Kansas Ornithological Society
BULLETIN
PUBLISHED QUARTERLY

Vol. 70 SEPTEMBER, 2019 No. 3

Breeding Bird Surveys in Forested Habitats on the Fort Leavenworth Military Reservation, Kansas

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ABSTRACT

Forested floodplains along the Missouri River have declined due to construction of multiple dams, levees, and urban and agricultural expansion. Breeding bird communities in floodplain forests are sensitive to habitat loss and degradation, are therefore useful targets for long-term monitoring. Fort Leavenworth, Kansas, supports large tracts of floodplain forests and associated mature upland oak/hickory forests along the Lower Missouri River. Point-count stations were established and surveyed during the 2018 breeding season based on prior surveys in 2003. We also surveyed point-counts in upland oak/hickory forests for comparison. A total 850 birds of 56 species were detected during point-counts. Old growth floodplain forest supported higher mean abundance and richness of Neotropical migrants and total species than mature upland oak/hickory forests. However, we detected several regional priority species only in the upland forests, including the Louisiana Waterthrush (*Parkesia motacilla*) and Kentucky Warbler (*Geothlypis formosa*). The combination of large forested tracts of old growth floodplain and mature upland oak/hickory forests likely form an important refuge for many seasonal rare and sensitive species, and future efforts should strive to protect these areas from future disturbance and development.

INTRODUCTION

Floodplain forests, along with associated upland forest systems, provide critical ecological services including habitat refuges for sensitive and rare species, movement corridors for wildlife, and capacity to promote water quality in the region (Freeman et al. 2003). A series of dams, levees, dikes and revetments, have altered overall hydrologic function of the Missouri River, reducing sediment deposition and

formation of natural sand point-bars that can serve to regenerate future native stands of cottonwood (*Populus deltoides*) and willow (*Salix* spp.) (Johnson et al. 1976, Johnson et al. 2012). Flood reduction, while important for human-land uses of agriculture and urban/residential development, prevents natural disturbance regimes that historically served to promote habitat heterogeneity and biological diversity in the region.

Forested riparian areas, in particular, are vital for maintenance of regional avifauna (Liknes et al. 1994, Ohmart 1994). Poor regeneration of mature floodplain forests, plus future projections of continued habitat loss in the region (Johnson et al. 2012), forebodes future declines of riparian bird communities. Resilience of riparian forest bird communities to infrequent disturbance (Munes et al. 2015), are not likely to be sufficient to maintain avifauna diversity in light of ongoing habitat loss, invasion of non-native species, and expansion of introduced diseases (e.g., emerald ash borer, *Agrilus planipennis* and Dutch elm disease, *Ophiostoma ulmi*) (Johnson et al. 2012). Large-scale restoration efforts that may include dam removal, habitat manipulation and tree plantings, island and nesting site creation, and long-term monitoring may be needed to facilitate restoration of riparian habitats in the Missouri River floodplain. Monitoring of avian communities is a long-established practice that can effectively document habitat degradation and subsequent success of restoration and habitat enhancement on bird populations, including the Peregrine Falcon (*Falco peregrinus*) (White et al. 2002), Kirtland's Warbler (*Setophaga kirtlandii*) (Bocetti et al. 2014), and the Southwestern Willow Flycatcher (*Empidonax traillii extimus*) (Finch and Stoleson 2000), among others (Guilfoyle and Fischer 2007).

The Fort Leavenworth Military Reservation supports some of the largest old growth, globally significant forest remnants in the lower Missouri River valley (Freeman et al. 1997, 2003). Of particular importance is the old growth floodplain forest in the north-central part of the installation. This floodplain forest is largely composed of mature cottonwood-sycamore and pecan-hackberry forests, and likely constitutes the largest floodplain forest system along the lower Missouri River. Generally, much of the floodplain and upland forests throughout the Missouri River floodplain have been removed for agriculture, forest products, and human residential growth (Johnson et al. 2012). For these reasons, continued maintenance and monitoring of the forest systems on Fort Leavenworth is important for the planning and conservation of local and regional rare and sensitive species (Schukman 1996, Freeman et al. 1997, 2003, Munes et al. 2015).

Floodplain forest systems on Fort Leavenworth have been surveyed for breeding birds in floodplain forests using points-count surveys (Freeman et al. 2003), but have not been surveyed using standardized methods since. In 2018, we reestablished these point-count stations and conducted surveys during the breeding season. We established and surveyed additional point-count stations in mature upland oak/hickory forests for comparison. Proper management of migratory birds and habitats, including the timely implementation of appropriate conservation practices, will help installation personnel to avoid or minimize any action that may negatively affect breeding birds. Our objectives in this effort were 1) re-sample breeding bird communities in old growth floodplain forest, and other floodplain forest types,

utilizing the same methods and sampling locations as prior efforts, 2) expand point-count survey efforts to include upland oak/hickory forests, 3) compare results among forest types to gain insight into the current value of forested habitats for breeding birds, especially regionally rare and sensitive species, and 4) compare with prior survey efforts to gain insights into the current status of breeding bird communities on Fort Leavenworth.

METHODS

Study Site

The Fort Leavenworth Military Reservation is a U.S. Army Installation located in Leavenworth County, in northeast Kansas (Figure 1). This installation is the oldest active U.S. Army post west of the Mississippi River and is the oldest permanent settlement in Kansas. Fort Leavenworth occupies approximately 2,280 ha (5,634 ac). This installation supports one of the largest old growth floodplain forests in the lower Missouri River valley, and associated mature upland forests are important regionally (Freeman et al. 1997, 2003). This installation is located in the Eastern

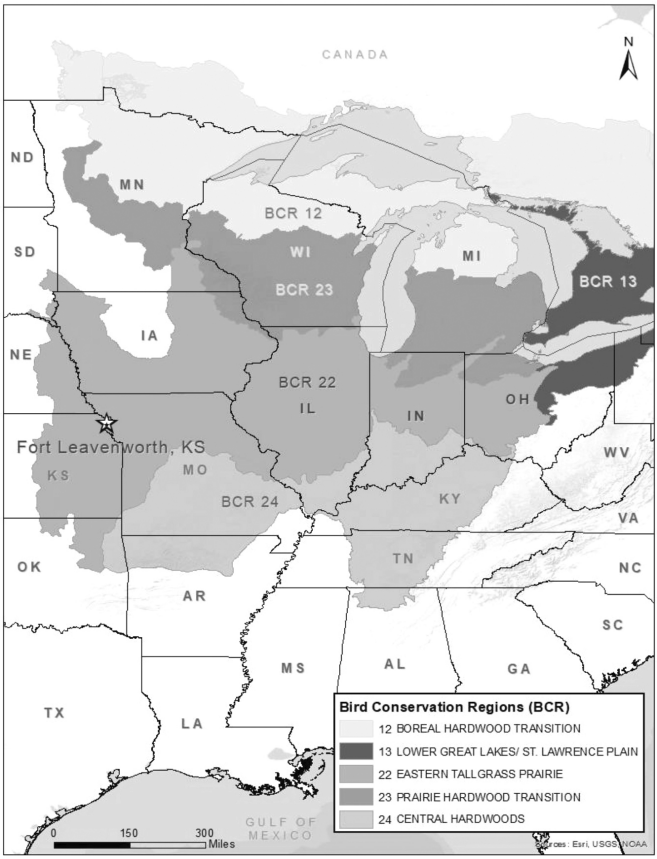

Figure 1. Location of U.S. Fort Leavenworth in northeast Kansas. This installation is located in the Eastern Tallgrass Prairie Bird Conservation Region (#22) identified by Partner's in Flight.

Tallgrass Prairie Bird Conservation Region (BCR) as identified and used by Partners in Flight (PIF) and the North American Bird Conservation Initiative (NABCI) for regional bird conservation (NABCI 2019). The floodplain forest was categorized into three different sections by Freeman et al. (2003), including old growth, 312 ha (771 ac), midsuccessional, 212 ha (524 ac), and early successional 71 ha (175 ac). The old growth floodplain forest largely supports cottonwood, hackberry (*Celtis occidentalis*), American elm (*Ulmus americana*), and sycamore (*Platanus occidentalis*) (Figure 2). Mid-successional (Figure 3) and early successional, savannah-like, habitats (Figure 4) generally support the same tree species, but are much more open compared to old growth forest. The installation supports approximately 380 ha (940 ac) of mature, upland oak/hickory forests in the central and southwest sections (Figure 5). These areas consist of moderately rolling hills dominated by mature oak (*Quercus* spp.) and hickory (*Carya* spp.). Secondary upland species include green ash (*Fraxinus pennsylvanica*), black walnut (*Juglans nigra*), and common pawpaw (*Asimina triloba*). Understory of the floodplains support thickets of American stinging nettle (*Urtica dioica*) and the invasive Japanese hop (*Humulus japonicus*). Due to significant flooding in 2011, there were large numbers of fallen cottonwood trees that created openings in old growth areas that now support dense patches of sapling boxelder (*Acer negundo*). Detailed descriptions of the vegetative communities of the floodplain and upland forests on Fort Leavenworth are available in Freeman et al. (1997, 2003).

Figure 2. Old Growth Floodplain Forest.

Figure 3. Mid-successional Floodplain Forest.

Avian Community Sampling

Establishment and surveying of Point Counts Stations

Freeman et al. (2003) did not provide coordinates for point-count stations established during the 2003 breeding season. For this reason, a hard copy of the map of the point-count stations was taken in the field and emulated as much as possible using a hand-held GPS unit (Garmin ®E-trex) (Figure 2; point-count station coordinates are provided in Appendix A). The original approach to establishing the point-count stations by Freeman et al. (2003) is not clear; however, the point-count stations appear to be established in a systematic-random manner sufficient to cover a large portion of the floodplain forest. To maintain point-count station establishment under the protocols set by Hamel et al. (1986), stations were located at a minimum of 250 m apart. However, to maintain this distance, not all stations established by Freeman et al. (2003) could fit into the various floodplain forest tracts. Therefore, total number of established point-count stations varied. Instead of 13 point-count stations for each floodplain forest type, we established 12 stations in old growth forest, 7 stations in mid-successional forest and 13 stations in early successional forest. We established an additional 14 stations in mature, upland oak/hickory forest in the southcentral portion of Fort Leavenworth (Figure 6).

Figure 4. Early Successional Floodplain Forest.

In order to complete the surveys in a timely manner, 5 min point-count surveys were conducted at each station as recommended by Hamel et al. (1996), rather than using the 10 min point-count survey approach used by Freeman et al. (2003). All birds detected by sight or vocalizations were noted on a field data form by one observer (M. P. Guilfoyle, with over 30 years bird survey experience). Birds detected during the surveys were denoted in two time categories (3 min, and 3-5 min intervals; Hamel et al. 1996). Birds were denoted into distance categories at 5 m increments, up to >100 m (unlimited distance point-counts; Hamel et al. 1986). Flyovers were noted separately and used in the tally of all birds detected; however, these data were not used in analyses between floodplain and upland forest comparisons. These distance category designations permit an estimation of detectability that can be used to estimate density and to verify the quality of the count data (Guilfoyle and Fischer 2007). Breeding surveys were conducted from 1 June to 4 June 2018; most all surveys started around 6:30 am (CST) and ended around 10:30 am (CST). No surveys were completed during periods of rain or strong winds.

We also placed birds into specific migratory groups: Neotropical migrants (migrant birds that breed in North America, but migrate to wintering areas in Mexico, Central and South America, and the Caribbean Islands), Nearctic migrants (also called temperate migrants, these birds reside in North America year-round and typically breed in northern U.S. and Canada, but winter in the southern U.S.), and resident species (these are birds that rarely migrate and remain within a geographic area year-round). Species were placed into migratory categories based on species

Figure 5. Mature Upland Oak/Hickory Forest.

accounts in The Birds of North American (Poole and Gill, eds. 1992). Since nearly half of all breeding birds in Missouri floodplain forests are migrants (Munes et al. 2015), and since migratory birds, particularly Neotropical Migrants, are experiencing the most significant populations declines in the region, as detailed by Partners in Flight (PIF) (PIF Science Committee 2013), we categorized birds in this manner to estimate which habitats are most important for their conservation. We also classified birds into "Total Group" (which contains all birds detected) and PIF Priority Species, which represent those birds identified by PIF as most in need of conservation in the region.

Statistical Analyses

Survey data were entered into the MS Excel program, and all records were checked for accuracy. Differences in mean counts for species groups (Neotropical migrants, resident species, PIF species and total species) and selected species among habitats were tested for normality (Proc Normal; SAS Institute, Inc. 2010). Only count data ≤50 m was used in statistical habitat comparisons to reduce any bias from bird detections influenced by proximity to adjacent edge or other habitat types (Hamel et al. 1996). We also compared values of mean species richness among forest types, where species richness is simply the total number of species detected at each

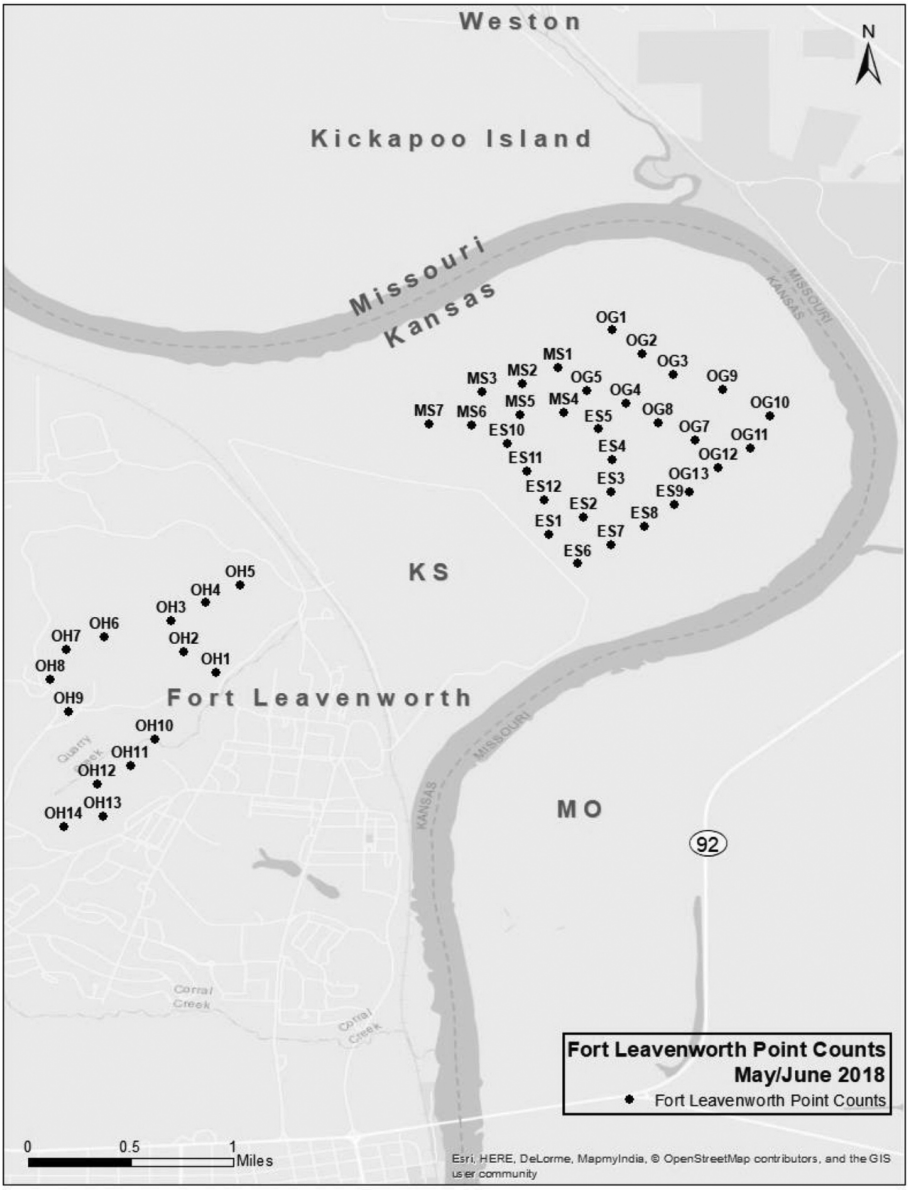

Figure 6. Point-count stations established in 2018 to emulate stations established and surveyed by Freeman et al. (2003).

point (Krebs 1989). Raw counts and species richness values did not fit a normal distribution; but parametric analyses are generally robust to this violation (Sokal and Rohlf 1995). In most statistical analyses of population data, raw data are rarely normally distributed. However, since parametric analyses are more powerful and capable of detecting differences than non-parametric methods, parametric statistical

approaches are usually preferred and recommended (Zar 1984, Sokal and Rohlf 1994). In cases with heavily skewed data, mathematical transformation of data are often be used to shift the data into a more normal distribution. However, statistical data that relies on mean values as the values for analyses, as in the case of mean bird counts and richness values, are rarely skewed far from normal due to the central limit theorem (Zar 1984, Sokal and Rohlf 1995). Therefore, a standard Analysis of Variance (ANOVA) (Proc GLM; SAS Institute, Inc. 2010) was used on mean bird counts and mean species richness values to assess differences among habitats. A Tukey's Multiple-Range test was used to determine habitat types with significantly different means (α=0.05).

RESULTS

From 1-4 June 2018, we detected 850 birds of 56 species in forested habitats during unlimited distance point-count surveys on Fort Leavenworth (Table 1). Twenty-eight species were Residents, 28 were Neotropical migrants, and 15 were regionally identified PIF Priority Species of Concern in the Eastern Tallgrass Prairie Bird Conservation Region (BCR) (Table 1). Overall, 15 species detected during this effort have been identified by PIF as regional Priority Species including the Red-headed Woodpecker, Chimney Swift, Yellow-billed Cuckoo, and Acadian Flycatcher (Table 2) (common and scientific names of all birds detected or mentioned in this manuscript are listed in Appendix B). One Cerulean Warbler, a regional PIF priority species and a recent candidate for listing under the Endangered Species Act (1973), was detected in the old growth floodplain forest outside of point-count surveys. Several PIF Priority Species were found only in upland forests, including the Kentucky Warbler, Eastern Meadowlark, Brown Thrasher, and Louisiana Waterthrush.

Floodplain forest types and upland oak/hickory forests had similar mean counts for PIF Species, Resident Species, and Total Species as determined through analysis of the point-count data from ≤50 m (Table 3). Old growth floodplain forests supported significantly higher mean abundance (P=0.001) of Neotropical migrants (mean+STDERR=7.50+0.70; n=12) than upland oak/hickory forests (3.93+0.57; n=14) (Table 3).

Floodplain forest types and upland oak/hickory forests had similar mean species richness values for PIF Species and Resident Species, as determined through analysis of point-count data (Table 3). Old growth floodplain forest supported significantly higher mean species richness (5.83+0.22; n=12) (P=0.002) of Neotropical migrants than oak/hickory forests (3.21+0.32; n=14) (Table 3). Mean species richness for Neotropical Migrants in midsuccessional and early successional floodplain forests did not differ from the other forest types (Table 3). All floodplain forest types had significantly (P=0.007) higher mean Total Species richness than oak/hickory forests (6.64+0.65; n=14) (Table 3).

Table 1. Number of detections by species and number of points at which each species was detected during unlimited radius point-count surveys, Fort Leavenworth, Kansas, 1 – 4 June 2018.

Species	# Detected	# Points	Species	# Detected	# Points
Northern Cardinal	72	37	American Robin	4	2
Red-bellied Woodpecker	61	40	Common Grackle	4	3
Eastern Tufted Titmouse	56	34	Eastern Meadowlark§	3	3
American Redstart	49	30	Northern Bobwhite§	3	3
Blue Jay	41	26	*Prothonotary Warbler*§	3	3
Carolina Wren	37	32	*Yellow-breasted Chat*§	3	3
Great-crested Flycatcher	35	25	American Goldfinch	2	2
Indigo Bunting	35	21	Brown Thrasher§	2	2
Red-eyed Vireo	33	24	*Cliff Swallow*	2	1
Eastern Wood-Pewee§	27	27	Hairy Woodpecker	2	2
Pileated Woodpecker	27	21	*Louisiana Waterthrush*§	2	1
Brown-headed Cowbird	25	19	*Summer Tanager*	2	2
Mourning Dove	21	17	Turkey Vulture	2	1
Wood Thrush	19	17	Eastern Phoebe	1	1
Baltimore Oriole	18	17	*Ovenbird*	1	1
House Wren	18	14	Red-tailed Hawk	1	1
Yellow-billed Cuckoo§	18	17	Red-shouldered Hawk	1	1
Acadian Flycatcher§	16	12	*Ruby-throated Hummingbird*	1	1
Rose-breasted Grosbeak	16	13			
White-breasted Nuthatch	15	11			
Gray Catbird	14	10	Total	850	
Black-capped Chickadee	13	7			
Downy Woodpecker	13	11			
Orchard Oriole	13	9			
Eastern Towhee	12	10			
Warbling Vireo	12	11			
Yellow-throated Vireo	12	11			
Common Yellowthroat§	11	8			
Northern Flicker§	11	8	[1]Neotropical migrants are		
Northern Parula	11	9	denoted in *italics*		
Red-headed Woodpecker§	8	7			
American Crow	7	5	§ Eastern Tallgrass Prairie		
Blue-gray Gnatcatcher	7	7	BCR (#22) Priority Species		
Kentucky Warbler§	7	6			
Chimney Swift§	6	4			
Eastern Bluebird	5	5			
Scarlet Tanager	5	4			
Yellow-throated Warbler§	5	5			

Table 2. Partner's in Flight "Priority" Species (Ranked ≥13) detected during summer breeding season surveys (unlimited radius counts), Fort Leavenworth, Kansas, 1 – 4 June 2018, as scored in the Eastern Tallgrass Prairie Physiographic Region (#22) (Partner's in Flight Science Committee 2013). http://pif.birdconservancy.org/ACAD/Database.aspx).

Species	PIF Concern Score	Number of Detections
Red-headed Woodpecker	18	8
Eastern Meadowlark	17	3
Brown Thrasher	16	2
Northern Bobwhite	16	3
Northern Flicker	16	11
Acadian Flycatcher	15	16
Chimney Swift	15	6
Yellow-billed Cuckoo	15	18
Eastern Wood-pewee	14	27
Louisiana Waterthrush	14	2
Yellow-breasted Chat	14	3
Common Yellowthroat	14	11
Kentucky Warbler	13	7
Prothonotary Warbler	13	3
Yellow-throated Warbler	13	5

Table 3. ANOVA and Tukey's Multiple Range Test[1] results on mean (+STDERR) counts and species richness for species groups (≤50 m radius counts) during the breeding season on Fort Leavenworth, Kansas, 1–4 June 2018.

Species Groups	ANOVA Results				
	Old Growth (n=12)	Midsuccessional (n=7)	Early Successional (n=13)	Oak/Hickory (n=14)	*P*
Mean Counts					
Neotropical Migrants	7.50±0.70A	5.86±0.74AB	6.23±0.69AB	3.93±0.39B	0.001
Resident Species	5.42±0.87	6.57±1.11	6.15±0.83	5.29±0.99	0.82
PIF Species	1.17±0.27	1.86±0.40	1.00±0.36	1.21±0.35	0.35
Total Species	12.92±1.14	12.43±1.43	12.39±1.16	9.21±1.11	0.08
Mean Species Richness					
Neotropical Migrants	5.83±0.22A	5.00±0.49AB	4.69±0.50AB	3.21±0.32B	0.001
Resident Species	4.08±0.58	4.57±0.48	5.00±0.64	3.43±0.52	0.22
PIF Species	1.08±0.24	1.71±0.18	0.77±0.18	1.07±0.17	0.22
Total Species	9.92±0.73A	9.57±0.57A	9.69±0.90A	6.64±0.65B	0.007

[1]Means with the same letter are not significantly different.

DISCUSSION

Our study supports prior research that shows that mature bottomland hardwood and floodplain forests support high abundance and richness of forest bird communities, particularly Neotropical migrants and other rare or sensitive bird species (Zimmerman and Tatschal 1975, Dickson 1978, Johnston 1979, Buffington et al. 1997). By grouping data from individual species' detections from point-count data, we were able to perform analyses on mean abundance and species richness for Neotropical migrants, Resident birds, PIF Priority Species and Total Species. From this analysis, floodplain forests generally supported higher numbers and species richness values of Neotropical migrants, resident species, and total species, while oak/hickory forest metrics were lower. However, oak/hickory forests were the only areas that supported the Kentucky Warbler, Louisiana Waterthrush, and other regionally uncommon species (e.g., Ovenbird; though not a regional PIF Priority Species). Freeman et al. (1997, 2003) notes that both the upland mature forests and the old growth floodplain forests likely form a refuge for many seasonal breeding and migratory birds throughout the Lower Missouri Valley region and our data support that contention for the 2018 breeding season.

It is also generally recognized that older, more mature floodplain forest systems support bird communities with higher abundance and richness than early successional forests, particularly for Neotropical migrants (Dickson 1978, Buffington et al. 1997). Our results did not support this generalization as we found old growth forests having non-significant differences between midsuccessional and early successional floodplain forests for all bird group categories. One explanation might be that the different successional floodplain forests were immediately adjacent to each other and the presence of birds in the old growth forests influenced the detection of birds in the adjacent successional forest types and vice versa.

In general, results from the floodplain forests are very similar to the results of surveys conducted by Freeman et al. (1997, 2003). Freeman et al. (2003) detected 53 species during point-count surveys in the floodplain forests. We detected 56 species, but some of our counts were in oak/hickory forests. However, most of the species detected in 2018 (44 of 56) match the species detected by Freeman et al. (2003). A few exceptions include the Ring-necked Pheasant, Lark Sparrow, Red-winged Blackbird and Eastern Kingbird, which were not detected in 2018. A few species were detected in the floodplain forests in 2018 that were not detected by Freeman et al. (2003) including the Summer Tanager, House Finch, Chimney Swift, Cliff Swallow, Red-tailed Hawk and Ruby-throated Hummingbird. In addition, there were several species detected in 2018 in the upland oak/hickory forests that were not observed by Freeman et al (2003), but are mentioned in Freeman et al. (1997) including the Ovenbird, Kentucky Warbler, and Louisiana Waterthrush.

There is increasing concern about the decline of floodplain and riparian forests, and the impact on sensitive and rare birds (Zimmerman and Tatschl 1975, Dickson 1978, Buffington et al. 1996), and overall diversity of these systems (Harris and O'Meara

1989, Johnson et al. 2012). Forested wetlands have experienced ongoing declines since the 1970s (Mitsch and Gosselink 1993) and continued declines are expected into 2030 (U.S. Department of Agriculture [USDA] Forest Service 1988). Moreover, it has recently been reported that all North American birds have declined by almost 3 billion, or 29 percent during the past 48 years (Rosenberg et al. 2019). Conservation and monitoring of the remaining floodplain forests on Fort Leavenworth are necessary to protect existing bird populations, particularly Neotropical migrants, including the Cerulean Warbler. However, the value of mature upland forests should not be lost as important areas for numerous other bird species, including several regional PIF Priority Species. In increasingly fragmented and urbanized landscapes, military installations, such as Fort Leavenworth, can form islands of habitat that act as sources for populations of our rare and sensitive birds and other wildlife. Further, these areas can act as sources of immigrants into patches of existing habitats inside and outside the installation, including newly restored habitats (Martin et al. 1996).

Finally, these results focus only on the breeding season. For many migratory species, the availability of large tracts of high quality migratory stopover habitat is necessary for long-term sustainability of migratory populations (Moore et al. 2000). It is likely that the habitats on Fort Leavenworth also support diverse assemblages of migratory birds during spring and fall migration and overwintering seasons. To get a handle on the importance of year-round seasonal habitat relationships on Fort Leavenworth, year-round seasonal bird community monitoring is recommended about every three years for all forest types.

Territory mapping through repeated line-transects (Schukman 1996) during the breeding season is recommended to determine the presence, arrival, pairing-success, and potentially, reproductive success of important PIF Priority warblers, including the Cerulean Warbler and Yellow-throated Warbler. The capture, color-banding and resighting of target species (Calvo and Furness 1992) to determine reproductive success is possible, but often logistically difficult, labor intensive, and expensive (Ralph et al. 1993). An alternate, less expensive observational approach may include repeated visits, determination of nest locations (as possible), and establishing a nest success index through observations of paired males, nest attempts, nest failures, and detection of hatched yet dependent young (Vickery et al. 1992). Such information, along with long-term bird community monitoring, would provide land managers important information on the status of seasonal bird communities and population viability of important PIF Priority species on the installation.

ACKNOWLEDGMENTS

We thank Jake Jung and Darrell Evans, both of the U.S. Army Engineer Research and Development Center, Environmental Laboratory, for internal reviews of this manuscript. Additional reviewers include Eugene Young, Roger Boyd, John Schukman and an anonymous reviewer. Max Thompson reviewed all scientific names. U.S. Army Installation, Fort Leavenworth, KS, funded this effort. Sam

Jackson, U.S. Army Engineer Research and Development Center, used ArcGIS Version 10.3, to create Figures 1 & 6. The funders had no role in study design, data collection and analysis, decision to publish or preparation of the manuscript. Permission was granted by the Chief of Engineers to publish this information. The views expressed are those of the authors and do not necessarily represent those of the U.S. Army of Corps of Engineers. The use of trade, product or firms named in this paper is descriptive in purpose only and does not imply endorsement by the U.S. Government.

LITERATURE CITED

Buffington, J. M., J. C. Kilgo, R. A. Sargent, K. V. Miller, and B. R. Chapman. 1997. Comparison of breeding bird communities in bottomland forests of different successional stages. Wilson Bulletin 109:314-319.

Bocetti, C. I., D. M. Donner, and H. F. Mayfield. 2014. Kirtland's Warbler (*Setophaga kirtlandii*), version 2.0. In The Birds of North America (A. F. Poole, Editor). Cornell Lab or Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.19.

Calvo, B., and R. W. Furness. 1992. A review of the use and effects of marks and devices on birds. Ringing and Migration 13:129-151.

Dickson, J. G. 1978. Forest bird communities of bottomland hardwoods. Pages 66-73 in Proceedings of the Workshop: Management of Southern Forests for Nongame Birds (R. M. DeGraaf, eds.), USDA Forest Service General Technical Report SE-14.

Finch, D. M., and S. H. Stoleson, eds. 2000. Status, ecology, and conservation of the Southwestern Will Flycatcher. General Technical Report RMRS-GTR-60. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Freeman, C. C., W. H. Busby, C. L. Lauver, K. Kindscher, J. Elliott, and D. A. Eifer. 1997. A Natural Areas Inventory of the Ft. Leavenworth Military Reservation, Leavenworth County, Kansas. Reports of the State Biological Survey of Kansas, The University of Kansas, Lawrence, KS. Report #77. 170 pp.

Freeman, C. C., W. H. Busby, J. Delisle, W. D. Kettle, K. Kindscher, H. Loring, C. A. Morse, and V. B. Salisbury. 2003. A natural areas inventory of the Ft. Leavenworth Military Reservation, Leavenworth County, Kansas. II. Open-file Report No. 117. Kansas Natural Heritage Inventory, Kansas Biological Survey, Lawrence, KS. 199 pp.

Guilfoyle, M. P., and R. A. Fischer. 2007. Implementing avian inventory and monitoring efforts on Corps of Engineers project lands. EMRRP Technical Notes Collections (ERDC TN-EMRRP-SI-32), U.S. Army Engineer Research and Development Center, Vicksburg, MS.
http://el.erdc.usace.army.mil/emrrp/techtran.html. Accessed August 2019.

Hamel, P. B., W. P. Smith, D. J. Twedt, J. R. Woehr, E. Morris, R. B. Hamilton, and R. J. Cooper. 1996. A land manager's guide to point counts of birds in the Southeast. General Technical Report SO-120. New Orleans: U.S. Department of Agriculture, Forest Service, Southern Research Station, Stoneville, MS.

Harris, L. D., and T. E. O'Meara. 1989. Changes in southeastern bottomland forests and impacts on vertebrate fauna. Pages 755-772 in Freshwater Wetlands and Wildlife (R. R. Sharitz and J. W. Gibbons, eds.). U.S. Department of Energy, Office of Scientific and Technical Information Symposium Series No. 61.

Johnston, R. F. 1979. Woodland breeding bird communities in eastern Kansas. Transactions of the Kansas Academy of Sciences 82:246-251.

Johnson, W. C., R. L. Burgess, and W. R. Keammerer. 1976. Forest overstory vegetation and environment on the Missouri River floodplain in North Dakota. Ecological Monographs 46:59-84.

Johnson, W. C., M. D. Dixon, M. L. Scott, L. Rabbe, G. Larson, M. Volke, and B. Werner. 2012. Forty years of vegetation change on the Missouri River Floodplain. Bioscience 62:123-135.

Krebs, C. J. 1989. Ecological Methodology. Harper-Collins Publishers, New York, NY.

Liknes, E. T., K. L. Dean, and D. L. Swanson. 1994. Avian diversity, density, and breeding status in a riparian community in southeastern South Dakota. Proceedings of the South Dakota Academy of Sciences 73:83-100.

Martin, C. O., R. A. Fischer, M. G. Harper, D. J. Tazik, and A. Trame. 1996. Regional strategies for managing threatened and endangered species habitats: a concept plan and status report. Strategic Environmental Research and Development Program, Technical Report SERDP-96¬-1. Vicksburg, Mississippi; U.S. Army Engineer Research and Development Center.

Mitsch, W. J., and J, G, Gosselink. 1993. Wetlands, Second Edition. Van Nostrand Reinhold, New York, NY.

Moore, F. R. (Ed.). 2000. Stopover ecology of Nearctic-Neotropical landbird migrants: habitat relations and conservation implications. Studies in Avian Biology 20:1-133.

Munes, E. C., M. D. Dixon, D. L. Swanson, C. L. Merkord, and A. R. Benson. 2015. Large, infrequent disturbance on a regulated river: response of floodplain forest birds to the 2011 Missouri River Flood. Ecosphere 6: 1-19.

North American Bird Conservation Initiative. 2019. Bird Conservation Regions Map. http://nabci-us.org/resources/bird-conservation-regions-map/ Accessed September 2019.

Ohmart, R. D. 1994. The effects of human-induced changes on the avifauna of western riparian habitats. Studies in Avian Biology 16:273-285.

Partners in Flight Science Committee. 2013. Population Estimates Database, Version 2013. http://pif.birdconservancy.org/PopEstimates/. Accessed September 2019.

Poole, A. and F. Gill, Eds. 1992. The Birds of North America. Philadelphia, PA: The Birds of North America, Inc.

Ralph, C.J., G.R. Geupel, P. Pyle, T.E. Martin, and D.F. Desante. 1993. Handbook of field methods for monitoring landbirds. Gen. Tech. Rep. PSW-GTR-144. Pacific Southwest Research Station, Forest Service, U.S. Dept. of Agriculture. Albany, CA. 41 pp.

Rosenberg, K. V., A. M. Dokter, P. J. Blancher, J. R. Sauer, A. C. Smith, P. A. Smith, J. C. Stanton, A. Panjabi, L. Helft, M. Parr, and P. P. Marra. 2019. Decline of the North American avifauna. Science 10.1126/scince.aaw1313.

SAS Institute, Inc. 2010. SAS/Stat v. 9.3 user's guide. SAS Institute, Inc., Cary, North Carolina.

Schukman, J. M. 1996. Temporal and spatial relationships of three canopy-dwelling warblers in a Missouri River bottomland forest. Kansas Ornithological Society Bulletin Vol 47, No. 4, 37-40.

Sokal, R. R. and F. J. Rohlf. 1995. Biometry, 3rd Edition. W. H. Freeman Company, New York, NY.

U. S. Department of Agriculture [USDA] Forest Service. 1988. The South's fourth forest: alternatives for the future. USDA Forest Resources Report 24.

Vickery, P. D., M. L. Hunter, Jr., and J. V. Wells. 1992. Use of a new reproductive index to evaluate relationship between habitat quality and breeding success. Auk 109:697-705.

White, C. M., N. J. Clum, T. J. Cade, and W. G. Hunt. 2002. Peregrine Falcon (*Falco peregrinus*). In The Birds of North America, A. Poole and F. Gill, eds., No. 660. Philadelphia, PA: The Birds of North America, Inc.

Zar, J. H. 1984. Biostatistical Analyses. Prentice Hall, Englewood Cliffs, N. J.

Zimmerman, J. L., and J. L. Tatschl. 1975. Floodplain birds of Weston Bend, Missouri River. Wilson Bulletin 87: 196-205.

Appendix A. Established point-count number and coordinates for summer breeding bird surveys on U.S. Army Base, Fort Leavenworth, Kansas, 1-4 June 2018.

Point Count ID	Latitude	Longitude
OG 01	N 39.38570	W 94.89769
OG 02	N 39.38405	W 94.89564
OG 03	N 39.38254	W 94.89344
OG 04	N 39.38052	W 94.89672
OG 05	N 39.38140	W 94.89952
OG 07	N 39.37790	W 94.89189
OG 08	N 39.37915	W 94.89449
OG 09	N 39.38153	W 94.88987
OG 10	N 39.37964	W 94.88659
OG 11	N 39.37732	W 94.88792
OG 12	N 39.37597	W 94.89025
OG 13	N 39.37427	W 94.89226
MS 01	N 39.38303	W 94.90153
MS 02	N 39.38192	W 94.90411
MS 03	N 39.38138	W 94.90696
MS 04	N 39.37986	W 94.90118
MS 05	N 39.37968	W 94.90426
MS 06	N 39.37895	W 94.90766
MS 07	N 39.37910	W 94.91067
ES 01	N 39.37127	W 94.90224
ES 02	N 39.37249	W 94.89973
ES 03	N 39.37424	W 94.89784
ES 04	N 39.37654	W 94.89776
ES 05	N 39.37870	W 94.89869
ES 06	N 39.36917	W 94.90020
ES 07	N 39.37048	W 94.89781
ES 08	N 39.37181	W 94.89541
ES 09	N 39.37336	W 94.89330
ES 10	N 39.37771	W 94.90516
ES 11	N 39.37573	W 94.90377
ES 12	N 39.37366	W 94.90252
OH 01	N 39.36144	W 94.92578
OH 02	N 39.36292	W 94.92801
OH 03	N 39.36511	W 94.92891
OH 04	N 39.36640	W 94.92648
OH 05	N 39.36767	W 94.92402
OH 06	N 39.36401	W 94.93364
OH 07	N 39.36307	W 94.93635
OH 08	N 39.36098	W 94.93749
OH 09	N 39.35867	W 94.93616
OH 10	N 39.35675	W 94.93004
OH 11	N 39.35487	W 94.93175
OH 12	N 39.35357	W 94.93414
OH 13	N 39.35131	W 94.93369
OH 14	N 40.23954	W 78.22127

Appendix B. Common and scientific names for birds detected during line transects and point-count surveys on Fort Leavenworth, Kansas, during the breeding season, 31 May – 4 June 2018; or otherwise mentioned in the report.

Common Name	Scientific Name
Canada Goose	*Branta canadensis*
Northern Bobwhite	*Colinus virginianus*
Wild Turkey	*Meleagris gallopavo*
Mourning Dove	*Zenaida macroura*
Yellow-billed Cuckoo	*Coccyzus americanus*
Chimney Swift	*Chaetura pelagica*
Ruby-throated Hummingbird	*Archilochus colubris*
Great Blue Heron	*Ardea herodias*
Ring-necked Pheasant	*Phasianus colchicus*
Turkey Vulture	*Cathartes aura*
Red-shouldered Hawk	*Buteo lineatus*
Red-tailed Hawk	*Buteo jamaicensis*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Red-bellied Woodpecker	*Melanerpes carolinus*
Hairy Woodpecker	*Picoides villosus*
Downy Woodpecker	*Picoides pubescens*
Northern Flicker	*Colaptes auratus*
Pileated Woodpecker	*Dryocopus pileatus*
Peregrine Falcon	*Falco peregrinus*
Eastern Wood-pewee	*Contopus virens*
Acadian Flycatcher	*Empidonax virescens*
Southwestern Willow Flycatcher	*Empidonax traillii extimus*
Eastern Phoebe	*Sayornis phoebe*
Great-crested Flycatcher	*Myiarchus crinitus*
Eastern Kingbird	*Tyrannus tyrannus*
Yellow-throated Vireo	*Vireo flavifrons*
Red-eyed Vireo	*Vireo olivaceus*
Warbling Vireo	*Vireo gilvus*
Blue Jay	*Cyanocitta cristata*
American Crow	*Corvus brachyrhynchos*
Cliff Swallow	*Petrochelidon pyrrhonota*
Tufted Titmouse	*Baeolophus bicolor*
Black-capped Chickadee	*Poecile atricapillus*
White-breasted Nuthatch	*Sitta carolinensis*
House Wren	*Troglodytes aedon*
Carolina Wren	*Thryothorus ludovicianus*
Blue-gray Gnatcatcher	*Polioptila caerulea*
Eastern Bluebird	*Sialia sialis*
Wood Thrush	*Hylocichla mustelina*
American Robin	*Turdus migratorius*
Gray Catbird	*Dumetella carolinensis*
Brown Thrasher	*Toxostoma rufum*
House Finch	*Haemorhous mexicanus*
American Goldfinch	*Spinus tristis*
Ovenbird	*Seiurus aurocapilla*

Common Name	Scientific Name
Louisiana Waterthrush	*Parkesia motacilla*
Prothonotary Warbler	*Protonotaria citrea*
Common Yellowthroat	*Geothlypis trichas*
Kentucky Warbler	*Geothlypis formosa*
American Redstart	*Setophaga ruticilla*
Cerulean Warbler	*Setophaga cerulea*
Northern Parula	*Setophaga americana*
Yellow-throated Warbler	*Setophaga dominica*
Kirtland's Warbler	*Setophaga kirtlandii*
Yellow-breasted Chat	*Icteria virens*
Eastern Towhee	*Pipilo erythrophthalmus*
Lark Sparrow	*Chondestes grammacus*
Summer Tanager	*Piranga rubra*
Scarlet Tanager	*Piranga olivacea*
Northern Cardinal	*Cardinalis cardinalis*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Indigo Bunting	*Passerina cyanea*
Eastern Meadowlark	*Sturnella magna*
Red-winged Blackbird	*Agelaius phoeniceus*
Common Grackle	*Quicalus quiscula*
Brown-headed Cowbird	*Molothrus ater*
Orchard Oriole	*Icterus spurius*
Baltimore Oriole	*Icterus galbula*

Manuscripts Needed and Instructions to Authors

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ISSN-0022-8729 1/16/2020