Sharp-shinned Hawk*          | <i>Accipiter striatus</i>                | SSHA        | WR                     |
| Song Sparrow                 | <i>Melospiza melodia</i>                 | SOSP        | WR                     |
| Sora                         | <i>Porzana carolina</i>                  | SORA        | M                      |
| Summer Tanager               | <i>Piranga rubra</i>                     | SUTA        | SR                     |
| Swainson's Thrush            | <i>Catharus ustulatus</i>                | SWTH        | T                      |
| Tree Swallow*                | <i>Tachycineta bicolor</i>               | TRES        | SR                     |
| Tufted Titmouse              | <i>Baeolophus bicolor</i>                | ETTI        | R                      |
| Turkey Vulture               | <i>Cathartes aura</i>                    | TUVU        | R                      |
| Veery                        | <i>Catharus fuscescens</i>               | VEER        | T                      |
| Warbling Vireo               | <i>Vireo gilvus</i>                      | WAVI        | SR                     |
| <b>Whip-poor-will</b>        | <b><i>Caprimulgus vociferous</i></b>     | <b>WPWI</b> | <b>SR</b>              |
| White-breasted Nuthatch      | <i>Sitta carolinensis</i>                | WBNU        | R                      |
| White-eyed Vireo             | <i>Vireo griseus</i>                     | WEVI        | SR                     |
| Wild Turkey                  | <i>Meleagris gallopavo</i>               | WITU        | R                      |

\* Species recorded only while traveling between point transects or at other times outside of 5-min survey periods.

<sup>1</sup> Residency: M = migrant; R = year around resident; SR = summer resident; T = transient; WR = winter resident; According to James and Neal (1986).

Species names are valid and verified names taken from the Integrated Taxonomic Information System web site (ITIS 2016).

Bolded species names are those species considered of regional concern for the Central Hardwoods Bird Conservation Region (U.S. Fish and Wildlife Service 2008).

**Table 2 (continued).** Bird species recorded during breeding bird surveys at Pea Ridge National Military Park, Arkansas in 2008-2010, 2012, 2013, and 2016. The American Ornithologists' Union Code (AOU code) and residency status of each species is given.

| Common name                | Species name                         | AOU code    | Residency <sup>1</sup> |
|----------------------------|--------------------------------------|-------------|------------------------|
| Willow Flycatcher          | <i>Empidonax traillii</i>            | WIFL        | SR                     |
| <b>Wood Thrush</b>         | <b><i>Hylocichla mustelina</i></b>   | <b>WOTH</b> | <b>SR</b>              |
| <b>Worm-eating Warbler</b> | <b><i>Helmitheros vermivorus</i></b> | <b>WEWA</b> | <b>SR</b>              |
| Yellow-bellied Sapsucker   | <i>Sphyrapicus varius</i>            | YBSA        | WR                     |
| Yellow-billed Cuckoo       | <i>Coccyzus americanus</i>           | YBCU        | SR                     |
| Yellow-breasted Chat       | <i>Icteria virens</i>                | YBCH        | SR                     |
| Yellow-rumped Warbler      | <i>Dendroica coronata</i>            | MYWA        | WR                     |
| Yellow-throated Vireo      | <i>Vireo flavifrons</i>              | YTVI        | SR                     |
| Yellow-throated Warbler    | <i>Dendroica dominica</i>            | YTWA        | SR                     |
| Yellow Warbler             | <i>Dendroica petechia</i>            | YWAR        | SR                     |

\* Species recorded only while traveling between point transects or at other times outside of 5-min survey periods.

<sup>1</sup> Residency: M = migrant; R = year around resident; SR = summer resident; T = transient; WR = winter resident; According to James and Neal (1986).

Species names are valid and verified names taken from the Integrated Taxonomic Information System web site (ITIS 2016).

Bolded species names are those species considered of regional concern for the Central Hardwoods Bird Conservation Region (U.S. Fish and Wildlife Service 2008).

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## Appendix A

**Table A-1.** Annual proportion of plots occupied (includes flyovers) by, and estimated abundance (determined using Distance software) of breeding bird species at Pea Ridge National Military Park during the 2008-2010, 2012, 2013, and 2016 spring bird surveys.

| Common name           | <u>Proportion of plots occupied</u> |              |              |              |              |              |
|-----------------------|-------------------------------------|--------------|--------------|--------------|--------------|--------------|
|                       | Abundance                           |              |              |              |              |              |
|                       | 2008<br>n=99                        | 2009<br>n=97 | 2010<br>n=36 | 2012<br>n=98 | 2013<br>n=24 | 2016<br>n=99 |
| Blue-gray Gnatcatcher | 0.20<br>1088                        | 0.25<br>386  | 0.02<br>96   | 0.31<br>1672 | 0.21<br>975  | 0.26<br>1419 |
| Eastern Wood-pewee    | 0.29<br>196                         | 0.16<br>14   | 0<br>0       | 0.31<br>198  | 0.38<br>251  | 0.21<br>156  |
| Field Sparrow         | 0.17<br>134                         | 0.09<br>34   | 0<br>0       | 0.05<br>34   | 0.21<br>162  | 0.11<br>67   |
| Indigo Bunting        | 0.29<br>1039                        | 0.48<br>461  | 0.04<br>91   | 0.30<br>867  | 0.42<br>1304 | 0.30<br>903  |
| Northern Cardinal     | 0.31<br>553                         | 0.61<br>202  | 0.18<br>53   | 0.29<br>452  | 0.58<br>977  | 0.43<br>671  |
| Northern Parula       | 0.24<br>305                         | 0.06<br>12   | 0<br>0       | 0.19<br>217  | 0.33<br>513  | 0.21<br>260  |
| Red-eyed Vireo        | 0.08<br>118                         | 0.18<br>76   | 0.02<br>30   | 0.27<br>419  | 0.33<br>550  | 0.31<br>488  |
| Summer Tanager        | 0.29<br>413                         | 0.09<br>102  | 0<br>0       | 0.39<br>552  | 0.58<br>1058 | 0.25<br>312  |
| Tufted Titmouse       | 0.26<br>359                         | 0.20<br>52   | 0.02<br>26   | 0.31<br>492  | 0.79<br>1534 | 0.37<br>513  |
| Yellow-throated Vireo | 0.36<br>741                         | 0.02<br>36   | 0<br>0       | 0.11<br>232  | 0.17<br>291  | 0.07<br>124  |

## Appendix B

**Table B-1.** Annual proportion of plots occupied (includes flyovers) by, and estimated abundance (determined using bird within 200-m of plot center) of breeding bird species at Pea Ridge National Military Park during the 2008-2010, 2012, 2013, and 2016 spring bird surveys.

| Common name        | <u>Proportion of plots occupied</u> |              |              |              |              |              |
|--------------------|-------------------------------------|--------------|--------------|--------------|--------------|--------------|
|                    | Abundance                           |              |              |              |              |              |
|                    | 2008<br>n=99                        | 2009<br>n=97 | 2010<br>n=36 | 2012<br>n=98 | 2013<br>n=24 | 2016<br>n=99 |
| Acadian Flycatcher | 0.18                                | 0.05         | 0            | 0            | 0.17         | 0.16         |
|                    | 26                                  | 6            | 0            | 0            | 29           | 25           |
| American Crow      | 0.12                                | 0.42         | 0.18         | 0.08         | 0.50         | 0.10         |
|                    | 3                                   | 16           | --           | 10           | 63           | 7            |
| American Goldfinch | 0.02                                | 0            | 0            | 0            | 0.04         | 0.05         |
|                    | 6                                   | 0            | 0            | 0            | 11           | 1            |
| American Kestrel   | 0                                   | 0            | 0            | 0            | 0            | 0.01         |
|                    | 0                                   | 0            | 0            | 0            | 0            | 1            |
| American Redstart  | 0.04                                | 0.04         | 0            | 0.04         | 0            | 0.06         |
|                    | 8                                   | 1            | 0            | 6            | 0            | 8            |
| American Robin     | 0.02                                | 0.01         | 0            | 0.01         | 0            | 0.03         |
|                    | 3                                   | 1            | 0            | 1            | 0            | 4            |
| American Woodcock  | 0                                   | 0.01         | 0            | 0            | 0            | 0            |
|                    | 0                                   | 1            | 0            | 0            | 0            | 0            |
| Baltimore Oriole   | 0                                   | 0            | 0            | 0            | 0            | 0.06         |
|                    | 0                                   | 0            | 0            | 0            | 0            | 7            |

\*-- denotes when a species was present on a plot but outside 50-m of plot center therefore their annual abundance value could not be calculated.

**Table B-1 (continued).** Annual proportion of plots occupied (includes flyovers) by, and estimated abundance (determined using bird within 200-m of plot center) of breeding bird species at Pea Ridge National Military Park during the 2008-2010, 2012, 2013, and 2016 spring bird surveys.

| Common name             | <u>Proportion of plots occupied</u><br>Abundance |              |              |              |              |              |
|-------------------------|--------------------------------------------------|--------------|--------------|--------------|--------------|--------------|
|                         | 2008<br>n=99                                     | 2009<br>n=97 | 2010<br>n=36 | 2012<br>n=98 | 2013<br>n=24 | 2016<br>n=99 |
| Barn Swallow            | 0.03                                             | 0.03         | 0            | 0            | 0            | 0.01         |
|                         | --                                               | 1            | 0            | 0            | 0            | --           |
| Barred Owl              | 0                                                | 0.01         | 0            | 0.02         | 0            | 0.02         |
|                         | 0                                                | --           | 0            | 1            | 0            | 1            |
| <b>Bewick's Wren</b>    | <b>0.03</b>                                      | <b>0.01</b>  | <b>0</b>     | <b>0</b>     | <b>0</b>     | <b>0</b>     |
|                         | <b>4</b>                                         | <b>1</b>     | <b>0</b>     | <b>0</b>     | <b>0</b>     | <b>0</b>     |
| Black-and-white Warbler | 0.08                                             | 0.01         | 0            | 0            | 0            | 0.07         |
|                         | 11                                               | 1            | 0            | 0            | 0            | 10           |
| Black-billed Cuckoo     | 0                                                | 0            | 0            | 0.03         | 0            | 0            |
|                         | 0                                                | 0            | 0            | 4            | 0            | 0            |
| Black Vulture           | 0                                                | 0            | 0.02         | 0            | 0            | 0            |
|                         | 0                                                | 0            | --           | 0            | 0            | 0            |
| Blue Grosbeak           | 0                                                | 0.01         | 0            | 0.02         | 0            | 0.04         |
|                         | 0                                                | --           | 0            | 4            | 0            | 6            |
| Blue Jay                | 0.09                                             | 0.28         | 0.12         | 0.10         | 0.13         | 0.06         |
|                         | 6                                                | 10           | 3            | 14           | 17           | 3            |

\* — denotes when a species was present on a plot but outside 50-m of plot center therefore their annual abundance value could not be calculated.

Bolded species names are those species considered of regional concern for the Central Hardwoods Bird Conservation Region (U.S. Fish and Wildlife Service 2008).

**Table B-1 (continued).** Annual proportion of plots occupied (includes flyovers) by, and estimated abundance (determined using bird within 200-m of plot center) of breeding bird species at Pea Ridge National Military Park during the 2008-2010, 2012, 2013, and 2016 spring bird surveys.

| Common name                | <u>Proportion of plots occupied</u> |              |              |              |              |              |
|----------------------------|-------------------------------------|--------------|--------------|--------------|--------------|--------------|
|                            | Abundance                           |              |              |              |              |              |
|                            | 2008<br>n=99                        | 2009<br>n=97 | 2010<br>n=36 | 2012<br>n=98 | 2013<br>n=24 | 2016<br>n=99 |
| <b>Blue-winged Warbler</b> | <b>0.02</b>                         | <b>0.03</b>  | <b>0.02</b>  | <b>0.08</b>  | <b>0</b>     | <b>0.04</b>  |
|                            | <b>3</b>                            | <b>1</b>     | <b>3</b>     | <b>11</b>    | <b>0</b>     | <b>6</b>     |
| Brown-headed Cowbird       | 0.07                                | 0.02         | 0            | 0.04         | 0            | 0.12         |
|                            | 8                                   | 4            | 0            | 10           | 0            | 14           |
| Brown Thrasher             | 0.02                                | 0            | 0            | 0            | 0.04         | 0.02         |
|                            | 4                                   | 0            | 0            | 0            | 6            | 3            |
| Carolina Chickadee         | 0.02                                | 0.10         | 0.03         | 0.06         | 0.17         | 0.05         |
|                            | 3                                   | 1            | --           | 11           | 29           | 7            |
| Carolina Wren              | 0.18                                | 0.04         | 0            | 0.07         | 0.33         | 0.13         |
|                            | 29                                  | --           | 0            | 8            | 46           | 21           |
| Chimney Swift              | 0                                   | 0            | 0            | 0            | 0            | 0.01         |
|                            | 0                                   | 0            | 0            | 0            | 0            | --           |
| Chipping Sparrow           | 0.02                                | 0.04         | 0            | 0            | 0.04         | 0.02         |
|                            | 3                                   | 3            | 0            | 0            | 6            | 4            |
| Common Grackle             | 0                                   | 0.04         | 0            | 0            | 0            | 0            |
|                            | 0                                   | 20           | 0            | 0            | 0            | 0            |
| Common Yellowthroat        | 0.03                                | 0.04         | 0            | 0.03         | 0            | 0.11         |
|                            | 6                                   | 4            | 0            | 4            | 0            | 21           |

\* — denotes when a species was present on a plot but outside 50-m of plot center therefore their annual abundance value could not be calculated.

Bolded species names are those species considered of regional concern for the Central Hardwoods Bird Conservation Region (U.S. Fish and Wildlife Service 2008).

**Table B-1 (continued).** Annual proportion of plots occupied (includes flyovers) by, and estimated abundance (determined using bird within 200-m of plot center) of breeding bird species at Pea Ridge National Military Park during the 2008-2010, 2012, 2013, and 2016 spring bird surveys.

| Common name        | <u>Proportion of plots occupied</u> |              |              |              |              |              |
|--------------------|-------------------------------------|--------------|--------------|--------------|--------------|--------------|
|                    | Abundance                           |              |              |              |              |              |
|                    | 2008<br>n=99                        | 2009<br>n=97 | 2010<br>n=36 | 2012<br>n=98 | 2013<br>n=24 | 2016<br>n=99 |
| Dickcissel         | 0                                   | 0.04         | 0            | 0.06         | 0.21         | 0.10         |
|                    | 0                                   | 3            | 0            | 15           | 98           | 29           |
| Downy Woodpecker   | 0                                   | 0.03         | 0.02         | 0.01         | 0.17         | 0.02         |
|                    | 0                                   | 3            | 0            | 1            | 29           | 3            |
| Eastern Bluebird   | 0.02                                | 0            | 0.02         | 0.03         | 0            | 0            |
|                    | 6                                   | 0            | 3            | 11           | 0            | 0            |
| Eastern Kingbird   | 0.01                                | 0.01         | 0.04         | 0.07         | 0            | 0.01         |
|                    | 3                                   | --           | 6            | 15           | 0            | --           |
| Eastern Meadowlark | 0.10                                | 0.10         | 0.02         | 0.04         | 0.08         | 0.07         |
|                    | 18                                  | 13           | --           | 6            | 46           | 15           |
| Eastern Phoebe     | 0.02                                | 0.05         | 0.04         | 0.01         | 0            | 0.01         |
|                    | 3                                   | 4            | 6            | 1            | 0            | 1            |
| Eastern Towhee     | 0.20                                | 0.12         | 0            | 0.12         | 0.08         | 0.11         |
|                    | 28                                  | 1            | 0            | 17           | 11           | 14           |
| European Starling  | 0                                   | 0.02         | 0            | 0.01         | 0            | 0            |
|                    | 0                                   | 10           | 0            | 1            | 0            | 0            |
| Fish Crow          | 0                                   | 0            | 0            | 0.01         | 0.04         | 0            |
|                    | 0                                   | 0            | 0            | --           | 11           | 0            |

\* — denotes when a species was present on a plot but outside 50-m of plot center therefore their annual abundance value could not be calculated.

**Table B-1 (continued).** Annual proportion of plots occupied (includes flyovers) by, and estimated abundance (determined using bird within 200-m of plot center) of breeding bird species at Pea Ridge National Military Park during the 2008-2010, 2012, 2013, and 2016 spring bird surveys.

| Common name              | <u>Proportion of plots occupied</u> |              |              |              |              |              |
|--------------------------|-------------------------------------|--------------|--------------|--------------|--------------|--------------|
|                          | Abundance                           |              |              |              |              |              |
|                          | 2008<br>n=99                        | 2009<br>n=97 | 2010<br>n=36 | 2012<br>n=98 | 2013<br>n=24 | 2016<br>n=99 |
| Grasshopper Sparrow      | 0.06                                | 0.02         | 0            | 0.03         | 0            | 0.07         |
|                          | 10                                  | 1            | 0            | 4            | 0            | 14           |
| Gray Catbird             | 0.02                                | 0            | 0            | 0.04         | 0.08         | 0.01         |
|                          | 3                                   | 0            | 0            | 6            | 11           | 1            |
| Great Blue Heron         | 0                                   | 0            | 0            | 0            | 0            | 0.01         |
|                          | 0                                   | 0            | 0            | 0            | 0            | 1            |
| Great Crested Flycatcher | 0.02                                | 0.05         | 0            | 0.20         | 0.04         | 0.10         |
|                          | 3                                   | 3            | 0            | 34           | 6            | 17           |
| Great Horned Owl         | 0                                   | 0.02         | 0.02         | 0            | 0            | 0            |
|                          | 0                                   | --           | --           | 0            | 0            | 0            |
| Hairy Woodpecker         | 0.01                                | 0.07         | 0            | 0.01         | 0.04         | 0.02         |
|                          | 1                                   | 3            | 0            | 1            | 6            | 3            |
| Horned Lark              | 0                                   | 0            | 0            | 0.01         | 0            | 0            |
|                          | 0                                   | 0            | 0            | 1            | 0            | 0            |
| House Sparrow            | 0                                   | 0.01         | 0            | 0            | 0            | 0            |
|                          | 0                                   | 1            | 0            | 0            | 0            | 0            |
| <b>Kentucky Warbler</b>  | <b>0.05</b>                         | <b>0.01</b>  | <b>0</b>     | <b>0.05</b>  | <b>0.08</b>  | <b>0.06</b>  |
|                          | <b>7</b>                            | <b>--</b>    | <b>0</b>     | <b>7</b>     | <b>11</b>    | <b>8</b>     |

\* — denotes when a species was present on a plot but outside 50-m of plot center therefore their annual abundance value could not be calculated.

Bolded species names are those species considered of regional concern for the Central Hardwoods Bird Conservation Region (U.S. Fish and Wildlife Service 2008).

**Table B-1 (continued).** Annual proportion of plots occupied (includes flyovers) by, and estimated abundance (determined using bird within 200-m of plot center) of breeding bird species at Pea Ridge National Military Park during the 2008-2010, 2012, 2013, and 2016 spring bird surveys.

| Common name           | <u>Proportion of plots occupied</u> |              |              |              |              |              |
|-----------------------|-------------------------------------|--------------|--------------|--------------|--------------|--------------|
|                       | Abundance                           |              |              |              |              |              |
|                       | 2008<br>n=99                        | 2009<br>n=97 | 2010<br>n=36 | 2012<br>n=98 | 2013<br>n=24 | 2016<br>n=99 |
| Killdeer              | 0                                   | 0.01         | 0            | 0            | 0            | 0            |
|                       | 0                                   | --           | 0            | 0            | 0            | 0            |
| Lark Sparrow          | 0                                   | 0.01         | 0            | 0            | 0            | 0            |
|                       | 0                                   | 1            | 0            | 0            | 0            | 0            |
| Louisiana Waterthrush | 0.01                                | 0.01         | 0            | 0            | 0            | 0.01         |
|                       | 1                                   | 1            | 0            | 0            | 0            | 3            |
| Mourning Dove         | 0.01                                | 0.01         | 0.04         | 0.01         | 0            | 0.03         |
|                       | --                                  | 1            | --           | --           | 0            | 3            |
| Northern Bobwhite     | 0.01                                | 0.07         | 0            | 0.08         | 0.04         | 0.05         |
|                       | 1                                   | --           | 0            | 10           | 11           | 4            |
| Northern Flicker      | 0                                   | 0            | 0.04         | 0.01         | 0.04         | 0            |
|                       | 0                                   | 0            | --           | 1            | 6            | 0            |
| Northern Mockingbird  | 0.01                                | 0            | 0            | 0.02         | 0            | 0.03         |
|                       | 1                                   | 0            | 0            | 3            | 0            | 6            |
| Orchard Oriole        | 0                                   | 0            | 0            | 0.02         | 0            | 0            |
|                       | 0                                   | 0            | 0            | 3            | 0            | 0            |
| Ovenbird              | 0.01                                | 0.02         | 0            | 0.01         | 0            | 0.03         |
|                       | 1                                   | --           | 0            | 1            | 0            | 4            |

\* — denotes when a species was present on a plot but outside 50-m of plot center therefore their annual abundance value could not be calculated.

**Table B-1 (continued).** Annual proportion of plots occupied (includes flyovers) by, and estimated abundance (determined using bird within 200-m of plot center) of breeding bird species at Pea Ridge National Military Park during the 2008-2010, 2012, 2013, and 2016 spring bird surveys.

| Common name                  | <u>Proportion of plots occupied</u> |              |              |              |              |              |
|------------------------------|-------------------------------------|--------------|--------------|--------------|--------------|--------------|
|                              | Abundance                           |              |              |              |              |              |
|                              | 2008<br>n=99                        | 2009<br>n=97 | 2010<br>n=36 | 2012<br>n=98 | 2013<br>n=24 | 2016<br>n=99 |
| Pileated Woodpecker          | 0.09                                | 0.05         | 0            | 0.01         | 0            | 0.05         |
|                              | 8                                   | 4            | 0            | --           | 0            | 6            |
| <b>Prairie warbler</b>       | <b>0.03</b>                         | <b>0</b>     | <b>0</b>     | <b>0.05</b>  | <b>0</b>     | <b>0.02</b>  |
|                              | <b>4</b>                            | <b>0</b>     | <b>0</b>     | <b>8</b>     | <b>0</b>     | <b>3</b>     |
| Red-bellied Woodpecker       | 0.17                                | 0.28         | 0.08         | 0.12         | 0.08         | 0.19         |
|                              | 19                                  | 11           | --           | 14           | 11           | 25           |
| <b>Red-headed Woodpecker</b> | <b>0</b>                            | <b>0.01</b>  | <b>0</b>     | <b>0</b>     | <b>0</b>     | <b>0</b>     |
|                              | <b>0</b>                            | <b>1</b>     | <b>0</b>     | <b>0</b>     | <b>0</b>     | <b>0</b>     |
| Red-shouldered Hawk          | 0                                   | 0            | 0            | 0.01         | 0.04         | 0            |
|                              | 0                                   | 0            | 0            | 1            | --           | 0            |
| Red-tailed Hawk              | 0.03                                | 0.06         | 0            | 0.02         | 0.04         | 0.02         |
|                              | 1                                   | 6            | 0            | 1            | --           | 1            |
| Red-winged Blackbird         | 0.02                                | 0.04         | 0            | 0.01         | 0            | 0.02         |
|                              | 7                                   | 6            | 0            | 11           | 0            | 4            |
| Ruby-throated Hummingbird    | 0.01                                | 0.01         | 0            | 0.01         | 0            | 0.04         |
|                              | --                                  | 1            | 0            | --           | 0            | --           |
| Scarlet Tanager              | 0.04                                | 0            | 0.02         | 0            | 0            | 0            |
|                              | 6                                   | 0            | 3            | 0            | 0            | 0            |

\* — denotes when a species was present on a plot but outside 50-m of plot center therefore their annual abundance value could not be calculated.

Bolded species names are those species considered of regional concern for the Central Hardwoods Bird Conservation Region (U.S. Fish and Wildlife Service 2008).

**Table B-1 (continued).** Annual proportion of plots occupied (includes flyovers) by, and estimated abundance (determined using bird within 200-m of plot center) of breeding bird species at Pea Ridge National Military Park during the 2008-2010, 2012, 2013, and 2016 spring bird surveys.

| Common name               | <u>Proportion of plots occupied</u><br>Abundance |              |              |              |              |              |
|---------------------------|--------------------------------------------------|--------------|--------------|--------------|--------------|--------------|
|                           | 2008<br>n=99                                     | 2009<br>n=97 | 2010<br>n=36 | 2012<br>n=98 | 2013<br>n=24 | 2016<br>n=99 |
| Scissor-tailed Flycatcher | 0                                                | 0.02         | 0            | 0.01         | 0.04         | 0.02         |
|                           | 0                                                | 3            | 0            | 1            | 11           | 1            |
| Summer Tanager            | 0.29                                             | 0.09         | 0            | 0.39         | 0.58         | 0.25         |
|                           | 51                                               | 11           | 0            | 67           | 132          | 36           |
| Turkey Vulture            | 0.02                                             | 0.04         | 0.04         | 0            | 0            | 0.02         |
|                           | 1                                                | --           | --           | 0            | 0            | --           |
| Warbling Vireo            | 0                                                | 0.02         | 0            | 0            | 0            | 0            |
|                           | 0                                                | --           | 0            | 0            | 0            | 0            |
| <b>Whip-poor-will</b>     | <b>0.02</b>                                      | <b>0</b>     | <b>0</b>     | <b>0</b>     | <b>0</b>     | <b>0</b>     |
|                           | <b>3</b>                                         | <b>0</b>     | <b>0</b>     | <b>0</b>     | <b>0</b>     | <b>0</b>     |
| White-breasted Nuthatch   | 0.07                                             | 0.07         | 0.04         | 0.17         | 0.17         | 0.08         |
|                           | 11                                               | 6            | 6            | 25           | 23           | 13           |
| White-eyed Vireo          | 0.05                                             | 0.03         | 0            | 0.04         | 0            | 0.07         |
|                           | 7                                                | 1            | 0            | 6            | 0            | 10           |
| Wild Turkey               | 0                                                | 0.01         | 0            | 0.01         | 0            | 0.01         |
|                           | 0                                                | --           | 0            | --           | 0            | 1            |

\* — denotes when a species was present on a plot but outside 50-m of plot center therefore their annual abundance value could not be calculated.

Bolded species names are those species considered of regional concern for the Central Hardwoods Bird Conservation Region (U.S. Fish and Wildlife Service 2008).

**Table B-1 (continued).** Annual proportion of plots occupied (includes flyovers) by, and estimated abundance (determined using bird within 200-m of plot center) of breeding bird species at Pea Ridge National Military Park during the 2008-2010, 2012, 2013, and 2016 spring bird surveys.

| Common name                | <u>Proportion of plots occupied</u> |              |              |              |              |              |
|----------------------------|-------------------------------------|--------------|--------------|--------------|--------------|--------------|
|                            | Abundance                           |              |              |              |              |              |
|                            | 2008<br>n=99                        | 2009<br>n=97 | 2010<br>n=36 | 2012<br>n=98 | 2013<br>n=24 | 2016<br>n=99 |
| Willow Flycatcher          | 0                                   | 0            | 0            | 0.05         | 0            | 0            |
|                            | 0                                   | 0            | 0            | 7            | 0            | 0            |
| <b>Wood Thrush</b>         | <b>0.04</b>                         | <b>0.01</b>  | <b>0</b>     | <b>0.01</b>  | <b>0.13</b>  | <b>0.02</b>  |
|                            | <b>10</b>                           | --           | <b>0</b>     | <b>1</b>     | <b>11</b>    | <b>3</b>     |
| <b>Worm-eating Warbler</b> | <b>0.05</b>                         | <b>0</b>     | <b>0</b>     | <b>0</b>     | <b>0</b>     | <b>0</b>     |
|                            | <b>10</b>                           | <b>0</b>     | <b>0</b>     | <b>0</b>     | <b>0</b>     | <b>0</b>     |
| Yellow-billed Cuckoo       | 0.02                                | 0.01         | 0.04         | 0.10         | 0.33         | 0            |
|                            | 3                                   | --           | --           | 11           | 46           | 0            |
| Yellow-breasted Chat       | 0.07                                | 0.02         | 0            | 0.06         | 0.04         | 0.03         |
|                            | 10                                  | --           | 0            | 10           | --           | 4            |
| Yellow-throated Warbler    | 0                                   | 0.05         | 0            | 0            | 0            | 0            |
|                            | 0                                   | --           | 0            | 0            | 0            | 0            |
| Yellow Warbler             | 0.02                                | 0.01         | 0            | 0.02         | 0            | 0.02         |
|                            | 3                                   | 1            | 0            | 3            | 0            | 3            |

\* — denotes when a species was present on a plot but outside 50-m of plot center therefore their annual abundance value could not be calculated.

Bolded species names are those species considered of regional concern for the Central Hardwoods Bird Conservation Region (U.S. Fish and Wildlife Service 2008).

## Appendix C

**Table C-1.** Regional trends in breeding birds recorded on Pea Ridge National Military Park, Arkansas for years 2008 through 2013.

| Common name                | Trend        | Central Hardwoods       |              |
|----------------------------|--------------|-------------------------|--------------|
|                            |              | 95% Confidence Interval |              |
|                            |              | Lower                   | Upper        |
| Acadian Flycatcher         | 1.05         | -0.63                   | 2.72         |
| American Crow              | 1.21         | -0.38                   | 2.83         |
| American Goldfinch         | 1.60         | -0.99                   | 4.29         |
| American Kestrel           | 2.94         | -1.26                   | 7.74         |
| American Redstart          | 4.85         | -2.43                   | 15.01        |
| American Robin             | 1.52         | -0.13                   | 3.27         |
| American Woodcock          | 2.44         | -16.47                  | 33.61        |
| Baltimore Oriole           | -0.01        | -4.32                   | 4.13         |
| Barn Swallow               | -1.66        | -3.57                   | 0.08         |
| Barred Owl                 | 7.67         | 0.48                    | 17.62        |
| <b>Bewick's Wren</b>       | <b>-2.07</b> | <b>-10.87</b>           | <b>9.95</b>  |
| Black-and-white Warbler    | -1.69        | -7.82                   | 4.80         |
| Black-bellied Cuckoo       | -2.31        | -12.80                  | 7.57         |
| Black Vulture              | -0.15        | -12.88                  | 12.91        |
| Blue-gray Gnatcatcher      | -0.53        | -2.86                   | 1.65         |
| Blue Grosbeak              | 1.94         | -0.41                   | 4.46         |
| Blue Jay                   | -0.38        | -1.92                   | 1.36         |
| <b>Blue-winged Warbler</b> | <b>-7.88</b> | <b>-15.41</b>           | <b>-0.99</b> |
| Broad-winged Hawk          | 3.16         | -2.78                   | 11.41        |
| Brown-headed Cowbird       | -0.69        | -2.45                   | 1.00         |
| Brown Thrasher             | -1.05        | -2.80                   | 0.78         |
| Carolina Chickadee         | 1.75         | -0.81                   | 4.51         |
| Carolina Wren              | 5.75         | 3.17                    | 8.33         |
| Chimney Swift              | -3.49        | -5.84                   | -1.07        |
| Chipping Sparrow           | 2.99         | 1.00                    | 4.94         |
| Cliff Swallow              | 21.79        | 7.85                    | 31.68        |
| Common Grackle             | -2.72        | -4.44                   | -0.91        |
| Common Yellowthroat        | -1.33        | -2.86                   | 0.23         |
| Dickcissel                 | 0.91         | -3.76                   | 5.73         |
| Downy Woodpecker           | 4.07         | 0.77                    | 7.72         |
| Eastern Bluebird           | 3.67         | 0.71                    | 6.91         |
| Eastern Kingbird           | -0.15        | -1.95                   | 1.81         |

| Common name                  | Central Hardwoods |                         |             |
|------------------------------|-------------------|-------------------------|-------------|
|                              | Trend             | 95% Confidence Interval |             |
|                              |                   | Lower                   | Upper       |
| Eastern Meadowlark           | -2.55             | -4.32                   | -0.88       |
| Eastern Phoebe               | 0.87              | -1.62                   | 3.38        |
| Eastern Towhee               | 0.28              | -1.74                   | 2.35        |
| Eastern Wood-pewee           | -2.26             | -4.01                   | -0.61       |
| European Starling            | 1.14              | -1.14                   | 3.92        |
| Field Sparrow                | -2.02             | -3.95                   | 0.06        |
| Fish Crow                    | 7.61              | -10.43                  | 21.91       |
| Grasshopper Sparrow          | -3.68             | -9.03                   | 0.95        |
| Gray Catbird                 | -2.74             | -5.30                   | -0.23       |
| Great Blue Heron             | 3.27              | -0.81                   | 6.92        |
| Great Crested Flycatcher     | -0.42             | -2.43                   | 1.81        |
| Great Horned Owl             | -1.64             | -11.45                  | 8.55        |
| Hairy Woodpecker             | 1.59              | -2.08                   | 5.69        |
| Horned Lark                  | -3.13             | -8.74                   | 1.95        |
| House Sparrow                | -0.47             | -3.05                   | 2.43        |
| Indigo Bunting               | -1.17             | -2.20                   | -0.20       |
| <b>Kentucky Warbler</b>      | <b>-0.13</b>      | <b>-2.90</b>            | <b>2.81</b> |
| Killdeer                     | 0.57              | -2.13                   | 3.37        |
| Lark Sparrow                 | 5.35              | -9.89                   | 29.82       |
| Louisiana Waterthrush        | 2.02              | -1.68                   | 5.65        |
| Mourning Dove                | 1.78              | 0.22                    | 3.49        |
| Northern Bobwhite            | -3.18             | -5.52                   | -0.85       |
| Northern Cardinal            | 0.66              | -0.31                   | 1.72        |
| Northern Flicker             | NA                | NA                      | NA          |
| Northern Mockingbird         | 3.65              | 1.66                    | 5.73        |
| Northern Parula              | 3.20              | 0.67                    | 5.03        |
| Orchard Oriole               | -0.82             | -2.99                   | 1.51        |
| Ovenbird                     | -2.19             | -6.59                   | 2.23        |
| Pileated Woodpecker          | 1.71              | -0.76                   | 4.62        |
| <b>Prairie Warbler</b>       | <b>-1.78</b>      | <b>-3.63</b>            | <b>0.17</b> |
| Red-bellied Woodpecker       | 0.96              | -1.03                   | 2.98        |
| Red-eyed Vireo               | -0.60             | -2.48                   | 1.11        |
| <b>Red-headed Woodpecker</b> | <b>0.59</b>       | <b>-3.92</b>            | <b>5.45</b> |
| Red-shouldered Hawk          | 7.07              | 2.79                    | 12.04       |
| Red-tailed Hawk              | 3.94              | 0.77                    | 7.71        |
| Red-winged Blackbird         | -1.55             | -3.58                   | 0.55        |

| Common name                | Central Hardwoods |                         |              |
|----------------------------|-------------------|-------------------------|--------------|
|                            | Trend             | 95% Confidence Interval |              |
|                            |                   | Lower                   | Upper        |
| Ruby-throated Hummingbird  | 0.73              | -3.10                   | 4.28         |
| Scarlet Tanager            | -0.61             | -3.64                   | 2.26         |
| Scissor-tailed Flycatcher  | 8.88              | 0.69                    | 15.65        |
| Summer Tanager             | -0.06             | -2.02                   | 1.94         |
| Tree Swallow               | 7.25              | -1.63                   | 15.49        |
| Tufted Titmouse            | -0.02             | -2.24                   | 2.16         |
| Turkey Vulture             | 4.24              | 0.68                    | 7.64         |
| Warbling Vireo             | -1.40             | -5.05                   | 1.77         |
| <b>Whip-poor-will</b>      | <b>-2.17</b>      | <b>-6.36</b>            | <b>2.26</b>  |
| White-breasted Nuthatch    | 1.95              | -1.83                   | 5.91         |
| White-eyed Vireo           | -2.69             | -4.91                   | -0.54        |
| Wild Turkey                | 10.35             | 0.19                    | 19.19        |
| Willow Flycatcher          | 2.64              | -4.31                   | 12.86        |
| <b>Wood Thrush</b>         | <b>-3.41</b>      | <b>-5.71</b>            | <b>-1.15</b> |
| <b>Worm-eating Warbler</b> | <b>-0.23</b>      | <b>-5.88</b>            | <b>3.84</b>  |
| Yellow-billed Cuckoo       | -2.56             | -6.22                   | 1.23         |
| Yellow-breasted Chat       | -1.93             | -3.73                   | -0.18        |
| Yellow-throated Vireo      | 1.93              | -0.71                   | 4.61         |
| Yellow-throated Warbler    | 3.82              | 1.01                    | 6.81         |
| Yellow Warbler             | -4.06             | -10.52                  | 1.38         |

Bolded species names are those species considered of regional concern for the Central Hardwoods Bird Conservation Region (U.S. Fish and Wildlife Service 2008).

Regional trend data from BBS surveys (Sauer et al. 2014).

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