



Results of 2016 Breeding Bird Surveys at St. Joe State Park

Report to the Missouri Department of Natural Resources ~ Missouri State Parks



2016 Project Summary



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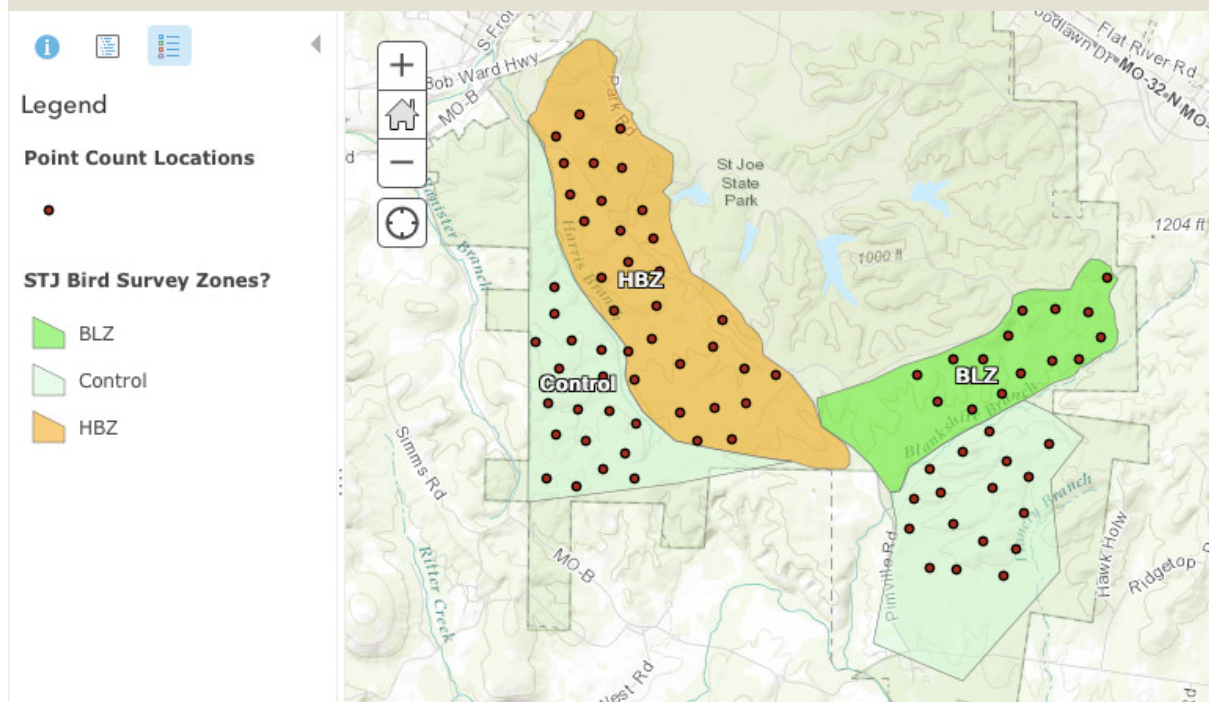
On the cover: Photograph of a typical point count setting within the Harris Branch bird survey zone.

- MRBO staff conducted bird surveys via time removal point-counts at 80 points in St. Joe State Park: 35 in the Control Unit, 30 in the Harris Branch Zone and 15 in the Blankshire Woods.
- A total of 1,230 bird detections were recorded throughout the study area representing 56 species, including 595 detections of 13 restoration target species and 188 detections of 8 regional priority species. Spatially explicit locations for each individual bird were logged during and between point counts. Distance analyses were generated for the 868 detections documented while on point count.
- Several restoration target species were detected in relatively high numbers, including Eastern Wood-Pewee ($n=156$), Blue-gray Gnatcatcher ($n=84$), Red-eyed Vireo ($n=76$), and Summer Tanager ($n=76$).
- Sample sizes were large enough to generate density estimates for the aforementioned species, the restoration target species guild, and the regional priority species guild. In some cases, sample sizes afforded accurate density estimates within each treatment unit, the control, and at the pine vs. non-pine stand level.
- Acadian Flycatcher, Blue-gray Gnatcatcher, Eastern Wood-Pewee, Red-eyed Vireo, and Summer Tanager populations are relatively high and evenly distributed across sites. Pine Warblers were relatively abundant within the short-leaf pine groves of the Blankshire Woods.
- In 2016, few significant differences in density and occupancy were documented for priority species between control and treatment sites.

Project Background

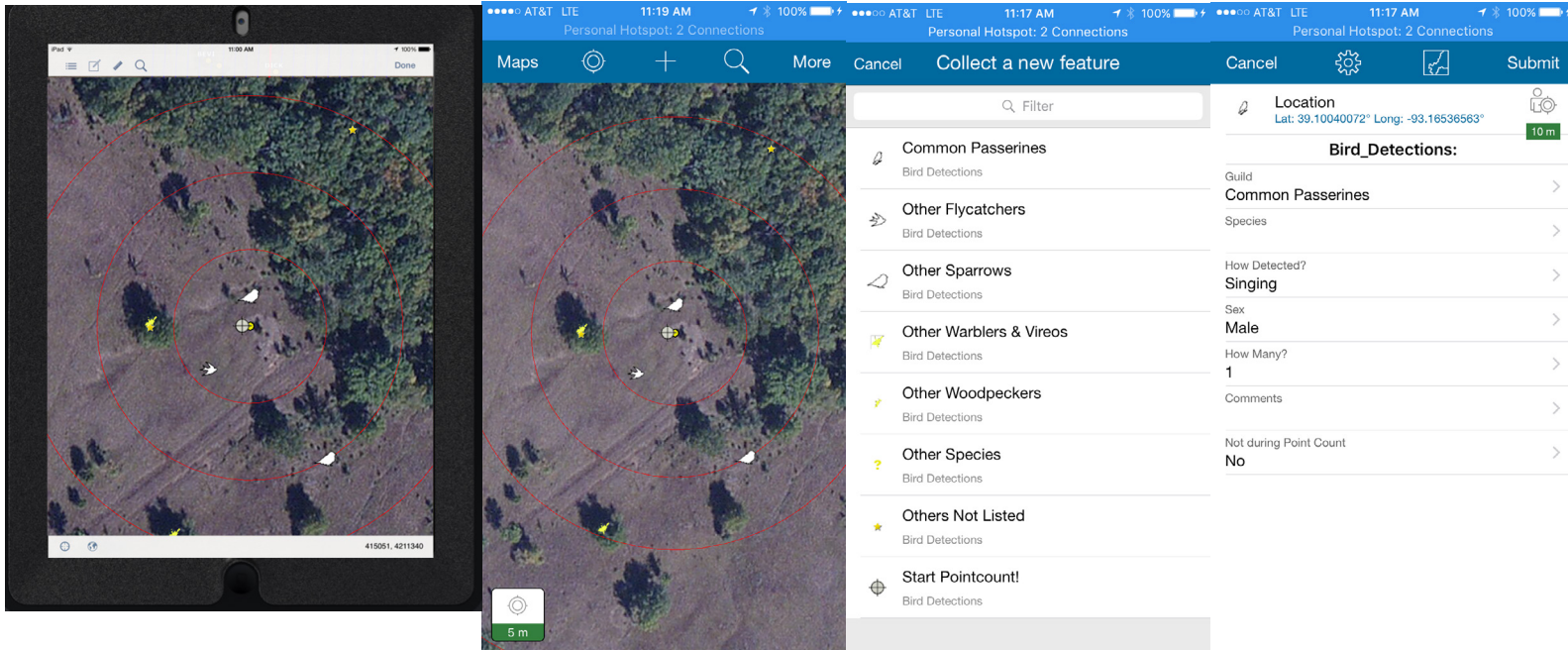
Many woodland- and savanna-dwelling bird species have exhibited population declines as upland habitat has been altered due to fire suppression, forest succession and conversion to other land uses (Thompson et al. 2012). In response, land managers have instituted restoration efforts to regain the ecological integrity of some of Missouri's Ozark forests. Biological monitoring can be an effective tool for illustrating the success of habitat restoration or a particular management regime. In keeping with Missouri Bird Conservation Initiative (MoBCI) restoration monitoring goals, in 2016 Missouri Department of Natural Resources (DNR) contracted the Missouri River Bird Observatory (MRBO) to conduct 80 avian point-count surveys at St. Joe State Park to assess the current occupancy and density of target bird species. These baseline data will be useful in assessing future response of breeding birds to St. Joe's continued management and restoration efforts on savanna, open woods, and glade communities.

Figure 1: St. Joe State Park bird study area indicating point count locations and survey zones within the park. Survey zones include: Blankshire Woods (BLZ), Harris Branch (HBZ), and the surrounding Control unit (control).



Methods

Figures (2-4) (left to right): ArcGIS Collector screenshots of (2) field surveyors view of point count location, distance bands (for reference) and birds detected, (3) menu options of guild selections, and (4) attributes to populate for each detection.



DNR and MRBO staff collaborated to produce a randomized point-count sampling design within three zones at St. Joe State Park: the treatment zones of Harris Branch (HBZ, 1,177.9 acres) and Blankshire Woods (BLZ; 605 acres), which have a history of prescribed fire and are undergoing an intensive restoration and management regime, and a surrounding Control Unit (Control; 1,491.9 acres) that has historically received little to no prescribed fire or other intensive management treatment.

Point counts were designed using the Lower Mississippi Valley Joint Venture (LMVJV) monitoring protocol (Wilson and Twedt 2007). This protocol is designed to test bird response to stand improvement activities and provide guidance for adaptive management over time. Point count locations were randomly generated within bird survey zones (Fig. 1) to maximize coverage with the ultimate goal of comparing treatment (burned) areas and controls (unburned). Points were located at least 250-m apart following LMVJV design protocol. There were 35 points in the Control unit, 30 in the HBZ, and 15 in the Blankshire BWZ.

The natural community types within the bird survey zones consisted of predominately flatwoods, dry-mesic woodland, mesic woodland, and dry woodland. Only 8.6 acres fell within glade. The majority of the restoration targets bird species detections fell within dry-mesic woodland, flatwoods and dry woodland.

Breeding bird survey methodology also followed LMVJV protocol (Wilson and Twedt 2007), with the modification of entering survey data directly into the Collector for ArcGIS application (ESRI 2016) on iPads in place of using LMVJV data sheets. Using this application, each bird detection was placed directly on an overlay of aerial imagery with the point-count boundaries (Fig. 2). Drop-down menus allowed observers to select a guild of birds (Fig. 3), and populate all attributes via dropdown menus (Fig. 4). Detections were given a unique timestamp and spatial data were synchronized with MRBO's ArcGIS Online hosted feature service after each survey morning.

Point count surveys were conducted by trained observers during the period of May 23 – June 1, 2016. All surveys were conducted between 0530h and 0930h, and on mornings with no precipitation and wind <8 mph. Based on point location within stands and ease of traversing the understory, surveyors were able to complete approximately 6 points each morning. Birds were marked upon a surveyor's approach to a point in addition to the official point-count duration, but were not included in Distance analysis.

The timestamp associated with each detection in the Collector application, along with exact spatial placement of birds within distance bands, facilitated ease of Distance analysis. Bird data collected within the allotted point-count duration (as opposed to bird

detections collected upon approach) were imported into Program Distance (Buckland et al. 2001). Bird survey zone data received from Missouri DNR were associated with each detection for import into Distance and analysis of covariates. Zone determination was based on assessment of data containing natural community types and burn histories. In addition to parsing detection data by zone, we also conducted analyses on bird occupancy and density within pine (553 acres of the study area) and non-pine stands (2,722 acres) as described by the natural community layers provided by Missouri DNR.

Data analysis focused on the suite of birds that are assumed to benefit from management resulting in desired conditions of savanna, glade, open pine and open woodland communities ("Restoration Targets"; Tables 1 and 2). Other species, which are species of regional concern or watchlist species ("Other Priority Species"; Table 3), were examined separately as they are not necessarily expected to benefit from the ideal condition of the natural communities in which they are currently found. For this year of analysis, we used the global detection function to generate density estimates for species and guilds where we had >30 detections throughout the study area and >10 detections at the individual zone level (e.g., Tables 4a-c). Density estimates are not given where the Coefficient of Variance is >40%.

Results & Discussion

This survey was intended to capture a snapshot in time of breeding bird use and to provide basic occupancy and density information at the current stage of natural community restoration. All data and results are housed using ArcGIS Online (AGOL) at mrbo.maps.arcgis.com for current and future DNR staff. Currently, mapped content can be used to understand species and guild localized occupancy within the park. Several pre-built maps and tools are available in the [St. Joes State Park Gallery](#) (Fig. 5). This gallery also contains a seven-page [User's Manual](#) to guide data access, use, and attribute examination, all specific to the St. Joe State Park project. Additional files, such as analysis results in spreadsheet form, can also be found there.

All 80 points generated under the proposed study design were surveyed in 2016. During the study, 1,230 birds were documented during and in between point counts including 595 individuals (Table 2) of restoration target species.

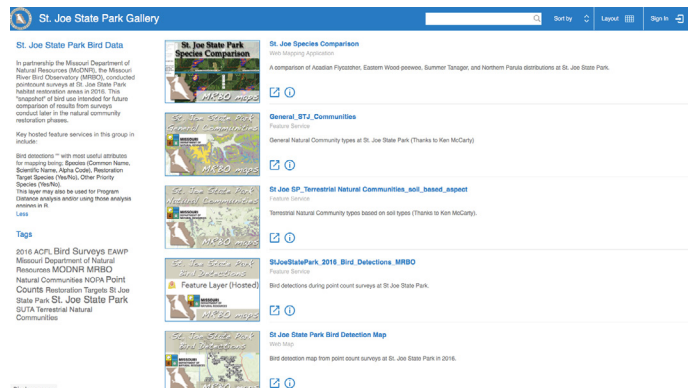


Figure 5: A screenshot of the “St. Joe State Park Gallery”, housed in ArcGIS Online.

Table 2: Counts of Restoration Target Species at St Joe State Park in 2016.

Species	Count
Eastern Wood-Pewee	156
Blue-gray Gnatcatcher	94
Acadian Flycatcher	88
Red-eyed Vireo	76
Summer Tanager	76
Yellow-billed Cuckoo	24
Great Crested Flycatcher	21
Pine Warbler	20
Northern Parula	18
Yellow-throated Vireo	13
Chipping Sparrow	6
White-eyed Vireo	2
Orchard Oriole	1
Prairie Warbler	0
Red-headed Woodpecker	0
Grand Total	595

Table 1: Counts of all species detected during and outside of point count surveys at St. Joe State Park in 2016.

Species	Count	Species	Count
Acadian Flycatcher	88	Kentucky Warbler	10
American Crow	8	Louisiana Waterthrush	6
American Goldfinch	2	Mourning Dove	8
American Robin	2	Northern Cardinal	14
Baltimore Oriole	3	Northern Parula	18
Barn Swallow	1	Olive-sided Flycatcher	1
Barred Owl	1	Orchard Oriole	1
Black-and-white Warbler	3	Ovenbird	87
Blue Grosbeak	9	Pileated Woodpecker	24
Blue Jay	23	Pine Warbler	20
Blue-gray Gnatcatcher	94	Purple Martin	4
Brown-headed Cowbird	51	Red-bellied Woodpecker	44
Carolina Chickadee	22	Red-eyed Vireo	76
Carolina Wren	3	Red-shouldered Hawk	1
Chimney Swift	13	Red-tailed Hawk	2
Chipping Sparrow	6	Rose-breasted Grosbeak	3
Downy Woodpecker	8	Ruby-throated Hummingbird	11
Eastern Bluebird	3	Scarlet Tanager	21
Eastern Kingbird	1	Summer Tanager	76
Eastern Phoebe	3	White-breasted Nuthatch	49
Eastern Towhee	4	White-eyed Vireo	2
Eastern Tufted Titmouse	87	Wood Thrush	6
Eastern Wood-Pewee	156	Woodpecker Spp	5
Field Sparrow	7	Worm-eating Warbler	18
Gray Catbird	3	Yellow-billed Cuckoo	24
Great Crested Flycatcher	21	Yellow-breasted Chat	4
Hairy Woodpecker	4	Yellow-throated Vireo	13
Indigo Bunting	49	Yellow-throated Warbler	7
		Grand Total	1230

Table 3: Counts of Other Priority Species at St Joe State Park in 2016.

Brown-headed Cowbirds were included in this list, following Reidy et al. 2014, due to their potential influence on reproduction within the avian community. Future surveys may be used to track trends in Brown-headed Cowbird populations within St. Joe.

Species	Count	Species	Count
Brown-headed Cowbird	51	Blue-winged Warbler	0
Field Sparrow	7	Wood Thrush	6
Indigo Bunting	49	Worm-eating Warbler	18
Northern Bobwhite	0	Yellow-breasted Chat	4
Kentucky Warbler	10	Yellow-throated Warbler	7
Ovenbird	87	Grand Total	239

Results: Occupancy

Restoration target species and other priority species were selected following Reidy et al. 2014 with input from Missouri DNR and MoBCI staff, and were considered at the guild and individual-species levels for further analysis. Of the 15 species included on the restoration target list, we documented 13 (Table 2). Red-headed Woodpecker and Prairie Warbler were absent from the sample. Several species were detected in high numbers, including Acadian Flycatcher, Blue-gray Gnatcatcher, Eastern Wood-Pewee, Red-eyed Vireo, and Summer Tanager. Twenty Pine Warblers (11 during the official point-count window) were detected within the small pine survey zone they were expected to occupy.

Other priority species (Table 3) have been included in this report. Brown-headed Cowbirds are included as they have a propensity to effect breeding bird success. Other species in this group are birds of concern

or watch-list species that may not necessarily benefit from ideal natural community restorations. For instance, the Ovenbird is species of rich woodland with a predominantly closed canopy, but the desired condition of the unique natural communities at St. Joe State Park are open woodlands, savanna, and glades.

In this report we are able to present occupancy, density and abundance information in the context of bird survey Zones and the Control Zone. While this survey produced adequate sample sizes for basic species occupancy and guild density estimates, few statistically significant patterns emerged in terms of individual target species preference for treatment areas. However, from an avian community perspective, 2016 data from St. Joe State Park provided a satisfactory snapshot of current occupancy and abundance within the study area.

Table 4: Occupancy by guild and individual species at points within all bird survey zones and pine sub-zones at St. Joe State Park in 2016. The table indicates the number of point counts within zones, number of detections per point (det. per point), and percentage of points occupied (% points occupied). Orange indicates highest average of detections per point across zones.

Species or Guild	Blankshire Zone		Control		Harris Branch Zone		Pine Stands		Non-Pine Stands	
	15 points		35 points		30 points		17 points		63 points	
	det. per point	% points occupied	det. per point	% points occupied	det. per point	% points occupied	det. per point	% points occupied	det. per point	% points occupied
Restoration Target Guild	5.2	100%	5.5	100%	4.9	97%	5.1	100%	5.2	100%
Other Priority Species Guild	1.5	93%	2.4	83%	1.9	87%	1.5	88%	2.2	86%
Acadian Flycatcher	0.5	40%	1.1	66%	0.3	23%	0.6	41%	0.7	46%
Blue-grey Gnatcatcher	0.7	60%	1.0	71%	0.8	57%	0.7	59%	0.9	65%
Blue-winged Warbler	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
Brown-headed Cowbird	0.4	33%	0.3	26%	0.5	33%	0.4	29%	0.4	30%
Chipping Sparrow	0.2	20%	0.0	0%	0.0	3%	0.2	18%	0.0	2%
Eastern Wood-Pewee	1.1	67%	1.5	94%	1.5	80%	1.0	65%	1.5	89%
Field Sparrow	0.0	0%	0.0	0%	0.1	10%	0.0	0%	0.1	5%
Great-crested Flycatcher	0.2	13%	0.1	6%	0.3	30%	0.2	12%	0.2	17%
Indigo Bunting	0.3	27%	0.0	0%	0.9	57%	0.3	24%	0.4	27%
Kentucky Warbler	0.0	0%	0.1	14%	0.0	3%	0.0	0%	0.1	10%
Northern Bobwhite	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
Northern Parula	0.1	13%	0.2	14%	0.1	10%	0.2	18%	0.1	13%
Orchard Oriole	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
Ovenbird	0.5	33%	1.6	74%	0.2	20%	0.5	41%	1.0	49%
Pine Warbler	0.7	53%	0.0	0%	0.0	0%	0.6	47%	0.0	0%
Prairie Warbler	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
Red-eyed Vireo	0.3	27%	0.8	51%	0.7	57%	0.4	35%	0.7	54%
Red-headed Woodpecker	0.0	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
Summer Tanager	0.9	73%	0.5	43%	0.8	53%	0.8	71%	0.6	48%
White-eyed Vireo	0.0	0%	0.0	0%	0.1	3%	0.0	0%	0.0	2%
Wood Thrush	0.0	0%	0.1	11%	0.0	3%	0.0	0%	0.1	8%
Worm-eating Warbler	0.0	0%	0.3	23%	0.0	3%	0.1	6%	0.1	13%
Yellow-billed Cuckoo	0.3	33%	0.3	23%	0.2	13%	0.3	29%	0.2	19%
Yellow-breasted Chat	0.0	0%	0.0	0%	0.03	3%	0.0	0%	0.016	2%
Yellow-throated Vireo	0.1	13%	0.1	11%	0.1	13%	0.1	12%	0.1	13%
Yellow-throated Warbler	0.3	33%	0.0	0%	0.0	0%	0.3	29%	0.0	0%

Results: Density

Table 5: Density of all bird species, the restoration target species and priority species guilds, and individual species within bird survey zones at St. Joe State Park in 2016. Number of detections (n), density (D), lower and upper 95% confidence variables around D (D-LCL and D-UCL), estimated abundance (N), and coefficient of variance (CV). Density estimates not generated where n<10; density estimates not reported where CV >40%.

Species or Guild	Blankshire Zone						Control						Harris Branch Zone					
	15 points						35 points						30 points					
	n	D	D-LCL	D-UCL	N	CV	n	D	D-LCL	D-UCL	N	CV	n	D	D-LCL	D-UCL	N	CV
All Species	158	6.34	5.50	7.31	3835	0.07	409	7.03	6.04	8.19	10492	0.08	301	6.04	5.24	6.96	7112	0.07
Restoration Target Guild	78	3.25	2.96	3.96	1964	0.10	191	3.41	2.84	4.09	5082	0.09	148	3.08	2.46	3.86	3627	0.11
Other Priority Species Guild	23	0.83	0.57	1.21	503	0.18	85	1.32	0.95	1.82	1963	0.16	56	1.01	0.70	1.46	1191	0.18
Acadian Flycatcher	8						38	0.88	0.51	1.53	1313	0.28	10					
Blue-gray Gnatcatcher	10	0.90	0.50	1.62	547	0.29	35	1.36	0.89	2.05	2023	0.21	23	1.04	0.62	1.74	1224	0.26
Blue-winged Warbler	0						0						0					
Brown-headed Cowbird	6						10	0.40	0.20	0.80	601	0.36	14	0.66	0.31	1.39	774	0.38
Chipping Sparrow	3						0						1					
Eastern Wood-Pewee	16	0.46	0.27	0.79	280	0.26	52	0.64	0.48	0.87	961	0.15	46	0.66	0.46	0.95	783	0.18
Field Sparrow	0						0						4					
Great-crested Flycatcher	3						2						10					
Indigo Bunting	5						0						27					
Kentucky Warbler	0						5						1					
Northern Bobwhite	0						0						0					
Northern Parula	2						6						3					
Orchard Oriole	0						0						0					
Ovenbird	7						56	0.75	0.47	1.19	1116	0.24	7					
Pine Warbler	11						0						0					
Prairie Warbler	0						0						0					
Red-eyed Vireo	5						27	0.21	0.13	0.33	307	0.24	20	0.18	0.11	0.28	209	0.24
Red-headed Woodpecker	0						0						0					
Summer Tanager	13	0.57	0.33	0.99	347	0.28	17	0.32	0.18	0.57	480	0.29	24	0.53	0.30	0.93	624	0.29
White-eyed Vireo	0						0						2					
Wood Thrush	0						5						1					
Worm-eating Warbler	1						9						0					
Yellow-billed Cuckoo	5						10						5					
Yellow-breasted Chat	0						0						1					
Yellow-throated Vireo	2						4						4					
Yellow-throated Warbler	5						0						0					

Results & Discussion *continued*

Occupancy: Restoration target species were found at all point count locations. A slightly greater number of birds within the restoration target guild and other priority species guild were found per point in the controls vs. the treated zones. Individual species occupancy varied throughout zones (Table 4). Of particular note is the absence of Red-headed Woodpeckers and Prairie Warblers from all points. Future presence of these target species will help illustrate the success of restoration efforts.

Diversity: In terms of restoration target species diversity, the treatment areas supported three species not found in the control areas: Pine Warbler, Chipping Sparrow and Indigo Bunting.

Density: There was little significant difference in the overall density of all species combined, the restoration target guild and other priority species guild between control and treatment Zones. Densities were slightly higher in control units for these categories, but fell largely within 95% confidence-interval limits (Table 5). Of the individual species, only Blue-gray Gnatcatcher, Eastern Wood-Pewee and Summer Tanager provided ample sample size and associated Coefficient of Variance <40% to allow for density estimates across all Zones.

Pine stands supported a higher density of all species combined as well as within the restoration target species guild. Other priority species guild densities were highest in the non-pine areas (Table 6). Sample sizes were not large enough to estimate densities of individual species in both pine and non-pine zones with exception of Eastern Wood-Pewee.

For future surveys, the Missouri DNR and partners may want to consider incorporating increased sampling effort (i.e. multiple survey visits) to bolster sample sizes and associated density and abundance estimates for individual species. We would also suggest sampling untreated areas within the pine community of the Blankshire Woods or surrounds to further elucidate differences in avian communities within treated

(e.g. burned) and untreated pine stands. Small areas of unique natural communities such as glades may not provide large enough sample sizes of birds as useful indices of natural community condition within St. Joe State Park. Effects of on-going restoration of glade communities on avian species may best be examined by surveying a large sample of Missouri DNR glade holdings.

Acknowledgements: We would like to thank Allison Vaughn and Ron Colatskie for their input and assistance with developing the survey design and focal species lists. We would also like to express our appreciation for the opportunity to work with Missouri DNR/State Parks staff at St. Joe State Park.

Table 5: Density of all bird species, the restoration target species and priority species guilds, and individual species within 553 acres of pine and 2,722 acres of non-pine stands at St. Joe State Park in 2016. Number of detections (n), density (D), lower and upper 95% confidence variables around D (D-LCL and D-UCL), estimated abundance (N), and coefficient of variance (CV). Density estimates not generated where n<10; density estimates not reported where CV >40%.

Species or Guild	Pine Stands						Non-Pine Stands					
	16 points						64 points					
	n	D	D-LCL	D-UCL	N	CV	n	D	D-LCL	D-UCL	N	CV
All Species	175	7.06	5.63	8.86	3904.18	0.12	693	6.39	5.58	7.33	17394	0.07
Restoration Target Guild	86	4.09	3.08	5.44	2261.77	0.14	331	3.08	2.58	3.69	8384	0.09
Other Priority Species Guild	26	0.60	0.43	0.85	331.8	0.17	138	1.20	0.90	1.60	3266	0.15
Acadian Flycatcher	10						46	0.50	0.27	0.92	1361	0.31
Blue-gray Gnatcatcher	12						56	1.19	0.77	1.83	3239	0.22
Blue-winged Warbler	0						0					
Brown-headed Cowbird	6						24	0.55	0.29	1.00	1497	0.31
Chipping Sparrow	3						1					
Eastern Wood-Pewee	17	0.53	0.30	0.93	293.09	0.28	97	0.63	0.46	0.87	1715	0.16
Field Sparrow	0						4					
Great-crested Flycatcher	3						12	0.06	0.03	0.11	163	0.33
Indigo Bunting	5						27					
Kentucky Warbler	0						6					
Northern Bobwhite	0						0					
Northern Parula	2						9					
Orchard Oriole	0						0					
Ovenbird	9						61	0.47	0.29	0.76	1279	0.25
Pine Warbler	11						0					
Prairie Warbler	0						0					
Red-eyed Vireo	7						45	0.18	0.12	0.27	490	0.21
Red-headed Woodpecker	0						0					
Summer Tanager	14						40	0.36	0.21	0.64	980	0.29
White-eyed Vireo	0						2					
Wood Thrush	0						6					
Worm-eating Warbler	1						9					
Yellow-billed Cuckoo	5						15					
Yellow-breasted Chat	0						1					
Yellow-throated Vireo	2						8					
Yellow-throated Warbler	5						0					



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