



FirstEnergy RIGHT-OF-WAY HABITAT RECLAMATION REPORT

PREPARED MAY 2020

**JOHN T. HUSTON – DR. JOHN D. BRUMBAUGH
NATURE CENTER**

Authored by: Adam Zorn



UNIVERSITY OF
MOUNT UNION
HUSTON-BRUMBAUGH
**NATURE
CENTER**



ABOUT THE NATURE CENTER

MISSION

The John T. Huston - Dr. John D. Brumbaugh Nature Center provides and supports opportunities for enjoying and learning about our natural and cultural heritage. The three principal audiences served by our mission include:

- **Mount Union students:** to support and enhance the education of all students attending the University of Mount Union, emphasizing the general areas of ecology and environmental science
- **School and Youth Groups:** to provide a resource in environmental education for public, private and parochial schools and other organized youth groups, including field trips and teacher/leader enhancement programs
- **Community:** to promote an interest and awareness of environmental and ecological topics among the public

HISTORY

The John T. Huston - Dr. John D. Brumbaugh Nature Center was established thanks to a gift from Dr. John D. Brumbaugh. Dr. Brumbaugh donated the 109 acres that had been his grandfather's farm to Mount Union College in December of 1986. The farm, located in Washington Township, Stark County, Ohio included old growth and second growth forest and a large bank barn. Dr. Brumbaugh also established a generous endowment to provide for the development of the area as a nature preserve and educational facility. The property was named The John T. Huston - Dr. John D. Brumbaugh Nature Center, in honor of both Dr. Brumbaugh and his grandfather, John Huston. It was Dr. Brumbaugh's wish that the area be used as a nature preserve for the education and enjoyment of all people and the area be developed in such a way as to lead visitors into an exploration of the outside environment.

Today the Nature Center provides support for instruction and research at the University of Mount Union, welcomes thousands of school students to environmental education programs, creates opportunities for hundreds of people to give of themselves as volunteers, and offers a place for reflection and nature study for any who choose to visit.



STAFF

Jamie Greiner, *Sustainability and Campus Outreach Manager*

Michael Greiner, *Site Manager*

Karen Santee, *Facilities Manager*

R. Chris Stanton, Ph.D., *Director*

Bonnie Twaddle, *Community Outreach Coordinator*

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PHYSICAL LOCATION

Huston-Brumbaugh Nature Center

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CONTACT

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PROJECT BACKGROUND

RIGHT-OF-WAY DESCRIPTION

The Huston-Brumbaugh Nature Center's 162-acre nature preserve is bisected by a FirstEnergy Corp. electric transmission right-of-way (ROW). The ROW is approximately 1600 ft long in a north/south trajectory between Daniel Street on the north and the Nature Center's property boundary to the south. The ROW averages 40 ft wide. The surface area of the corridor is approximately 2 acres.

The transmission lines crossing the Nature Center are comprised of local distribution lines on the lower level of the poles and 69,000-volt transmission lines near the top of the poles. The upper lines supply electricity to portions of the city of Alliance, OH. See APPENDIX A for map and photos.

ROW MAINTENANCE

Prior to 2015, vegetation within the ROW was managed by FirstEnergy or one of its contractors. Most of the management was comprised of annual inspection of the corridor for trees at risk of contacting the utility lines. The Nature Center's site manager was notified before and after inspections as well as before scheduled pruning or culling trees along the corridor. Periodic vegetation maintenance was conducted under the utility lines by FirstEnergy to limit the height of woody growth. The Nature Center conducted periodic vegetation management along the corridor to control the spread of invasive species.

Beginning in 2016, the Nature Center and FirstEnergy began a more collaborative effort to maintain vegetation along and within the ROW. The Nature Center has assumed control of vegetation management under the utility lines to maintain the area as pollinator habitat. FirstEnergy continues to inspect and manage trees along the edge of the corridor with input from the Nature Center's site manager and oversight by FirstEnergy's transmission forestry specialist. Collaborative management of the ROW allows FirstEnergy to provide reliable service to their electric customers and the Nature Center to maintain important habitat within and alongside the ROW for local flora and fauna.

PROJECT TIMELINE

In 2016, FirstEnergy and the Nature Center began a habitat reclamation project within the area of the ROW on the Nature Center property. The project was developed when an error during vegetation management in the summer of 2015 resulted in an herbicide application and a full kill of woody and herbaceous vegetation. Nature Center staff had the fortune of meeting FirstEnergy representatives at a pollinator conference in early 2016 and began discussing the possibility of coordinating resources to rehabilitate the vegetation within the ROW.

In March of 2016, Nature Center staff and area representatives from FirstEnergy met at the ROW to discuss plans for the project. FirstEnergy committed to sending equipment to mow and grind dead vegetation along 1,500 ft of the corridor and to purchase wildflower seed to reestablish vegetation within the ROW. The Nature Center committed to monitoring the ROW for invasive species, managing invasive species and woody plants, and data collection on the flora and fauna present within the ROW.



Photo (left to right): Doug Shaffer, Bonnie Twaddle, Mark Contat, Adam Zorn, Mike Greiner, Pat Failor, Karen Santee, Kate Bloss, Roy Maldonado met in March 2016.

In April 2016, FirstEnergy used a skid steer equipped with a Fecon head to mow and grind dead vegetation within the corridor. The resulting duff layer protected the soil from erosion and allowed the dead vegetation to decompose and enrich the soil on the site. This created an environment suitable for some plant species to regenerate on their own as well as prepare the site for the introduction of wildflower seed the next winter. See APPENDIX B for photos.

In September 2016, Nature Center staff and representatives from FirstEnergy met at the ROW with Bob Kehres from Ohio Prairie Nursery to discuss fall site preparation, seed selection, seed sowing,

and on-going maintenance during the growing season of 2017. Nature Center staff and volunteers would later pull and spray a variety of invasive and woody plants, mow the ROW, and remove the cut vegetation to prepare for winter seeding.



Photo (left to right): Bonnie Twaddle, Adam Zorn, Ryan Goddard, Roy Maldonado, Karen Santee, Pat Failor, Mike Greiner, Bob Kehres met in September 2016.

In January 2017, the ROW was reseeded with 17 pounds of native wildflower and grass seed purchased by FirstEnergy. The seed mix was developed by Bob Kehres at Ohio Prairie Nursery with input from the Nature Center staff to create a mix suited to the soil, water, and light conditions of the ROW (APPENDIX C). Seed was evenly distributed into 24 buckets, mixed with sand, and broadcast by hand over a light coating of snow. Doing so allowed the staff to see where the seed was broadcast to avoid over-seeding or creating bare spots. Days later, the snow melted and carried the seed into the soil. Frost/thaw cycles through the remainder of winter and spring created ideal seed-to-soil contact. See APPENDIX B for photos.

During the growing season of 2017 (May-September), the ROW was periodically mowed to limit vegetation height. Mowing decreased competition from existing vegetation for space and sunlight, allowed seeds to germinate across a wide range of soil temperatures, and encouraged root growth of newly established vegetation.

During the growing seasons of 2018 and 2019, the Nature Center staff ceased mowing to allow vegetation to mature and flower. See APPENDIX B for photos. Continued monitoring identifies and results in removal of recurring patches of invasive creeping thistle (*Cirsium arvense*), foxtail grass (*Setaria spp.*), common mullein (*Verbascum thapsus*), and garlic mustard (*Alliaria petiolata*).



Photo: Signage explains the Nature Center and FirstEnergy partnership rehabilitating the ROW habitat

RESEARCH AND MONITORING

BIRD BANDING

Bird banding was the first research program organized by the Nature Center staff on the ROW. The goal was to monitor the effect of the initial loss and subsequent reestablishment of vegetation on bird species utilizing the ROW. The ROW creates a narrow, unforested corridor in the center of the Nature Center's forested property and provides novel resources for birds nesting along the edge and within proximity of the ROW. The ROW is narrow enough (approximately 40 ft) for many forest-dwelling species to cross in search of food. It also provides habitat for bird species that use forest edges or open habitat for foraging and/or nesting. Refer to APPENDIX D to see the location and a brief description of banding activities along the ROW.

Hypothesis

Our hypothesis was that the loss of vegetation within the ROW would result in low abundance and low diversity of bird species along the ROW. With the reintroduction and reestablishment of herbaceous vegetation, we expect bird abundance and species diversity to increase in subsequent years because of increased food and habitat for species that nest along the edge and in proximity to the ROW.

Protocol

Banding begins on the Thursday after Memorial Day and continues each Thursday through the second week of August, weather permitting. Banding is not conducted on days with precipitation occurring during scheduled banding hours. Eight mist nets are set up along the east side of the corridor. Each net measures 12 meters long and 3.5 meters high. The nets are opened at dawn, checked every forty-five to sixty minutes, and taken down at noon. Bird banding occurred in 2016 on 6 days; banding occurred in 2017 and 2018 on 10 days each year; banding in 2019 happened on 7 days.

The data collected from each bird includes species, age, sex, fat content, mass, wing chord, and general condition. Net number and time of capture are also recorded. All data is collected for new captures and recaptures. The recaptures can include birds previously banded on the ROW, from previous banding sessions at the Visitors Center, and nestlings that have been banded in nest boxes on Nature Center property.

Summary to Date

In 2016, some of the original plant community began regenerating on its own. In 2017, the corridor was seeded, and the vegetation was mowed to maintain a height between six and twelve inches

allowing germinating plants an opportunity to establish. In 2018 and 2019, the vegetation was permitted to grow without mowing.

Year	Days	Hours of Effort	Net Hours	Total Species	New Birds	Recaptured Birds	Total Unique Birds	Birds/Net Hour
2016	6	42	336	17	36	3	39	0.116
2017	10	70	560	15	37	9	46	0.082
2018	10	70	560	22	86	9	95	0.170
2019	7	48	384	26	73	21	94	0.245

Table 1: Summary of bird banding data collected from years 2016-2019. Net hours = hours of effort multiplied by 8 nets. Birds per net hour = total unique birds divided by net hours.

Table 1 shows the effort, number of species, and number of unique birds banded and recaptured each year. Though effort varies from year to year due to a late start in 2016 and complications with weather in 2019, the overall trend indicates more birds are using the ROW in 2019 compared to the beginning of the banding project in 2016. Increases in total species and birds/net hour are key positive indicators for improvement in ROW habitat.

Increases in recaptured birds is expected because newly banded birds often remain in the area as year-round residents or are returning summer residents banded in a previous year. The number of recaptured birds spiked noticeably in 2019 over the previous three years. Eleven of the twenty-one recaptured birds in 2019 were Wood Thrush (*Hylocichla mustelina*). Of those eleven Wood Thrush, seven were originally banded in 2018, two were originally banded in 2017, and two were originally banded in 2016. Other notable recaptured birds in 2019 include two Hooded Warblers (*Setophaga citrina*) originally banded in 2016 and a House Wren (*Troglodytes aedon*) originally banded in 2015, a year before the ROW banding project began.

A total of thirty-four species has been banded in the first four years of the banding project. Seventeen species were encountered in 2016 and an additional 6, 6, and 5 species were encountered in 2017, 2018, and 2019, respectively, to reach the present total of 34 species. Wood Thrush are encountered frequently, but eleven other species have been encountered only once. The top ten species of newly banded birds are Wood Thrush, Gray Catbird, Northern Cardinal, Acadian Flycatcher, House Wren, American Goldfinch, Hooded Warbler, Eastern Towhee, Red-eyed Vireo, and Ruby-throated Hummingbird. Ruby-throated hummingbirds are recorded but are not banded because of banding restrictions. Therefore, the actual number of unique Ruby-throated Hummingbirds is not known. See APPENDIX D for a table of banding totals.

Total species (species richness) can tell us something about the unrefined diversity of birds encountered each year. As shown in Table 1, the values for the total number of bird species encountered has increased each year. Because the number of species fluctuate between years, the

Shannon-Wiener index presents another technique to illustrate bird species diversity. Unlike species richness which only accounts for presence/absence, the Shannon-Wiener index accounts for the number of times individuals from each species is encountered. It also derives a value which can be converted to an effective number of species, which represents the true diversity of the community sampled via bird banding. The value for effective number of species can be compared to see how true diversity changes as the ROW vegetation also changes from the initial herbicide treatment through three years of habitat rehabilitation. For a full explanation of effective number of species representing true diversity, refer to Jost, Lou. (2006). Jost, L. *Entropy and diversity*. *Oikos*. *Oikos*. 113. 363 - 375. 10.1111/j.2006.0030-1299.14714.x. or visit <http://www.loujost.com/Statistics%20and%20Physics/Diversity%20and%20Similarity/DiversitySimilarityHome.htm>.

Table 2 shows the effective number of species has increased since an initial drop in 2017 when mowing kept the vegetation short during that year’s growing season. Ignoring the 2017 season, species richness and effective number of species increased in 2018 and 2019 from the first year of banding in 2016 suggesting that the regeneration of vegetation has had a positive impact on bird diversity.

	2016	2017	2018	2019
Treatment	After herbicide & No mowing	Seeding & mowing	None	None
Species Richness	17	15	22	26
Shannon Diversity	2.55741	2.22960	2.63899	2.68729
Effect. No. Species	12.90234	9.29615	13.99906	14.69174
% change Effect. No. Species	na	-27.9%	+33.6%	+4.7%

Table 2: Summary of diversity measurements calculated from banding data in years 2016-2019.

See APPENDIX D for additional data, photographs, and a list of personnel who contributed to collecting the bird banding data.

BIRD POINT COUNTS

Point counts are conducted during each bird banding session. Point counts record birds observed or heard in the bird banding study area. The count totals on each date do not include birds netted and banded, only birds moving freely about the area. These counts provide information about all species observed/heard in the study area unlike banding which only records birds captured in mist nets. Some species of birds are less likely to be captured in a mist net due to their scarcity, unwillingness to cross the ROW, and/or the height above ground in which they cross the ROW.

Point counts begin just before dawn as the banding mist nets are being set up and conclude when the mist nets are taken down. Birds are identified with binoculars, the unaided eye, or by bird song or call. Either seeing or hearing a bird is enough for detection and recording the individual on the list. Care is taken not to double-count birds; therefore the highest number of individuals of a species seen or heard in the area is the number recorded during each point count. All species observed are recorded. However, flyover birds (vultures, hawks, waterfowl, swallows, etc.) are excluded from this report because they are not likely using ROW habitat.

A total of 51 species have been observed along the ROW since 2016. Thirty-five out of the fifty-one species have been observed each year representing about two-thirds of all species observed. The list of 51 species observed during point counts is considerably higher than the number of species captured in mist nets (34) during bird banding. See APPENDIX E for a compilation of bird species observed during point counts each year.

SPECIES INVENTORIES

Observations of flora and fauna within the ROW are cataloged on the Nature Center's iNaturalist project. Some of the observations were made with effort to search for taxa such as dragonflies, butterflies, or flowering plants. Other observations are incidental observations recorded while doing another activity such as bird banding, leading a hike, conducting maintenance, etc. Recorded observations are made by staff, volunteers, and members of the public using the iNaturalist app.

To date, the iNaturalist database holds records of 52 species of flowering plants, 15 species of butterflies & moths, 8 species of dragonflies, 7 species of bees, 11 other invertebrate species, 4 reptile species, 2 amphibian species, and 1 mammal observed in the ROW. Observations and associated photos are available online at <https://www.inaturalist.org/projects/huston-brumbaugh-nature-center-biodiversity-project>. See APPENDIX F for a selection of photos of common or notable wildlife observed.

NATIVE BEE SURVEYS

Native bees are an important component of the area's insect fauna due to the wide variety of pollination services they provide as a collective group. Many species of native bees have seasonal activity periods (early spring, spring, summer, fall) that coincide with the bloom time of various flowering plants including trees, shrubs, and herbaceous plants. In order to track the species richness of native bees, trapping efforts within the ROW began in 2017 with passive pan traps but was not

continued. In 2018, a more standardized project began that incorporates pan traps, hanging vane traps, and hand collection of bees along a 100-meter transect.

A summer and a fall survey have been conducted and the bees collected have been identified to the Genus level, which is typical in bee diversity studies. So far, 10 genera of native bees from 4 Families have been collected (not including the non-native honeybee *Apis mellifera*). Sampling of native bees during the spring months is planned for 2020.

Spring 2017 (Apr, June)	Fall 2018 (Sept, Oct, Nov)	Summer 2019 (June, July, Aug)
Family Andrenidae	Family Andrenidae	Family Andrenidae
<i>Andrena</i>	<i>Andrena</i>	<i>Andrena</i>
Family Apidae	Family Apidae	Family Apidae
--	<i>Apis</i>	<i>Apis</i>
<i>Bombus</i>	<i>Bombus</i>	<i>Bombus</i>
<i>Ceratina</i>	--	<i>Ceratina</i>
--	--	<i>Melissodes</i>
<i>Nomada</i>	--	--
Family Halictidae	Family Halictidae	Family Halictidae
<i>Augochlorini (Tribe)</i>	<i>Augochlorini (Tribe)</i>	<i>Augochlorini (Tribe)</i>
<i>Halictus</i>	<i>Halictus</i>	<i>Halictus</i>
<i>Lasioglossum</i>	<i>Lasioglossum</i>	<i>Lasioglossum</i>
Family Megachilidae	Family Megachilidae	Family Megachilidae
--	--	<i>Chelostoma</i>
--	--	<i>Osmia</i>

Table 3: Summary of bee families and genera collected with traps and hand netting

See APPENDIX G for photographs and a list of personnel who contributed to collecting the native bee survey data.

Initial Conclusions

Nature Center staff, University of Mount Union students, and Nature Center volunteers have been collecting data on the ROW since 2016. The objective was to document changes in wildlife diversity in the ROW as the plant community was rehabilitated after an herbicide treatment. Data from 2016 through 2019 is reflective of a self-regenerating plant community (2016) and a managed reintroduction of herbaceous flowering plants (2017 to present) in the ROW. Most of the plant life in

the ROW was established by seed. Seeded plant communities usually require three to four growing seasons to reach full maturity. The 2020 growing season is year three of uninterrupted growth for the ROW vegetation, so the previous four-year period represents the “fledgling” stage of the ROW vegetation’s reestablishment.

Data from the various research and monitoring projects in the ROW indicate a positive correlation between increased plant abundance and increased wildlife abundance. Because the ROW habitat reclamation project was created in response to a management error, there is no data available prior to the reclamation project to compare with the data sets collected over the past four years. The data sets presented in this document indicate increases in bird diversity, native bee diversity, and diversity of other wildlife taxa such as butterflies and moths, dragonflies, etc. over the past four years.

The Nature Center staff continue to monitor the ROW and collect data as the ROW vegetation enters the mature stage of development. The ROW was mowed in early 2020 to control the incursion of woody plants such as shrubs and tree seedlings. Mowing also exposes the soil to allow for continued germination of seeds which is crucial for the continued presence of short-lived perennials such as cardinal flower, monkey flower, and swamp milkweed as well as small-statured plants that can be crowded out by taller plants.

Native bee surveys continued in early spring 2020, and bird banding and bird point counts continued in May 2020. Observational data continues to be recorded on iNaturalist. These efforts will continue indefinitely as the ROW vegetation matures. Data collected during the period of mature ROW vegetation development may bring to light additional opportunities for study and indicate new trends in certain wildlife associated with the ROW.

Finally, it would be thoughtless to omit the aesthetic benefits of the ROW habitat reclamation project for the Nature Center’s thousands of annual visitors. The abundance of flowering plants and associated wildlife are noticed by all who cross the ROW while exploring the Nature Center’s trails.

Acknowledgements

Thank you to all the FirstEnergy Corp. and Nature Center staff, students, and volunteers for their past, present, and future commitment to this habitat rehabilitation project.

Thank you to Chris Stanton, Mike Greiner, and Al Eibel for all of their diligent edits of the content of this report.

APPENDIX A – ROW map and photos

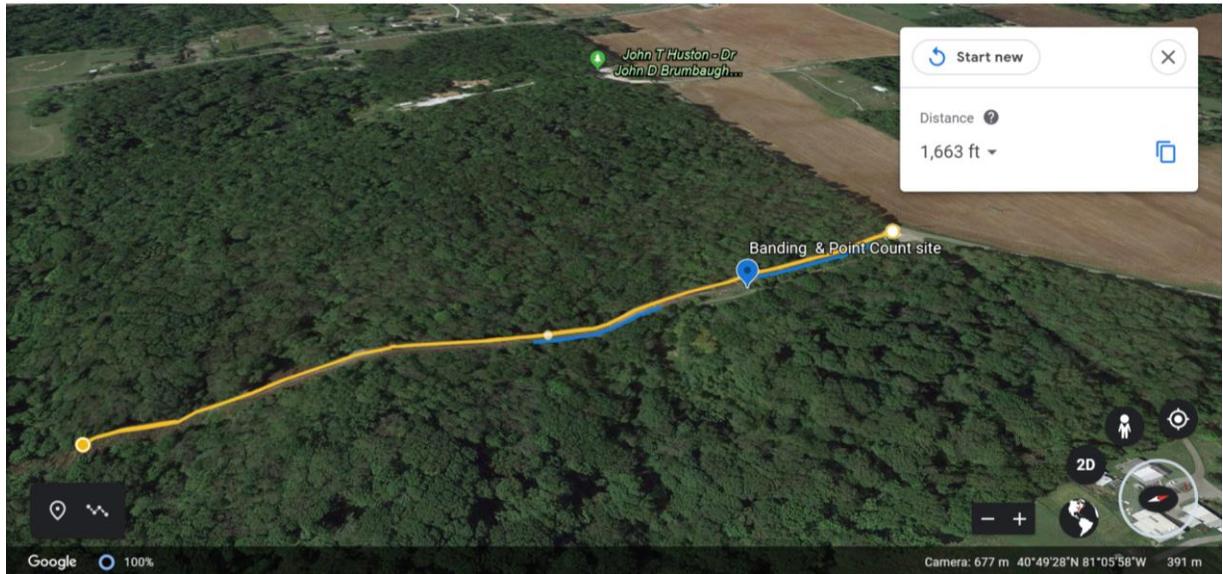


Image 1: Location of the FirstEnergy transmission ROW at the Huston-Brumbaugh Nature Center using Google Earth. The yellow line represents the approximate length of the ROW. The blue lines and place marker represent the location of bird banding and point count activities along the north half of the ROW.



Image 2: Location of the FirstEnergy transmission ROW at the Huston-Brumbaugh Nature Center on the Nature Center's trail map.



Image 3: FirstEnergy transmission ROW looking south from Daniel St. Photo taken in April 2016.



Image 4: FirstEnergy transmission ROW looking south from the hill between the Succession and Brumbaugh Woods trails. Photo taken in April 2016.

APPENDIX B – Project Timeline Photos



Image 5: FirstEnergy skid steer with Fecon head used to grind vegetation



Image 6: Site preparation by FirstEnergy in April 2016.



Image 7: Site preparation by FirstEnergy in April 2016.



Image 8: Regenerating vegetation sparsely covers the project area in July 2016.



Image 9: Native wildflower and grass seed are distributed over a couple inches of snow on the ROW in January 2017. Seed and sand were evenly portioned into 24 buckets for hand sowing.



Image 10: Vegetation in the ROW in April 2017.



Image 11: Vegetation in the ROW in June 2017. Periodic mowing took place throughout the growing season.



Image 12: Mowing continued through the end of August 2017. Some existing plants were spared the mower as seen in the image.



Image 13: Vegetation growing without a mowing treatment in July 2018. A few species of wildflowers begin to bloom.



Image 14: Additional wildflower species begin to bloom in August 2018.



Image 15: In September 2018, a few asters, goldenrod, and other late season wildflowers continue to bloom, and wild rye seeds mature.



Image 16: Wildflowers at peak bloom in early August 2019.



Image 17: Winter mowing in January 2020.

APPENDIX C – ROW seed mix

Seed Mix Specification

Mt. Union ROW Mix

Item Code 090716-1

Recommended Seeding Rates

Hydro Seeded / Broadcast

15.0 pounds / acre
0.34 pounds / 1000 sq. ft.
121 seeds / sq. ft.

Drilled

15.0 pounds / acre
117 seeds / sq. ft.

Category	% by Weight	% by Seed
Forb	36.87%	74.41%
Grass/Grasslike	63.13%	25.59%

Moisture Variable
Light Sun/Partial Shade
Application Meadow
Attracts Butterflies
Pollinators
Songbirds

Species Name	Common Name	%
Schizachyrium scoparium	Little Bluestem	35.31%
Elymus canadensis	Nodding Wild Rye	12.50%
Elymus virginicus	Virginia Wild Rye	12.50%
Asclepias syriaca	Common Milkweed	6.25%
Heliopsis helianthoides	Ox Eye Sunflower	6.25%
Echinacea purpurea	Purple Coneflower	4.69%
Ratibida pinnata	Yellow Coneflower/Grey-Headed C	3.13%
Monarda fistulosa	Wild Bergamot	3.13%
Vernonia altissima	Tall Ironweed	2.25%
Eupatorium Mix	Joy Pye Mix	1.56%
Asclepias incarnata	Rose Milkweed	1.56%
Sorghastrum nutans	Indian Grass	1.56%
Andropogon gerardii	Big Bluestem	1.25%
Solidago riddellii	Riddell's Goldenrod	1.25%
Solidago rigida	Stiff Goldenrod	1.25%
Coreopsis tripteris	Tall Coreopsis	0.94%
Aster azureus	Sky Blue Aster	0.75%
Aster umbellatus	Flat-topped White Aster	0.75%
Aster novae-angliae	New England Aster	0.75%
Aster puniceus	Purple stemmed aster	0.75%
Eupatorium perfoliatum	Common Boneset	0.63%
Pycnanthemum tenuifolium	Narrow Leaved Mountain Mint	0.31%
Lobelia siphilitica	Great Lobelia	0.31%
Lobelia cardinalis	Cardinal Flower	0.31%
Mimulus ringens	Monkey Flower	0.06%



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APPENDIX D – Bird Banding

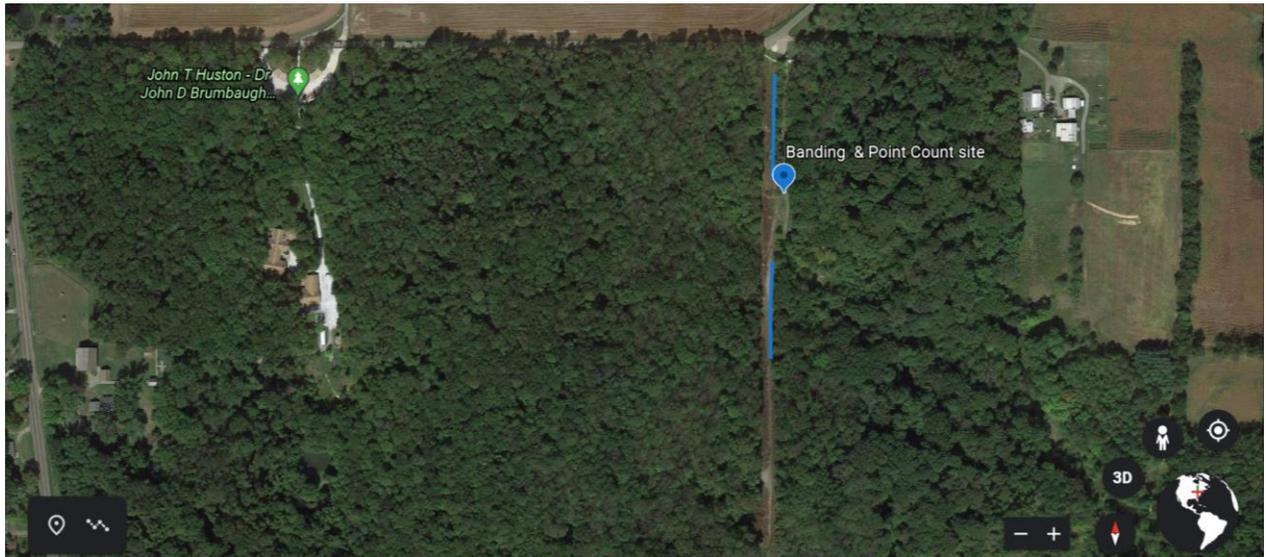


Figure 1 Google Earth image of the bird banding research area on the ROW

The image above shows the location of the banding research area along the ROW. North is at the top of the image. Three nets are located north of the banding and point count site. Five nets are located south of the banding and point count site. Each net is 12 meters long and 3.5 meters high and is held in place by aluminum poles at each end.



Figure 2 Mist net set along the east side of the ROW



Figure 3 Hooded Warbler and Ruby-throated Hummingbird shown in a mist net

After a bird is extracted from the mist net, it is placed in a brown, paper lunch bag until it is processed. Newly encountered birds are banded. A recaptured bird is identified by a band on its leg. Processing involves aging, sexing, and recording physical measurements from each bird. Each bird is carefully handled during the banding and data collection procedures and is released.



Figure 4 A Red-eyed Vireo pauses for a moment during its release

Species	2016	2017	2018	2019
Acadian Flycatcher	X	X	X	X
American Goldfinch	X	X	X	X
American Redstart		X	X	X
American Robin		X	X	X
Baltimore Oriole		X		
Black-capped Chickadee	X		X	
Carolina Wren	X		X	X
Cedar Waxwing	X			
Chipping Sparrow	X			X
Common Yellowthroat			X	
Downy Woodpecker			X	X
Eastern Bluebird	X		X	X
Eastern Phoebe			X	
Eastern Towhee	X	X	X	X
Eastern Wood Peewee	X	X		X
Gray Catbird	X	X	X	X
Hairy Woodpecker				X
Hooded Warbler	X		X	X
House Wren	X	X	X	X
Indigo Bunting			X	X
Louisiana Waterthrush				X
Northern Cardinal	X	X	X	X
Red-bellied Woodpecker	X			
Red-eyed Vireo	X		X	X
Rose-breasted Grosbeak				X
Scarlet Tanager			X	X
Song Sparrow		X		X
Swamp Sparrow				X
Tufted Titmouse		X		
Veery				X
White-breasted Nuthatch		X	X	X
Wood Thrush	X	X	X	X
Yellow-shafted Flicker			X	
Ruby-throated Hummingbird	X	X	X	X
Species Total (season)	17	15	22	26
Species Total (running)	17	23	29	34

Table 1. Species richness summary for birds banded from 2016 to 2019

Species are presented in alphabetical order. Ruby-throated hummingbird is placed last because to it is an unbanded species. X indicates the species was banded in that season. The Species Total (season) indicates how many species were banded during that season. The Species Total (running) is a compilation of how many species have been banded in all since banding began in 2016. Six new

species were added in 2017, six more in 2018, and five more in 2019, bringing the running total of species banded since 2016 to 34 species of birds.

Species	2016		2017		2018		2019		Total New Bands
	New Bands	Recaps							
Acadian Flycatcher	1	0	5	1	9	0	2	1	17
American Goldfinch	1	0	0	1	7	2	2	1	10
American Redstart	0	0	2	0	2	0	1	1	5
American Robin	0	0	1	0	1	0	4	0	6
Baltimore Oriole	0	0	1	0	0	0	0	0	1
Black-capped Chickadee	1	0	0	0	0	1	0	0	1
Carolina Wren	1	0	0	0	2	0	1	0	4
Cedar Waxwing	1	0	0	0	0	0	0	0	1
Chipping Sparrow	1	0	0	0	0	0	1	0	2
Common Yellowthroat	0	0	0	0	1	0	0	0	1
Downy Woodpecker	0	0	0	0	2	0	2	1	4
Eastern Bluebird	2	0	0	0	2	0	2	0	6
Eastern Phoebe	0	0	0	0	2	0	0	0	2
Eastern Towhee	3	0	1	0	3	0	1	0	8
Eastern Wood Peewee	2	0	1	0	0	0	1	0	4
Gray Catbird	1	0	2	1	17	0	11	1	31
Hairy Woodpecker	0	0	0	0	0	0	1	0	1
Hooded Warbler	4	0	0	0	2	1	3	2	9
House Wren	4	2	2	0	3	1	5	1	14
Indigo Bunting	0	0	0	0	2	0	1	0	3
Louisiana Waterthrush	0	0	0	0	0	0	1	0	1
Northern Cardinal	4	0	4	0	7	2	3	2	18
Red-bellied Woodpecker	1	0	0	0	0	0	0	0	1
Red-eyed Vireo	2	0	0	0	3	0	3	0	8

Rose-breasted Grosbeak	0	0	0	0	0	0	2	0	2
Scarlet Tanager	0	0	0	0	2	0	2	0	4
Song Sparrow	0	0	4	1	0	0	1	0	5
Swamp Sparrow	0	0	0	0	0	0	1	0	1
Tufted Titmouse	0	0	1	0	0	0	0	0	1
Veery	0	0	0	0	0	0	1	0	1
White-breasted Nuthatch	0	0	1	0	1	0	4	0	6
Wood Thrush	7	1	12	5	17	2	17	11	53
Yellow-shafted Flicker	0	0	0	0	1	0	0	0	1
Ruby-throated Hummingbird	5	0	4	0	5	0	3	0	17

Table 2. New bands and unique recapture summary for birds banded from 2016 to 2019

Personnel contributing to bird banding data collection:

Al Eibel – licensed bird bander and Nature Center volunteer

Adam Zorn – Nature Center program manager

Hailey Hoyat – Nature Center summer research 2016

Courtney Berish – Nature Center summer research 2016

Ben Mullaly – Nature Center summer research 2017

Kira Nicholson – Nature Center summer research 2017

Kayla Bowyer – Nature Center summer research 2018

Garrett Konet – Nature Center Brumbaugh Scholar 2019



Hailey Hoyat, Al Eibel, Courtney Berish



Kira Nicholson



Ben Mullaly



Kayla Bowyer



Garrett Konet

Photos of the ten most banded bird species in the ROW:



Wood Thrush (left)



Gray Catbird (right)



Northern Cardinal – male (left)



Acadian Flycatcher (right)



House Wren (left)



**American Goldfinch
(right)**



**Hooded Warbler –
male (left)**



**Eastern Towhee –
male (right)**



Red-eyed Vireo (left)



**Ruby-throated
Hummingbird – male
(right)**

APPENDIX E – Bird Point Counts

Species	2016	2017	2018	2019
Ruby-throated Hummingbird	X	X	X	X
Red-bellied Woodpecker	X	X	X	X
Downy Woodpecker	X	X	X	X
Hairy Woodpecker	X	X	X	X
Pileated Woodpecker	X	X	X	X
Northern Flicker	X	X	X	X
Eastern Wood-Pewee	X	X	X	X
Acadian Flycatcher	X	X	X	X
Eastern Phoebe		X		X
Great Crested Flycatcher		X		X
Eastern Kingbird		X		
White-eyed Vireo			X	
Yellow-throated Vireo	X	X	X	X
Red-eyed Vireo	X	X	X	X
Blue Jay	X	X	X	X
American Crow	X	X	X	X
Black-capped Chickadee	X	X	X	X
Tufted Titmouse	X	X	X	X
White-breasted Nuthatch	X	X	X	X
Blue-gray Gnatcatcher	X	X	X	X
House Wren	X	X	X	X
Carolina Wren	X	X	X	X
European Starling	X	X	X	X
Gray Catbird	X	X	X	X
Brown Thrasher				X
Northern Mockingbird	X			
Eastern Bluebird	X	X	X	X
Veery				X
Wood Thrush	X	X	X	X
American Robin	X	X	X	x
Cedar Waxwing	X	X	X	X
House Sparrow		X		
House Finch		X	X	
American Goldfinch	X	X	X	X
Chipping Sparrow	X	X	X	X
Song Sparrow	X	X	X	X
Eastern Towhee	X	X	X	X
Baltimore Oriole		X		X
Red-winged Blackbird	X	X	X	X

Species (continued)	2016	2017	2018	2019
Brown-headed Cowbird	X	X	X	X
Common Grackle	X	X	X	X
Ovenbird		X		X
Kentucky Warbler		X		
Common Yellowthroat	X	X	X	
Hooded Warbler	X	X	X	X
American Redstart		X	X	X
Yellow Warbler		X		
Scarlet Tanager	X	X	X	X
Northern Cardinal	X	X	X	X
Rose-breasted Grosbeak	X	X	X	X
Indigo Bunting		X	X	X
Species Total (season)	37	47	40	43
Species Total (running)	37	48	49	51

All species are presented in taxonomic order according to the American Ornithological Society's *Checklist of North and Middle American Birds*. Citation: Chesser, R. T., K. J. Burns, C. Cicero, J. L. Dunn, A. W. Kratter, I. J. Lovette, P. C. Rasmussen, J. V. Remsen, Jr., D. F. Stotz, and K. Winker. 2019. Check-list of North American Birds (online). American Ornithological Society. <http://checklist.aou.org/taxa>

X indicates the species was observed during point counts in that season. The Species Total (season) indicates how many species were observed during that season. The Species Total (running) is a compilation of how many species have been identified in all since point counts were first conducted in 2016. Eleven new species were added in 2017, one more in 2018, and two more in 2019, bringing the running total of species observed since 2016 to 51 species of birds. Point count data was compiled by bird banding personnel each season.

APPENDIX F – Species Inventories

Plants and wildlife are cataloged at iNaturalist. Here are some common or notable observations.

Plants



- False Sunflower, *Heliopsis helianthoides***
- Grey-headed Coneflower, *Ratibida pinnata***
- Ironweed species, *Vernonia species***
- Purple Coneflower, *Echinacea purpurea***
- Wild Bergamot, *Monarda fistulosa***

Butterflies and Moths



- American Lady, *Vanessa virginiensis***
- Eight-spotted Forester Moth, *Alypia octomaculata***
- Monarch, *Danaus plexippus***
- Painted Lady, *Vanessa cardui***
- Silver-spotted Skipper, *Epargyreus clarus***

Dragonflies



**Black Saddlebags, *Tramea lacerata*
Eastern Amberwing, *Perithemis tenera***

Reptiles



**Eastern Box Turtle, *Terrapene carolina carolina*
Common Gartersnake, *Thamnophis sirtalis*
Northern Redbelly Snake, *Storeria occipitomaculata*
*occipitomaculata***

APPENDIX G – Native Bee Surveys

In addition to bee-collecting efforts in 2017, there has been a systematic approach to collecting bees in the ROW during the fall of 2018, summer of 2019, and currently an effort during the spring of 2020. The collection of bees has involved three techniques:

Hand-netting: A 100-meter transect was measured and marked through the middle of the ROW. The student collector walks the transect slowly, taking 20 minutes from beginning to end. As the student walks, they catch any bee that they see within arm’s reach along the transect. After catching a bee, they pass the net back to a second researcher who is following behind. The student then receives an empty net to continue collecting. The second researcher moves the bee from the net, to a kill jar (which kills the bee using ethyl acetate), unless the bee can be identified without killing it (such as honeybees). At the end of the 20 minutes, the bees are combined into a container and taken to the lab to be pinned and identified. This collecting approach is done every 10 to 14 days, depending on the weather (windy conditions or temperatures below 50 degrees are not conducive to catching bees).



Figure 5 Walking a transect hand-netting bees

Vane traps: One yellow and one blue plastic trap containing soapy water are hung from a shepherd’s hook in the middle of the bee transect located in the ROW. These colors are known to attract a variety of bees when visible, so they are hung just above the vegetation level using fishing line. The

soapy water breaks the surface tension of the water and allows bees that land in the water to immediately sink to the bottom. The traps are left in place for approximately 48 hours during favorable weather conditions. After 48 hours, the traps are poured through a mesh strainer to remove the drowned bees and other invertebrates. These specimens are then taken to the lab to be pinned and identified. Vane traps are set about every 10 to 14 days on a schedule opposite the hand-netting efforts.



Figure 2 Vane traps hanging in the ROW



Figure 3 Checking vane traps for collected specimens

Pan traps: One yellow and one blue pan trap (or bowl) containing soapy water are also set on the ground, about 6 feet apart, at one end of the transect in the ROW on the same days that the vane traps are hung. These ground-level traps capture low-flying bees that are often different than the bees collected with vane traps. For each collection period, the pan trap locations change within the transect; one week they are at the south end, then they are at the north end for the next collection period. After 48 hours in place, they are poured through the strainer and the contents taken to the lab to be processed.



Figure 4 Pan traps placed on the ground in the ROW

One objective of this project is to see which collection technique collects the most bees and the highest diversity of bees during the different seasons. These results are still being determined.

Personnel contributing to native bee data collection:

R. Chris Stanton, Ph.D. – Nature Center Director

Adam Zorn – Nature Center program manager

Cali Granger, MS – Biology faculty and Nature Center volunteer

Carli Mentzer – Nature Center summer research 2017

Ben Mullaly – Nature Center summer research 2017 & senior thesis 2018

Kira Nicholson – Nature Center summer research 2017

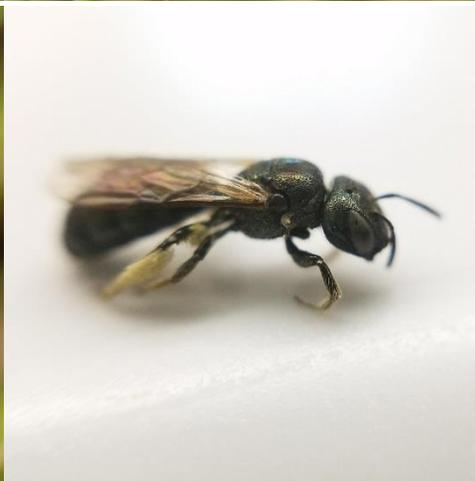
Carson Ciesinski – Nature Center summer research 2019 & 2020

Photos of select specimens observed or collected:



Left - Honeybee (*Apis*)

Right - Common Eastern Bumblebee (*Bombus*)



Left - Mining bee (*Andrena*)

Right - Small Carpenter Bee (*Ceratina*)



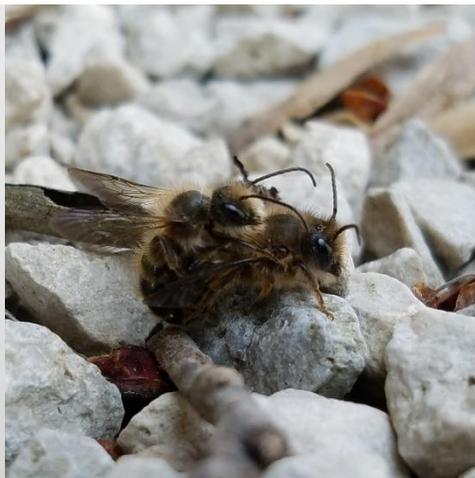
**Left - Two-spotted
Long-horn Bee
(*Melissodes*)**

**Right - Nomad Bee
(*Nomada*)**



**Left - Augochlorine
Sweat Bee
(*Augochlorini*)**

**Right - Furrow Bee
(*Halictus*)**



Left - *Lasioglossum* sp.

**Right - Mason Bees
(*Osmia*)**



