

**Flint Hills Resources
Pine Bend Bluffs Property**

2022 Ecological Activities Report



Unit SGP-M. Native bluff prairie with early summer blooms

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PROJECT SUMMARY

This report describes the ecological activities completed by Friends of the Mississippi River and Great River Greening at the Flint Hills Resources Pine Bend Bluffs natural area in 2022. This restoration work has been on-going for 23 years and there is a lot to show for it. Nearly 200 acres of forest, prairie and savanna have been restored, and the associated wildlife have rebounded, including an endangered bumblebee and 14 species of greatest conservation need (SGCN). The long-term goal is to restore all the accessible, non-aquatic areas of the FHR bluffland, about 400 acres.

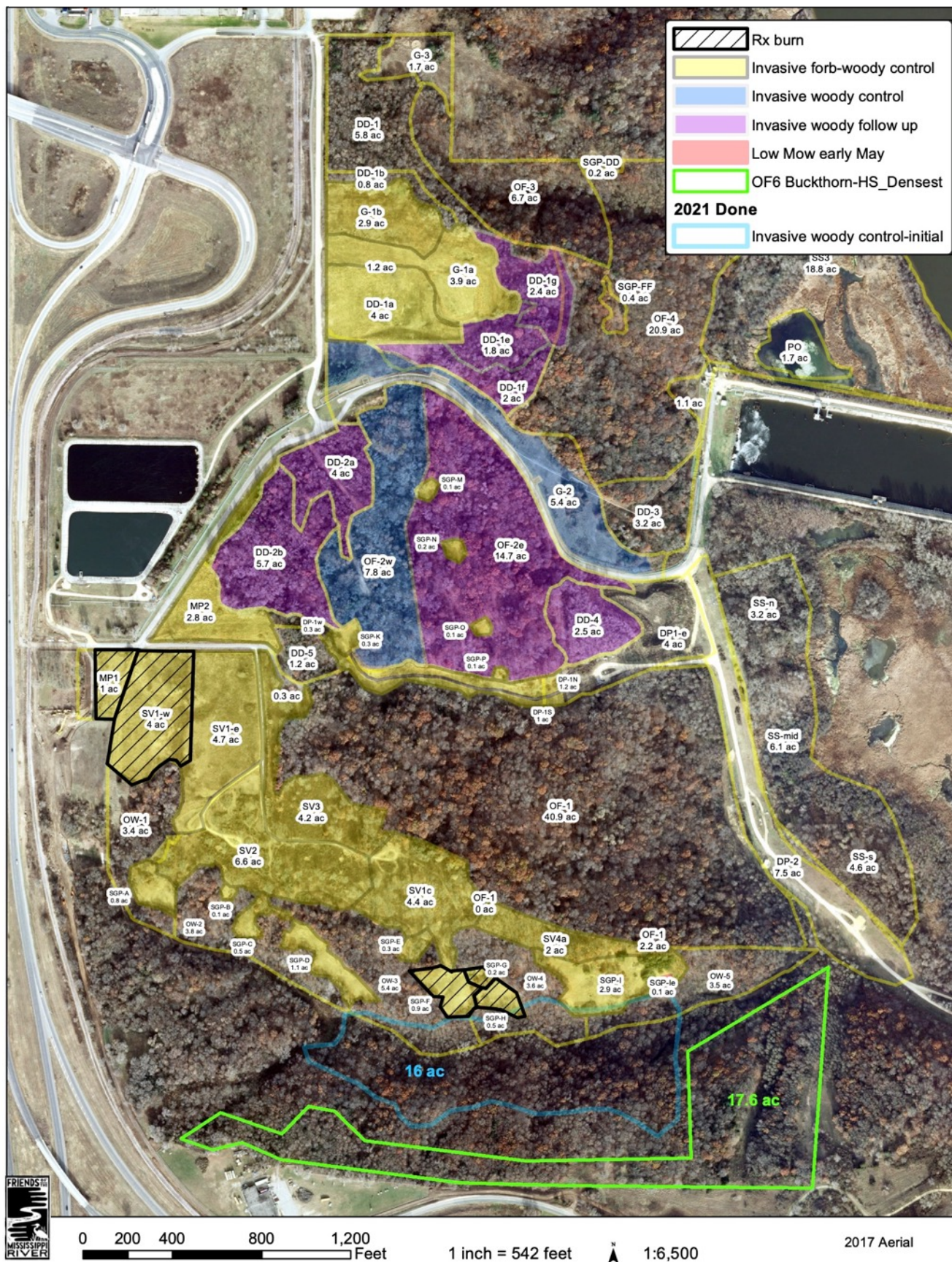
A summary of the 2022 ecological tasks is shown below.

Acres	Habitat	Activity
4	Oak forest	New acres, cut & stump treat invasive woody
26	Oak forest	Follow-up invasive woody control
45	Oak savanna resto	Management (spot spray invasive forbs, cut/treat woody, Rx burn)
10	Native Sand-gravel prairie	Management (spot mow, spot spray, Rx burn)

85

Volunteer events: FHR employee participation in 2022 included 68 participants in the spring kick-off, and 46 volunteers at 4 field events. In addition, 91 community and employee volunteers attended the fall community event. There was a total of 205 volunteers for the year, representing over 470 hours.

Map 1. Flint Hills Resources Pine Bend Bluffs Ecological Work 2022



FOREST RESTORATION – ON-GOING ENHANCEMENT, 28 AC

Unit DD2a: Management of this 4-acre unit began in 2019 with removal of a very dense shrub layer of mature buckthorn. The unit was later seeded with seven native grass species and in 2021 the ground layer was dominated by dense grasses, especially wild rye (Photo 1). The tree canopy is still dominated by boxelder, with some black cherry, and green ash. Eventually it could be converted to oak savanna by removing the boxelder and planting bur oak and hazelnut shrubs, among other species.

In 2022, garlic mustard was spot-sprayed in April, and buckthorn and honeysuckle resprouts were foliar treated in May. Birds foot trefoil and spotted knapweed were treated in June and a vegetation survey was completed in August.

Unit DD2b: This 2-acre unit has had buckthorn removal in past years. Over time the invasive woody plants return, especially along edges (Photo 2). In 2022, follow-up control of buckthorn and honeysuckle was completed in May and herbaceous weeds (knapweed, birds-foot trefoil) were treated in June.



Photo 1. DD2a - dense native grass cover after 2019 forestry mow. Some bare areas to re-seed.

Unit DD1e. This 3-acre unit was the site of the 2019 fall community volunteer event and was later seeded with native grasses. In the 2022 evaluation, small buckthorn and honeysuckle were noted, which should be treated in fall 2023.

Unit DD1f. Buckthorn and honeysuckle were treated in this 2-acre unit Jan 2023.

Unit DD1g. This 2.5 acre unit was the location of the 2021 volunteer brush removal work, followed by seeding. In 2022 the unit was mowed in June and August to reduce the buckthorn regrowth. Hazelnut seeds were planted to try to improve the native shrub cover.

Unit DD4. In April, garlic mustard was spot-sprayed in this 2.5-acre unit.

Unit OF2: Portions of the site had carpets of garlic mustard, which were sprayed in April when most other plants were still dormant. Buckthorn regrowth was abundant in much of the unit with some shrubs tall and ready



Photo 2. DD2b honeysuckle on edge prior to removal.

to be cut or basal-bark treated. About two acres were treated in fall 2022 (Map 2, polygons 1, 2 and 3). A plan was made to mow much of the unit in 2023 (with a brush mower or walk behind skid steer) to set back the small stems, and to do this once in June and again in August. The southern part of the unit was overseeded with native grasses in late fall. Additional woody control will be needed annually to address the regrowth as funding allows.

Unit SS: This was the location of the 2022 fall volunteer brush haul event. Non-native invasive woody plants (buckthorn, honeysuckle) on about 2.5 acres were cut and stump treated. Volunteers hauled most of it off the unit and created large stacks that were later removed by FHR contractors. Native woodland seed was broadcast in the woody removal area.

Map 2. Invasive woody treatment areas in OF2.



PRAIRIE/SAVANNA RESTORATIONS, 35 AC

Savanna Reconstruction Unit DD1a 4 ac



Photo 3. DD1a, four years after seeding, with abundant wildflowers.

Prior to 2017, this unit was a densely wooded area, almost entirely composed of non-native invasive shrubs (mature common buckthorn) and trees (large Siberian elm). It was clearcut in early 2017 then forestry mowed, followed by spraying weeds and seeding in fall 2018. The unit was burned in 2021. In 2022 invasive weeds (trefoil, knapweed) were spot-treated in June.

Vegetation surveys, including unit G1b, over the years since seeding have recorded 28 of the 44 species that were seeded (64%). In any restoration it is expected that some species will not establish for a variety of reasons. The seed mix included a large number of

species so that even if some didn't establish there would still be a good variety. In addition to the seeded species, several other native species have established, so the total number of native

flowers and grasses is 46, which is considered a good assemblage (Photo 3). The landscape change to this area from before and after restoration is dramatic (Photo 4).

However, many of the species that did not establish are those that bloom earlier in the season. It is important to have good floral resources throughout the entire growing season, to support pollinators and other wildlife. Some prairie plants are very slow to establish and it is very likely that additional species will appear over time. However, they are not likely to be present in large numbers. Therefore, to increase the early season species, it would be good to do supplemental seeding or planting. This may require creating planting patches, by spraying areas that have a lot of weeds to provide a planting bed. Some early species to add would be lupine, columbine, penstemon and onion. Common milkweed could also be increased and anise hyssop should also be added.

Canada goldenrod had become overly abundant in some areas, and was mowed in past years in mid-August when flowering started. This has been effective at reducing it and will likely need to be repeated, typically for two to three years in a row.

While native plants were about 90% cover, there were quite a few non-native species that were spot-treated in 2022: burdock, knapweed, Canada thistle, St John's wort, birds foot trefoil, and wild parsnip. This treatment will be needed again in 2023 and annually.



Photo 4. Unit DD1A before restoration (2016) and after (2022).

Prairie Reconstruction Unit G1a, 4 ac

This unit began as grassland that was primarily smooth brome, with an abundance of honeysuckle and small Siberian elm trees. Unit G1a was restored to prepped and seeded to native prairie in fall 2015. It was first burned in 2018.

Native plant diversity started out very good for a few years, but invasive grasses (switchgrass and reed canary grass) became too abundant, especially in the dredge spoils mound. The grasses have been mowed, grazed, and sprayed to reduce their cover. The grasses were sprayed again in May 2022 and mowed in August.

Prairie Reconstruction Unit G1b, 3 ac

Like G1a, Unit G1b started out as a brome dominated grassland with invasive woody plants. It was prepped in 2017 and seeded in fall 2018, along with DD1a with a similar seed mix. Both units have since been managed annually by spot-spraying or mowing invasive weeds. They were also burned at the same time in 2021, followed by overseeding the goldenrod dominated area.

Unit G1b has established better than DD1a, with a greater abundance of native species (90% or more). Thirty of the 37 seeded species have been detected so far (77%), and the cover of invasive species is low. Compass plant and rattlesnake master, which are both fairly conservative species, were found in small numbers (Photo 5). Compass plant is especially desirable because its tall stalks provide good perches for birds.



Photo 5. G1b with compass plant.

Some of the dense goldenrod stands were mowed in 2021 to help reduce it and black locust saplings were also cut. In 2022, invasive weed control (knapweed, Queen Anne's lace, thistles) was done in July.

Like DD1a, supplemental seeding or planting of early season blooms is needed.

Prairie Reconstruction Unit MP2, 3 ac

This unit was seeded in 2013. It has taken some years to get good establishment of native prairie species. It has improved a lot over the years and was dominated by native species, with about 30 of the 39 seeded species found. However, just a few species dominated, and most were present in very low numbers. And invasive grasses were still abundant.

The grasses were sprayed with a grass herbicide on May 18, but it was not very effective. So grasses were sprayed again with glyphosate on Oct 19, when native plants were dormant. In June the site was spot-treated for knapweed and birds foot trefoil, and the hoary alyssum was mowed in early July.

Savanna Reconstruction all SV units. 28 ac.

Invasive woody removal (honeysuckle, buckthorn, black locust) was completed in much of the SV units (SV3, SV1c) in May and July 2022. The multiflora rose discovered near SGP-E was also treated. Additional work is needed to manage the remaining SV acres before the shrubs bear fruit (Photo 6). This will be done in 2023.

There are a number of small bur oak trees that are establishing in the SV units. The grasses were mowed around these trees to help reduce the competition. About 1-acre of the goldenrod in SV2 was mowed in August to set it back. Overall, the eastern SV units look very good, with few invasive woody plants and a great abundance of natives.



Photo 6. Unit SV. Great native veg, but invasive woody encroaching under oaks.

NATIVE PRAIRIE – ON-GOING MANAGEMENT

Units SGP A,B,C,D,E,F,G,H,I,K, M,N,O,P 10 ac

Rx Burn and Invasive Plant Control

A prescribed burn was completed on April 11 at units SGP-F,G,H (Photo 12). Forbs (flowering plants) can be harmed by spring burns, especially spring blooming species. By burning in very early spring before most plants have started to grow, we minimize any negative impacts on the plants and also avoid impacts to some animal. Rusty-patched bumble bees, for example, emerge in April from overwintering in woodland edges. Burning the prairie before floral resources are available avoids negative impacts to bee foraging.

Invasive weeds, including trefoil, thistles, crown vetch and knapweed, were spot-treated or pulled throughout the summer. Galium mullogo was treated at SGP-M and N in late July. In August, invasive woody plants were removed from prairie edges to 20 feet into the woods at all the SGP A-I units as well as the SGP M-O units.

Removal of invasive woody plants from the wooded edges of units SGP-M,N,O left those areas devoid of much vegetation. To encourage spread of the prairie, we use seed that was harvested from the nearby restored prairie at Spring Lake Park to seed those areas. The species included hoary vervain, false boneset, purple prairie clover, white prairie clover, Canada wild rye, yellow prairie grass, yellow coneflower, lead plant, anise hyssop, round-headed bushclover, large-flowered penstemon, and showy goldenrod. About 0.5 lb total. Additional purchased seed may be needed. Seed origin should favor southern locations and most species should be within 75 miles.

Unit SGP-E was cleared in 2019 and seeded in 2020 but was still in rough shape in 2021 with an abundance of non-native plants. Most, however, were simply weedy and not invasive. We want to avoid using a lot of herbicide at this unit if possible, to allow the native seedbank to germinate. We'll continue to monitor and mow the weeds in 2023.

Prairie Vegetation Survey

Most of the native prairies have not been surveyed in many years, so we began to do that in 2019 to help evaluate changes to these areas over time. These metrics will allow us to comprehensively assess the current state of cheatgrass and native species after roughly a decade of management. We have withheld cheatgrass management for several years now, as it did not seem to be that effective and we were concerned about impacts to the native species.

For the SGP A-I units, we have not seen significant changes from year to year so far. Cheat grass has generally stayed about the same, with some modest decreases or increases.

The number of native species recorded has generally increased. The vegetation survey was not completed in 2022 because the drought caused the plants to go dormant and the vegetation was dry and brown. Surveys can be restarted in 2023.

An exciting discovery in 2021 was a single individual of the prairie turnip plant (*Pediomelum esculentum*) (Photo 7). This is a relict prairie species, and very seldom found any more in the local region. Though not rare, it is unusual. It was a very important food source for Native Americans. We collected 10 seeds off of it in 2021 to try to increase the population.



Photo 7. A single prairie turnip plant at SGP-A, first recorded at the site in 2021.



Photo 8. Buffalo bean or ground plum was abundant at SGP-I.

The seeds were grown in 2022 by our partners at Dakota County Parks (DCP) and seven plants survived. The plants were too small to plant in 2022 and will be planted in 2023. DCP also grew a couple dozen ground plum (*Astragalus crassicaarpus*) plants (Photo 8), from seed that we collected at SGP-I, which will also be planted in 2022.

The prairie turnip we found in 2021 was present in May 2022, but then got eaten by a deer or rabbit. It did grow back in July, but did not flower. This was a good lesson that plants that we install at the site will need to have fencing to protect them.

The SGP-M, N, and O units generally seemed to have better native species diversity than the A-I units, and also much less cheatgrass. At Unit M, we recorded abundant cheatgrass in 2008, but none in 2022.

Unit M was burned in 2021 and the floral response came in 2022, with a beautiful display of penstemon and puccoon in June (Photo 9). A vegetation survey was done at this unit and detected false baby's breath, a non-native invasive species, that was treated in July. Invasive woody plants were cut and treated along the perimeters of all the units in September.

The established 1-meter plots at all of the SGP units A-I were surveyed once in 2021, along with a meander survey of the entire unit. These units will be surveyed once more in 2023 to gain a more complete picture of the species present and correlation with cheatgrass. Previous surveys indicated overall native plant species richness (number of species) was lower in plots that had higher cheatgrass density.



Photo 9. A dazzling display of penstemon and puccoon at SGP-M, June 9.

Overall, we still recommend holding off on cheatgrass management at the remnant prairies until more information is known about native species presence and abundance in these remnants, and to determine whether or not native plants are being lost due to management or can recover in areas where cheatgrass has been managed.

Tracking cheatgrass abundance with native cover and diversity may also help shine a light on the effects of cheatgrass on native species. Moving forward, tracking the abundance of cheatgrass in these remnants will also help determine if management was keeping cheatgrass populations at bay and if future management is warranted to stop cheatgrass expansion. We suggest another year of surveys of these remnants to track both cheatgrass abundance and native species diversity and abundance for a couple years, and to use that data to reassess the management of cheatgrass in the prairie remnants at FHR.

Rare Plant Survey

The annual survey for the state endangered **James's polanisia** (JP) was completed at the sand-gravel prairie units on August 10. The populations at all previous locations were surveyed using the same methods as previous years. After two years with among the lowest total number of plants (35 and 29), there was a 100 percent increase in 2022 with 59 plants recorded. This

number, however is still quite low, especially compared to the highest year count of 843 in 2014. In addition, the plants in 2022 were only found in two locations. It seems that five of the seven historical locations may no longer harbor any plants.

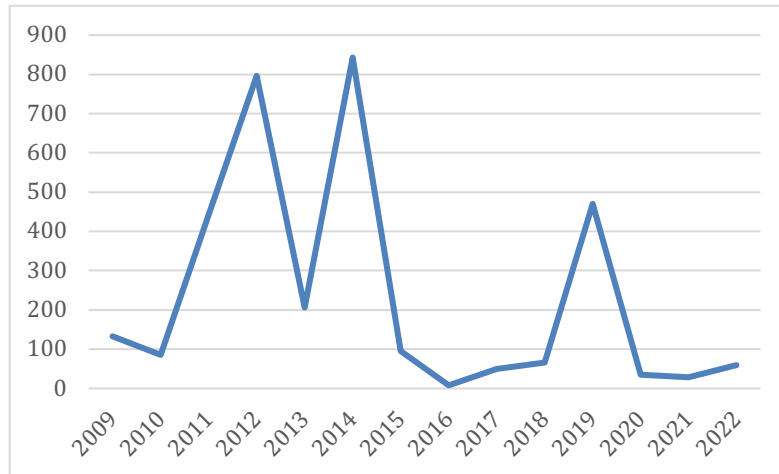
The far east end of Unit I has been a stronghold for the plant, in part due to the steep sandy slopes that tend to have a lot of bare soil. James's polanisia is an annual species that requires some soil disturbance to create bare soil openings where it can grow. Weedy species such as cheatgrass and mullein, however, also readily occupy such bare soils and seem to be a primary competitor at the Unit I location. We began cutting the weeds in early spring in that area over the past couple years, to help facilitate space for the polanisia, and that method seems to be helping. At other units, like Unit D, there are ample bare soil patches, but the polanisia is no longer there. We will continue to monitor and the plant may recur there.

How long the seeds remain viable in the soil is not known, but it is thought that a plant that grows in such dry conditions as this one is likely to have long seed viability, which will hopefully help the population to recover at some of the other units. It is also apparent that this species has significant year to year fluctuations so it will be important to continue annual monitoring.

Table 1. James's Polanisia (*Polanisia jamesii*) Monitoring at Flint Hills Resources Bluff Prairies

	2003	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Survey Dates		7/25	6/28, 7/7	8/14, 21	7/29, 8/5	7/29, 8/12, 9/16	8/4, 8/16, 9/1	8/8	9/4	8/14, 8/28	8/5	8/8	8/14	8/15	7/31	8/25	7/8	8/10
SGP-A	Present	-	-	-	2	2	0	1		0	0	0	0	0	0			
SGP-D east	Present	15+	Present	35 +	23	26	282	99		154	0	0	0	0	18	6	0	0
SGP-F	-	-	-	-	-	-	-	49	207	292	9	0	3	3	5	1	16	20
SGP-H east	-	-	-	-	50	0	15	0		0	0	0	0	0	0		0	0
SGP-I east	Present	27	-	Dozens	55	47	134	509	0	397	86	8	44	63	448	28	13	39
SGP-I mid	-	3	-	Dozens	-	1	0	67	0	0	0	0	0	0	0		0	0
SGP-I west	Present	-	5	Unkno wn	3	9	12	71	0	0	0	0	3	0	0		0	0
		45		88	133	85	443	796	207	843	95	8	50	66	471	35	29	59
% change from previous yr					51%	-36%	421%	80%	-74%	307%	-89%	-92%	525%	32%	614%	-93%	-17%	103%

Figure 1. James' Polanisia Population Trend



VOLUNTEER EVENTS

Pollinator Survey

Nine employees participated in the pollinator survey training on June 15, where they learned the Xerces Society survey protocols. Volunteers returned to complete three surveys over the summer (27 volunteer hours). The focus in 2022 was on native bees, and volunteers learned to identify the 10 common groups. Volunteers recorded all 10 groups at the site, plus one identified to genus, and a total of 42 individuals. If surveys are repeated annually it can provide documentation of the pollinator use of these restorations, supplementing the professional pollinator surveys.

Prairie Maintenance Event

On July 20, eight employee volunteers participated in a prairie tending event (12 hours). They pulled spotted knapweed and hoary alyssum from the SGP-O and N units.

Seed Collection

On September 21, seven FHR employees collected prairie seed from the restored prairies at the site (10 hours). Species collected included big bluestem, hoary vervain, wild bergamot, and yellow coneflower. The seed will be broadcast at some of the woodland areas where invasive woody plants have been removed.

Monarch Monitoring

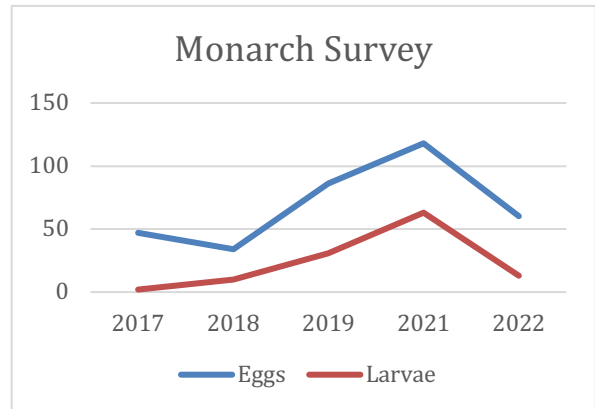
Nine employees, plus the FMR intern, participated in the fifth year of the monarch monitoring program. The season started with a 2-hour training on June 1. Volunteers were assigned to one of seven survey plots, including two located in a new area. Volunteers returned weekly through August, ten to thirteen visits, and recorded eggs and larvae at their designated plots, following

established protocols of Monarch Joint Venture. Each volunteer surveyed about 50 plants each week and total volunteer hours was about 60.

Table 2. Four-year summary of monarch survey data.

	2017	2018	2019	2021	2022
Avg Plants per wk:	341	242	294	240	266
Total eggs:	47	34	86	118	61
Instar 1	0	5	7	39	5
Instar 2	2	3	9	11	3
Instar 3	0	0	4	5	0
Instar 4	0	1	7	5	5
Instar 5	0	1	4	3	0
Total caterpillars:	2	10	31	63	13
% change eggs:		-28%	153%	37%	-48%
% change larvae:		400%	210%	103%	-79%

Figure 2. Monarch larvae trend

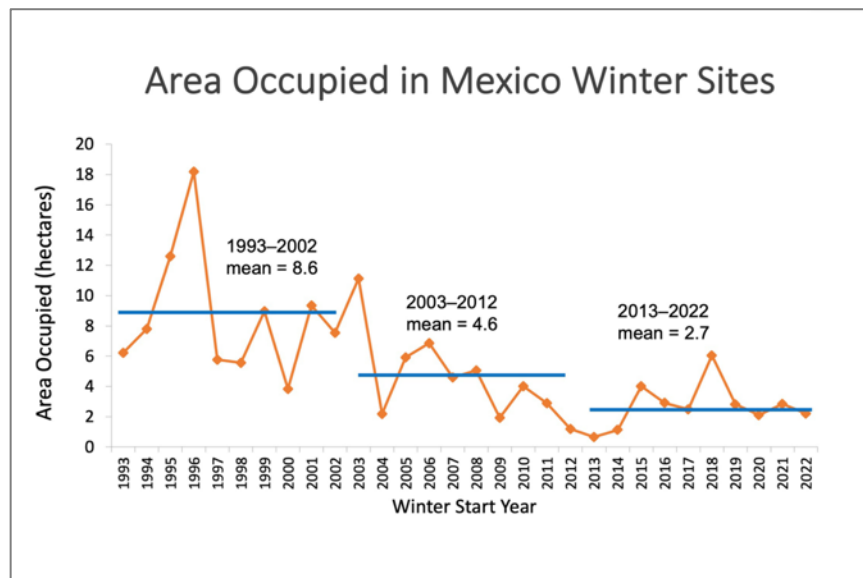


Results over four years show there was steady increase in numbers of eggs and larvae detected almost every year for the first four years, with a sharp decline in 2022 (Table 2, Figure 2). The number of eggs found in 2022 was a 48% decrease from the previous year, and the caterpillars decreased by 79%. A likely cause, or partial cause of the decline could be the severe drought in 2021 followed by another drought in 2022. The results were submitted to the Monarch Joint Venture database and are combined with other data from the region.

The overwintering population of monarchs in Mexico has declined dramatically (90 percent) over the past 35 years, but the population has been fairly stable in the past 8 years (Figure 3).

The FHR monitoring demonstrates the importance of the bluffland habitat and the vital resources it provides to monarchs, among many other animals. Plans are to continue monarch monitoring in 2023.

Figure 3. 30-year population trend of monarch butterflies at overwintering grounds in Mexico.



Community Volunteer Event

Ninety-one community volunteers participated in the annual community volunteer event on October 29, 2022, hauling invasive woody shrubs from the lowland forest by the spring lake marsh for three hours. The event expanded on invasive woody removal that has taken place in this area in previous years. The brush was stacked and the piles were later removed and chipped. 273 volunteer hours.



Photo 10. 91 volunteers participated in the brush hauling event on 10/29/22.

BREEDING BIRD SURVEYS

FMR has been conducting annual breeding bird surveys every year for thirteen of the past fourteen years (with the exception of 2020, due to Covid). We also typically host a bird hike during spring migration each year. The total the number of species observed during both spring migration and breeding bird surveys is 120. (**Appendix C**).

The 2022 annual breeding bird survey was completed on June 6 and 29, at the same points and using the same point count methods that have been used for 12 years (5 min, 50 m radius). All species seen or heard are recorded. Although one or two new species are typically recorded each year, 2022 was the second time when no new species were recorded. The total number of species recorded during the breeding season remains at 80 and the average number of in any given year is about 47. Of the 80 species recorded, a few of them (e.g. herons, egrets, cormorants) would not be breeding at the site, so the total species likely to use the property for breeding is 77.

The number of species recorded in the 2022 breeding bird survey was average at 46 and the number of birds (240) was somewhat higher than average (215).

The most abundant species in 2022 was wood duck, which was somewhat misleading as it was due to large numbers of ducklings recorded. Yellow warbler was the next most abundant species, followed by brown-headed cowbird, then American goldfinch. The top ten species fluctuate somewhat from year to year, but the other most common species are pretty consistently: American redstart, cedar waxwing, common yellowthroat, gray catbird, house wren, red-winged blackbird, and song sparrow (**Appendix C**). All are habitat generalist species, common in forest edges as well as suburban housing areas, and very common throughout their range. The abundance of cowbirds is an unfortunate byproduct of the habitat fragmentation that has occurred with human development of the landscape. These brood parasites are much more

abundant than they were historically, and have very negative impacts on the breeding success of many other bird species, especially the neotropical migrants.

The number of species of greatest conservation need (SGCN) in 2022 was right at the annual average of 5 (Table 3).

The chimney swift house built by FHR employee volunteer Jack Seibenaler, and installed in fall 2012, was used for the first time in 2017, and again in 2018. In 2019 it was used for roosting but no nest was visible. In 2020 and 21 it did not appear to have been used at all. However, in 2022 we could see TWO nests in the chimney (Photo 11). This is unusual as the research indicates chimneys are only used by one pair. We did not record any chimney swifts during the breeding bird survey, so it was exciting to discover they had been nesting at the site.



Photo 11. Two nests in the chimney swift tower.

Table 3. Thirteen-Year summary of Species of Greatest Conservation Need recorded during the breeding season.

Orange highlights indicate the first year a species was recorded.

Species	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2021	2022	Avg /yr
1 American Kestrel	2		1									1		1.3
2 Black-billed cuckoo												1		1.0
3 Brown thrasher			1				1	5	1	1				1.8
4 Chimney swift				5	3	1	1	2	2	1				2.1
5 Dickcissel								2	4			1		2.3
6 Eastern meadowlark	2				2		1					1		1.5
7 Eastern Towhee	3	3	3	7	5	4	4	6	3	6	4	7	6	4.7
8 Field Sparrow	7	4	7	10	4	7	10	7	5	7	3	7	7	6.5
9 Northern Rough-winged Swallow	1	1	1		2	1		1	6		2	23	2	4.0
10 Sedge wren		1												1.0
11 Wood thrush	1			1								4	1	1.8
12 Yellow-billed cuckoo			1					3	1					1.7
13 Yellow-headed blackbird												1	2	1.5
No. birds	16	9	14	23	16	13	17	26	22	15	9	46	18	18.8
No. species	6	4	6	4	5	4	5	7	7	4	3	9	5	5.3

POLLINATOR SURVEYS

While the native plant community restoration at FHR has progressed very well over the past 21 years, we have relatively little information on how wildlife have responded to the changes besides the bird surveys. To help answer that question, FMR hired wildlife biologist Chris Smith in 2021 for the third year, to conduct pollinator surveys at both the native bluff prairies and the restored savanna and prairie units.

Surveys were completed on once a month from June to September. The results are provided as a separate document. The primary focus was on bumble bees and butterflies.

The federally endangered rusty-patched bumble bee was recorded at the restored savanna (unit SV1) in 2019 and 2020, but was not noted in 2021 or 2022.

APPENDIX A. Seeding in 2022

Species seeded at SGP-N and SGP-O

The species below were hand-collected from the restored prairie at the Spring Lake Park Reserve archery trail in Oct 2022, with permission from Dakota County. Suitable dry prairie species were broadcast at FHR bluff prairies, the remainder were used at the MP2 prairie.

	Scientific Name	Common Name	SGP units	MP2 Unit	Collected amt (oz)
	Graminoids				
1	<i>Elymus canadensis</i>	nodding wild rye	x		3
2	<i>Sorghastrum nutans</i>	Indian grass	x		7
	Forbs, small shrubs				
1	<i>Agastache foeniculum</i>	anise hyssop	x		0.4
2	<i>Amorpha canescens</i>	leadplant	x		0.7
3	<i>Asclepias syriaca</i>	common milkweed	x		1
4	<i>Brickellia eupatorioides</i>	False boneset	x	x	0.7
5	<i>Dalea candida</i>	white prairie clover	x	x	6.4
6	<i>Dalea purpurea</i>	purple prairie clover	x	x	5.4
7	<i>Drymocallis arguta</i>	tall cinquefoil	x	x	0.6
8	<i>Eryngium yuccifolium</i>	rattlesnake master		x	2
9	<i>Helianthus pauciflorus</i>	stiff sunflower	x		0.1
10	<i>Lespedeza capitata</i>	round-headed bush clover	x	x	0.5
11	<i>Liatris punctata</i>	dotted blazing star	x		0.8
12	<i>Monarda fistulosa & punctata</i>	wild bergamot & dotted	x		0.1
13	<i>Penstemon grandiflorum</i>	large-flowered penstemon	x		1
14	<i>Ratibida pinnata</i>	gray-headed coneflower	x	x	3.3
15	<i>Solidago speciosa</i>	showy goldenrod		x	0.8
16	<i>Verbena stricta</i>	hoary vervain	x	x	0.6
	Miscellaneous/combo				0.7
					35.1
	Incidental				
1	<i>Achillea millefolium</i>	yarrow		x	
2	<i>Allium stellatum</i>	Prairie Wild Onion	x		
5	<i>Coreopsis palmata</i>	prairie coreopsis	x		
3	<i>Pseudognaphalium obtusifolium</i>	sweet everlasting	x		
4	<i>Rudbeckia hirta</i>	black-eyed susan	x		
17	<i>Symphyotrichum ericoides</i>	heath aster	x		
18	<i>Symphyotrichum sericeum</i>	silky aster	x		
3	<i>Sporobolus heterolepis</i>	Prairie dropseed	x		

Species seeded at OF2

Sci Name	Com Name	% of mix	LB	\$/lb	Cost	Origin
Grasses						
<i>Andropogon gerardii</i>	big bluestem	14%	2.50	\$11.00	\$27.50	Dakota Co MN
<i>Elymus canadensis</i>	Canada wild rye	19%	6.30	\$14.00	\$88.20	Benton Co MN
<i>Elymus hystrix</i>	Bottlebrush grass	2%	0.60	\$114.00	\$68.40	Benton/Wright Co MN
<i>Elymus virginicus</i>	Virginia wild rye	33%	13.70	\$10.00	\$137.00	Rice Co MN
<i>Sorghastrum nutans</i>	Yellow prairie grass	24%	3.80	\$11.00	\$41.80	Dakota/Rice Co. MN
TOTAL		68%	22.88		\$362.90	
Forbs						
<i>Ageratina altissima</i>	white snakeroot	5%	0.06		\$0.00	
<i>Campanula americana</i>	tall bellflower	5%	0.05	\$480.00	\$24.00	Clayton Co. IA
<i>Monarda fistulosa</i>	wild bergamot	5%	0.12	\$168.00	\$19.60	Rice Co MN
<i>Rudbeckia hirta</i>	Black-eyed susan	14%	0.27	\$48.00	\$12.78	Dakota Co MN
<i>Solidago flexicaulis</i>	zigzag goldenrod	3%	0.07	\$900.00	\$63.00	Wright Co MN
		32%	0.56		\$119.39	
	Total OF2 mix		23.4		\$482.29	

Species seeded at SS north (volunteer brush removal area)

Sci Name	Com Name	% of mix	LB	\$/lb	Cost	Origin
Grasses						
<i>Andropogon gerardii</i>	big bluestem	15%	2.50	\$11.00	\$27.50	Dakota Co MN
<i>Elymus canadensis</i>	Canada wild rye	30%	9.50	\$14.00	\$133.00	Benton Co MN
<i>Elymus hystrix</i>	Bottlebrush grass	2%	0.60	\$114.00	\$68.40	Benton/Wright Co MN
<i>Elymus virginicus</i>	Virginia wild rye	30%	11.70	\$10.00	\$117.00	Rice Co MN
TOTAL		77%	24.08		\$345.90	
Forbs						
<i>Ageratina altissima</i>	white snakeroot	5%	0.06		\$0.00	
<i>Rudbeckia hirta</i>	Black-eyed susan	15%	0.27	\$48.00	\$12.78	Dakota Co MN
<i>Solidago flexicaulis</i>	zigzag goldenrod	3%	0.07	\$900.00	\$63.00	Wright Co MN
		23%	0.40		\$75.78	
	Total SS mix		24.5		\$421.68	

Species seeded at MP2

	Scientific Name	Common Name	Gross # seeds/ s.f.	Totl Lb	Cost/ lb	Total cost	ORIGIN
	Graminoids						
1	<i>Bouteloua curtipendula</i>	side-oats grama	2.0	0.91	\$18.00	\$ 16.34	Pope Co. MN
2	<i>Schizachyrium scoparium</i>	little bluestem	4.0	1.02	\$18.00	\$ 18.30	
	Subtotal		6.0	1.92	\$36.00	\$ 34.63	
	Hand-collected seed (from SLP)						
	<i>Elymus canadensis</i>	Canada wild rye	0.2	0.08			
	<i>Sorghastrum nutans</i>	Yellow prairie grass	1.0	0.32			
	Subtotal		1.2	0.40	\$0.00	\$ -	
	Total Grams		7.2	2.3	36.0	\$ 34.63	
	FORBS						
1	<i>Agastache foeniculum</i>	blue giant hyssop	0.4	0.03	\$270.00	\$ 7.84	Benton Co. MN
2	<i>Allium stellatum</i>	Prairie Wild Onion	0.1	0.10	\$240.00	\$ 23.52	Kossuth Co. IA
3	<i>Asclepias tuberosa</i>	butterfly milkweed	0.5	0.06	\$540.00	\$ 34.19	Benton/McLeod Co. MN
4	<i>Baptisia alba</i>	white wild indigo	0.1	0.12	\$240.00	\$ 27.67	Northern IA
5	<i>Chamaecrista fasciculata</i>	partridge pea	1.0	0.61	\$12.00	\$ 7.26	MN/Allamakee Co. IA
6	<i>Desmodium canadense</i>	Canada tick trefoil	0.2	0.08	\$72.00	\$ 5.70	McLeod Co. MN
7	<i>Lobelia siphilitica</i>	great blue lobelia	1.5	0.05	\$576.00	\$ 28.23	Vernon Co. WI
8	<i>Lupinus perennis</i>	wild lupine	0.1	0.07	\$630.00	\$ 43.66	Sherburne Co. MN
9	<i>Rudbeckia hirta</i>	black-eyed susan	1.0	0.06	\$48.00	\$ 2.84	Dakota Co. MN
10	<i>Symphyotrichum novae-angliae</i>	New England aster	0.8	0.08	\$360.00	\$ 28.95	McLeod Co. MN
11	<i>Veronicastrum virginicum</i>	Culver's root	1.5	0.04	\$1,080.00	\$ 47.41	Dakota/Rice Co. MN
	Subtotal		7.2	1.3		\$ 257.28	
	Hand-collected seed (from SLP)						
	<i>Brickellia eupatorioides</i>	False Boneset		0.00		\$ -	
	<i>Dalea candida</i>	white prairie clover		0.00	\$90.00	\$ -	
	<i>Dalea purpurea</i>	purple prairie clover		0.00	\$50.00	\$ -	
	<i>Drymocallis arguta</i>	tall cinquefoil		0.00	\$ 350.00	\$ -	
	<i>Eryngium yuccifolium</i>	rattlesnake master		0.00	\$250.00	\$ -	
	<i>Lespedeza capitata</i>	clover		0.00	\$ 90.00	\$ -	
	<i>Ratibida pinnata</i>	coneflower		0.00		\$ -	
	<i>Solidago speciosa</i>	showy goldenrod		0.00		\$ -	
	<i>Verbena stricta</i>	hoary vervain		0.00	\$150.00	\$ -	
	Total Grams and Forbs		14.3	3.6		\$ 291.91	

**Species seeded at G1a- horse grazed subunit
About 0.5 ac**

	Scientific Name	Common Name	Gross # seeds /sf	Total lbs	Cost/ lb	Total cost	ORIGIN
	Grasses						
1	<i>Sorghastrum nutans</i>	Indian grass	4	0.3	\$12.00	\$ 3.60	Dakota/Rice Co. MN
	Total		4.0	0.3			
	Hand-collected seed available from FHR vols						
2	<i>Andropogon gerardii</i>	big bluestem	1.2				
3	<i>Elymus canadensis</i>	Canada wild rye	2.1				
	Forbs						
1	<i>Agastache foeniculum</i>	blue giant hyssop	1.00	0.02	\$270.00	\$ 5.40	Benton Co. MN
2	<i>Allium stellatum</i>	Prairie Wild Onion	1.00	0.09	\$240.00	\$ 21.60	Kossuth Co. IA
3	<i>Amorpha canescens</i>	lead plant	0.90	0.07	\$144.00	\$ 10.08	Dakota/Rice Co. MN
4	<i>Aquilegia canadensis</i>	columbine	0.50	0.02	\$720.00	\$ 14.40	Kandiyohi Co. MN
5	<i>Asclepias syriaca</i>	common milkweed	2.00	0.20	\$96.00	\$ 19.20	Blue Earth/Le Sueur/Nicollet Co. MN
6	<i>Asclepias tuberosa</i>	butterfly milkweed	0.50	0.06	\$540.00	\$ 32.40	Benton/McLeod Co. MN
7	<i>Baptisia alba</i>	white wild indigo	0.10	0.08	\$240.00	\$ 19.20	Northern IA
8	<i>Chamaecrista fasciculata</i>	partridge pea	0.60	0.09	\$12.00	\$ 1.08	Houston Co. MN/Allamakee Co. IA
9	<i>Dalea purpurea</i>	purple prairie clover	3.30	0.21	\$30.00	\$ 6.30	Dakota/Rice Co. MN
10	<i>Desmodium canadense</i>	Canada tick trefoil	1.00	0.10	\$72.00	\$ 7.20	McLeod Co. MN
11	<i>Euphorbia corollata</i>	flowering spurge	0.50	0.04	\$715.00	\$ 28.60	Webster Co. IA
12	<i>Heliopsis helianthoides</i>	ox-eye	1.00	0.11	\$60.00	\$ 6.60	Blue Earth Co. MN
13	<i>Liatris pycnostachya</i>	great blazing star	2.00	0.17	\$180.00	\$ 30.60	McLeod Co. MN
14	<i>Lobelia siphilitica</i>	great blue lobelia	9.20	0.08	\$576.00	\$ 46.08	Vernon Co. WI
15	<i>Rosa blanda</i>	smooth rose	0.13	0.02	\$360.00	\$ 7.20	Benton/Chickasaw/Fayette Co. IA
16	<i>Rudbeckia hirta</i>	black-eyed susan	3.00	0.04	\$48.00	\$ 1.92	Dakota Co. MN
17	<i>Silphium laciniatum</i>	compass plant	1.00	0.10	\$300.00	\$ 30.00	Kossuth/Greene Co. IA
18	<i>Symphyotrichum laeve</i>	smooth aster	3.00	0.07	\$216.00	\$ 15.12	Dakota/Rice Co. MN
19	<i>Symphyotrichum novae-angliae</i>	New England aster	1.60	0.04	\$360.00	\$ 14.40	McLeod Co. MN
20	<i>Tradescantia ohimensis</i>	Ohio spiderwort	1.00	0.09	\$360.00	\$ 32.40	Dakota Co. MN
21	<i>Verbena hastata</i>	blue vervain	1.00	0.02	\$138.00	\$ 2.76	Houston Co. MN
22	<i>Zizia aurea</i>	golden alexanders	0.50	0.04	\$72.00	\$ 2.88	Martin Co. MN
	Total horse unit seed		34.8	1.8		\$ 359.02	

APPENDIX B. Vegetation Surveys

Oak Forest (OF2) Vegetation Survey Plots

Ht (m)	Scientific name	Common Name	Plot 607 8/17/22	Plot 608 8/17/22	505 8/17/22
5-20	CANOPY		4.0	4.0	3.0
	<i>Quercus macrocarpa</i>	bur oak		1.0	
	<i>Quercus rubra</i>	red oak			3.0
	<i>Quercus ellipsoidalis</i>	pin oak	4.0	3.0	
2-5	SUBCANOPY		2.0	1.0	0.5
	<i>Prunus serotina</i>	black cherry	2.0		0.5
	<i>Quercus macrocarpa</i>	bur oak		1.0	
	<i>Quercus rubra</i>	red oak	1.0		
1-2	SHRUB LAYER		1.0	5.0	0.5
	<i>Lonicera tartarica</i>	Tartarian honeysuckle			0.5
	<i>Rhamnus cathartica</i>	common buckthorn		5.0	
	<i>Prunus serotina</i>	black cherry	1.0		
0-1	GROUND LAYER		4.0	3.0	5.0
	Forbs, vines		2.0	0.5	2.0
	<i>Ageratina altissima</i>	white snakeroot	2.0		2.0
	<i>Alliaria petiolata</i>	garlic mustard	0.5		
	<i>Arctium minus</i>	common burdock	0.5		0.5
	<i>Asclepias syriaca</i>	common milkweed			0.5
	<i>Circea lutetiana</i>	enchanter's nightshade	0.5		
	<i>Galium aparine</i>	cleavers	0.5		1.0
	<i>Geum canadense</i>	white avens	0.5		0.5
	<i>Hackelia virginiana</i>	Virginia stickseed	0.5		
	<i>Leonurus cardiaca</i>	motherwort	0.5		0.5
	<i>Osmorhiza claytonii</i>	sweet cicely	0.5	0.5	
	<i>Pilea sp</i>	clearweed	0.5		
	<i>Smilax tamnoides</i>	Bristly greenbrier	0.5		
	<i>Solidago canadensis & gigantea</i>	Canada & late goldenrod	0.5		1.0
	<i>Viola sororia</i>	common blue violet			0.5
		No. gr cover forbs:	12.0	1.0	8.0
	Graminoids			0.0	3.0
	<i>Carex blanda</i>		1.0		1.0
	<i>Carex pensylvanica</i>	Pennsylvania sedge			1.0
	<i>Elymus canadensis</i>	Canada wild rye	0.5		2.0
	<i>Grass spp</i>	Branched stems, patches.			1.0
	<i>Sorghastrum nutans</i>	Indiangrass			1.0
		No. gr cover grams:	2.0	0.0	5.0
	Woody plants		4.0	2.0	3.0
	<i>Celtis occidentalis</i>	hackberry	0.5	0.5	0.5
	<i>Fraxinus pensylvanica</i>	green ash	0.5		0.5
	<i>Lonicera tartarica</i>	Tartarian honeysuckle	1.0	1.0	1.0
	<i>Parthenocissus inserta</i>	Virginia creeper	0.5	0.5	0.5
	<i>Prunus serotina</i>	black cherry	1.0	2.0	1.0
	<i>Prunus virginiana</i>	chokecherry		0.5	
	<i>Quercus rubra</i>	red oak	0.5	0.5	0.5
	<i>Rhamnus cathartica</i>	common buckthorn	3.0	1.0	2.0
	<i>Ribes sp</i>	currant/gooseberry	0.5	0.5	0.5
	<i>Rubus ideaus</i>	raspberry	0.5		0.5
	<i>Rubus occidentalis</i>	black cap	1.0		1.0
	<i>Ulmus americana</i>	American elm	0.5		
	<i>Vitis riparia</i>	wild grapevine	0.5		0.5
	<i>Zanthoxylum americana</i>	prickly ash	0.5		0.5
		No. gr cover woody:	13.0	8.0	12.0
		TOTAL No. Gr cover spp	27.0	9.0	25.0
	<i>Bare ground</i>		2.0	4.0	1.0

- Three vegetation survey plots were established in 2013. 10x10 m each.
- Plots 505 & 607 were grazed by goats for 2 weeks in late summer in 2013, 2014, 2015. Cut/stump-treat Feb 2018. Foliar treated in 2021.
- Plots 608 was not grazed or brush cut, but buckthorn was foliar-treated in 2014. No additional treatment since then.

2022 Notes:

Positive changes

607: BT is still very short, almost unchanged since 2020. Ground layer species richness moderate, but dramatically improved from before mgmt.

505: Invasive woody cover no worse than 2020. Good native grass and forb cover and abundance.

Negative or neutral

607: BT treatment has set it back but has not killed it.

505: Invasive woody cover has not decreased since 2020. Herbaceous diversity is low.

608: No change - Buckthorn plants have increased in size but not fruiting. Native plants are sparse. Plan to remove buckthorn in 2023.

*Coverages: + = <1%, 1=1-5%, 2=5-25%, 3=25-50%, 4=50-75%, 5=75-100%

Disturbed Deciduous Woodland DD-2a Vegetation Survey

Forestry mowed Feb 2019. Sprayed July 2019. Seeded March 2020. Spot-sprayed BT & GM 2020, 2021.

			Cover*			
			Baseline	10/7/20	8/19/21	8/16/22
NON-Nativ	Scientific name	Common Name	2018	2020	2021	2022
Ground layer (0 to 0.5 meter)			0.5	4	5	5
	Herbaceous			2	2	1
	<i>Ageratina altissima</i>	white snakeroot	0.5	0.5	0.5	0.5
x	<i>Alliaria officinalis</i>	garlic mustard		1	2	0.5
x	<i>Arctium minus</i>	common burdock			0.5	0.5
	<i>Asclepias syriaca</i>	common milkweed			0.5	
	<i>Athyrium filix-femina</i>	lady fern			0.5	
	<i>Campanula americana</i>	American bellflower			0.5	0.5
x	<i>Chenopodium album</i>	lamb's quarter			0.5	
x	<i>Cirsium arvense</i>	Canada thistle			0.5	
x	<i>Cirsium vulgare</i>	bull thistle				0.5
	<i>Conyza canadensis</i>	horseweed		1	1	0.5
	<i>Dracocephalum parviflorum</i>	American dragonhead				
	<i>Erechtites hieraciifolius</i>	pilewort		2	2	
	<i>Erigeron sp</i>	daisy fleabane				0.5
x	<i>Fallopia scandens</i>	bindweed			0.5	
	<i>Galium triflorum</i>	sweet-scented bedstraw		1	1	1
	<i>Geum canadense</i>	white avens			0.5	0.5
	<i>Hackelia virginiana</i>	Virginia stickseed		1	0.5	1
	<i>Lactuca biennis</i>	wild blue lettuce			0.5	
x	<i>Leonurus cardiaca</i>	motherwort	0.5	2	0.5	0.5
	<i>Monarda fistulosa</i>	wild bergamot			0.5	0.5
	<i>Oxalis stricta</i>	wood sorrel			0.5	
	<i>Rudbeckia hirta</i>	black-eyed Susan				0.5
	<i>Scrophularia marilandica</i>	Maryland figwort			0.5	0.5
X	<i>Silene latifolia</i>	white campion				
	<i>Smilax sp</i>	carrion plant			0.5	0.5
	<i>Solidago canadensis</i>	Canada goldenrod			0.5	0.5
	<i>Symphotrichum ericoides</i>	Heath aster		0.5		
x	<i>Verbascum thapsus</i>	mullein		1	0.5	0.5
	<i>Verbena hastata</i>	blue vervain				0.5
	<i>Verbena urticifolia</i>	white vervain				0.5
	Graminoids		0	3	4	4
x	<i>Agrostis gigantea</i>	red top grass		0.5		
	<i>Andropogon gerardii</i>	big bluestem		0.5		
x	<i>Bromus inermis</i>	smooth brome			1	1
	<i>Carex blanda</i>	common woodland sedge		0.5	0.5	1
	<i>Elymus canadensis</i>	Canada wild rye			1	1
	<i>Elymus hystrix</i>	bottlebrush grass			1	1
	<i>Elymus virginiana</i>	Virginia wild rye		3	3	4
x	<i>Eriochloa villosa</i>	hairy cup grass		2	1	
	<i>Panicum virgatum</i>	switchgrass			0.5	
x	<i>Phalaris arundinacea</i>	reed canary grass		0.5		
x	<i>Poa pretensis</i>	Kentucky bluegrass			0.5	
x	<i>Setaria faberi</i>	giant foxtail		1	1	
	<i>Sorghastrum nutans</i>	Indiangrass		0.5		

Deciduous		0.5	1	2	1	
	<i>Celtis occidentalis</i>	Hackberry	0.5	0.5	0.5	
	<i>Fraxinus pensylvanica</i>	green ash			0.5	
x	<i>Lonicera tartarica</i>	Tartarian honeysuckle		0.5	1	1
	<i>Parthenocissus inserta</i>	Virginia creeper				0.5
	<i>Prunus serotina</i>	black cherry		0.5		1
	<i>Quercus rubra</i>	Red oak		0.5		
x	<i>Rhamnus cathartica</i>	common buckthorn		1	1	2
	<i>Ribes missouriensis</i>	Missouri gooseberry				
	<i>Rubus occidentalis</i>	black raspberry		0.5		0.5
	<i>Sambucus racemosa</i>	red-berried elder			0.5	
	<i>Vitis riparia</i>	Wild grape vine		1		0.5
Shrub layer (0.5-3 meters)			5	1	0.5	0.5
	<i>Acer negundo</i>	Boxelder			0.5	0.5
x	<i>Lonicera tatarica</i>	Tatarian honeysuckle	1	0.5	0.5	
x	<i>Rhamnus cathartica</i>	common buckthorn	5	1	0.5	
Canopy & Subcanopy (3 meters to 20 meters)			4	4	4	4
	<i>Acer negundo</i>	Boxelder	4	4	4	4
	<i>Prunus serotina</i>	black cherry	1	1	1	1
	<i>Quercus rubra</i>	Red oak	1	1	1	1
* Percent cover for species & vegetation layers: 0.5=0-1, 1=1-5, 2=5-25, 3=25-50, 4=50-75, 5=75-100						
		No. native forbs		6	15	14
		No. native grams		4	5	3
		No. native woody		5	4	4
		total spp		15	24	21
		No. non-native spp		10	14	9

2022 Notes: Need to re-treat buckthorn, and treat the few garlic mustard plants in fall.

Prairie Restoration Unit DD1a Vegetation Survey
4 ac Seeded Nov 2018

	Non-native	Seeded	Scientific Name	Common Name	9/4/20	7/8 & 8/19/21	7/13/22
			Graminoids-seeded		3	3	3
1		x	<i>Andropogon gerardii</i>	big bluestem			0.5
2		x	<i>Bouteloua curtipendula</i>	side-oats grama	1	0.5	0.5
3			<i>Carex blanda</i>	common woodland sedge		0.5	
4			<i>Carex cristatella</i>	crested sedge			0.5
5		x	<i>Elymus canadensis</i>	Canada wild rye	2	1	1
6		x	<i>Elymus hystrix</i>	bottlebrush grass			
6		x	<i>Elymus trachycaulus</i>	slender wheatgrass		1	
7	x		<i>Eriochloa villosa</i>	hairy cupgrass	1		
8			<i>Hordeum jubatum</i>	foxtail barley		0.5	
9			<i>Panicum virgatum</i>	switchgrass			1
10	x		<i>Poa pretensis</i>	Kentucky bluegrass		0.5	0.5
11		x	<i>Schizachyrium scoparium</i>	little bluestem	1	1	1
12	x		<i>Setaria pumilla</i>	yellow foxtail	2	2	1
14		x	<i>Sorghastrum nutans</i>	Indian grass			
15		x	<i>Sporobolus heterolepis</i>	prairie dropseed			
			Total		5.0	8.0	8.0
			non-native		2	2	2
			Forbs-seeded		3	4	4
1			<i>Achillea millefolium</i>	yarrow	1	1	
2		x	<i>Agastache foeniculum</i>	blue giant hyssop	0.5		
3			<i>Ageratina altissima</i>	white snakeroot	0.5		
4		x	<i>Allium stellatum</i>	prairie wild onion			
4			<i>Ambrosia artemisiifolia</i>	common ragweed		1	
6		x	<i>Amorpha canescens</i>	lead plant			
7		x	<i>Aquilegia canadensis</i>	columbine			
5	x		<i>Arctium minus</i>	common burdock	0.5	1	
6			<i>Artemisia absinthium</i>	absinthe wormwood			0.5
7		x	<i>Artemisia ludoviciana</i>	prairie sage	0.5	0.5	
8		x	<i>Asclepias syriaca</i>	common milkweed		0.5	0.5
9		x	<i>Asclepias tuberosa</i>	butterflyweed		0.5	
13		x	<i>Asclepias verticillata</i>	whorled milkweed			
10			<i>Aster pilosus</i>	frost aster	1		
11		x	<i>Astragalus canadensis</i>	Canada milk vetch		1	
16		x	<i>Baptisia alba</i>	white wild indigo			
12	x		<i>Berteroia incana</i>	hoary alyssum	0.5	0.5	1
13	x		<i>Cannabis sativa</i>	hemp		0.5	
14	x		<i>Carduus nutans</i>	musk thistle		0.5	0.5
15	x		<i>Centaurea stoebe</i>	spotted knapweed		1	
16		x	<i>Chamaecrista fasciculata</i>	partridge pea	0.5	0.5	
17	x		<i>Cirsium arvense</i>	Canada thistle		2	1
18			<i>Cirsium discolor</i>	field thistle	2	0.5	
19	x		<i>Cirsium vulgare</i>	bull thistle	1		
20			<i>Conyza canadensis</i>	horseweed	1		
21		x	<i>Dalea candida</i>	white prairie clover		0.5	1
22		x	<i>Dalea purpurea</i>	purple prairie clover		0.5	
23	x		<i>Daucus carota</i>	Queen Anne's lace	0.5		0.5
29		x	<i>Desmodium canadense</i>	Canada tick trefoil			
24			<i>Erigeron sp</i>	fleabane	1	0.5	
31		x	<i>Eryngium yuccifolium</i>	rattlesnake master			
25		x	<i>Galium boreale</i>	northern bedstraw		0.5	
26			<i>Hackelia virginiana</i>	Virginia stickseed	2		
27		x	<i>Helianthus maximiliani</i>	Maximilian's sunflower	1	1	1
28		x	<i>Heliopsis helianthoides</i>	ox-eye	1	0.5	1
29	x		<i>Hypericum perforatum</i>	common St. Johnswort		0.5	0.5
30		x	<i>Lespedeza capitata</i>	round-headed bush clover		1	

31	x		<i>Leucanthemum vulgare</i>	shasta daisy		0.5	
39		x	<i>Liatris ligulistylis</i>	northern plains blazing star			
32		x	<i>Liatris pycnostachya</i>	prairie blazing star		0.5	
33	x		<i>Lotus corniculatus</i>	birds-foot trefoil		1	0.5
34	x		<i>Melilotus alba</i>	white sweet clover	0.5		
35		x	<i>Monarda fistulosa</i>	wild bergamot	1	1	1
36	x		<i>Pastinaca sativa</i>	wild parsnip		0.5	0.5
45		x	<i>Penstemon grandiflorus</i>	large-flowered beard tongue			
37	x		<i>Potentilla recta</i>	sulfur cinquefoil			0.5
38		x	<i>Pycnanthemum virginianum</i>	Virginia mountain mint			0.5
39		x	<i>Ratibida pinnata</i>	gray-headed coneflower	2	2	2
40		x	<i>Rudbeckia hirta</i>	black-eyed susan	2	1	1
41	x		<i>Rumex crispus</i>	curly dock		0.5	0.5
42		x	<i>Scrophularia lanceolata</i>	lance-leaved figwort		0.5	1
43	x		<i>Silene latifolia</i>	white campion		0.5	
44		x	<i>Silphium laciniatum</i>	compass plant		0.5	
45			<i>Solidago canadensis</i>	Canada goldenrod	3	3	2
46			<i>Solidago gigantea</i>	late goldenrod		1	
47		x	<i>Solidago rigida</i>	stiff goldenrod	1	1	
57		x	<i>Solidago speciosa</i>	showy goldenrod			
48		x	<i>Symphotrichum laeve</i>	smooth aster	1		
59		x	<i>Symphotrichum novae-angliae</i>	New England aster			
60		x	<i>Tradescantia ohiensis</i>	Ohio spiderwort			
49			<i>Urtica dioica</i>	stinging nettle		0.5	
50	x		<i>Verbascum thapsus</i>	common mullein	1	0.5	0.5
51		x	<i>Verbena stricta</i>	hoary vervain	1	1	1
52			<i>Verbena urticifolia</i>	white vervain	1	0.5	
65		x	<i>Veronicastrum virginicum</i>	Culver's root			
53			<i>Viola sp</i>	violet	0.5		
54		x	<i>Zizia aurea</i>	golden alexanders	1	1	1
		44		Total	28	41	23
				non-native	6	13	11
			Woody				
1	x		<i>Rhamnus cathartica</i>	common buckthorn		0.5	
2			<i>Rubus ideaus</i>	red raspberry			0.5
3	x		<i>Ulmus pumila</i>	Siberian elm		0.5	
		22		non-native	0	2	0

* Cover Classes: 0.5 (0-1%), 1 (1-5%), 2 (5-25%), 3 (25-50%), 4 (50-75%), 5 (75-100%).

59 Total species
9 Native grasses
28 Native Forbs
22 Non-native Spp
44 No. spp seeded
24 No. Seeded spp recorded
55% % of seeded

**Prairie Restoration Unit G1b (west) Vegetation Survey
3 ac prairie, seeded fall 2018**

Non-native	Seeded		Scientific Name	Common Name	9/4/20	7/8 & 8/19/21	7/20/22	Notes '22
					2	3	3	
	x	1	<i>Andropogon gerardii</i>	big bluestem		0.5	1	
	x	2	<i>Bouteloua curtipendula</i>	side-oats grama	1	0.5	1	
x		3	<i>Bromus inermis</i>	smooth brome			2	
	x	4	<i>Bromus kalmii</i>	kalm's brome		0.5	1	
		5	<i>Carex scoparia</i>	pointed broom sedge		1	0.5	
	x	6	<i>Elymus canadensis</i>	Canada wild rye	1	2	2	
		7	<i>Elymus trachycaulus</i>	slender wheat grass			0.5	
		8	<i>Panicum virgatum</i>	switchgrass			1	
x		9	<i>Phalaris arundinacea</i>	reed canary grass			1	Esp at dredge knoll
x		10	<i>Poa pretensis</i>	Kentucky bluegrass		1	1	
	x	11	<i>Schizachyrium scoparium</i>	little bluestem		2	1	
	x	12	<i>Sorghastrum nutans</i>	Indian grass	1	2	1	
3								
			FORBS		3	4	4	
		1	<i>Achillea millefolium</i>	yarrow		1	1	
		2	<i>Ambrosia artemisiifolia</i>	common ragweed		0.5	0.5	
	x	3	<i>Amorpha canescens</i>	lead plant		0.5	0.5	
		4	<i>Antennaria neglecta</i>	field pussytoes		0.5		
		5	<i>Antennaria plataginea</i>	plantain leaved pussytoes		0.5		
	x	6	<i>Artemisia ludoviciana</i>	prairie sage	0.5	1	0.5	
	x	7	<i>Asclepias syriaca</i>	common milkweed		0.5	1	
	x	8	<i>Asclepias tuberosa</i>	butterfly milkweed		0.5		
x		9	<i>Berteroa incana</i>	hoary alyssum		0.5	1	
x		10	<i>Carduus nutans</i>	musk thistle		0.5	0.5	
x		11	<i>Centaurea stoebe</i>	spotted knapweed	1	1		West by road
x		12	<i>Cirsium arvense</i>	Canada thistle	1	1	1	abund at dredge knoll
		13	<i>Cirsium discolor</i>	field thistle	2	0.5	0.5	
x		14	<i>Cirsium vulgare</i>	bull thistle	1			
		15	<i>Conyza canadensis</i>	horseweed	1	0.5	0.5	
	x	16	<i>Coreopsis palmata</i>	bird's foot coreopsis		1	0.5	
		17	<i>Dalea candida</i>	white prairie clover		0.5	0.5	
	x	18	<i>Dalea purpurea</i>	purple prairie clover		0.5	0.5	
	x	19	<i>Desmodium canadense</i>	Canada tick trefoil		0.5	0.5	
		20	<i>Dryocallis arguta</i>	tall cinquefoil	1			
		21	<i>Erigeron sp</i>	fleabane	1	0.5	1	
	x	22	<i>Eryngium yuccifolium</i>	rattlesnake master		1	0.5	
	x	23	<i>Euphorbia corollata</i>	flowering spurge		0.5		
		24	<i>Galium boreale</i>	northern bedstraw			0.5	
		25	<i>Galium triflorum</i>	fragrant bedstraw		0.5		
		26	<i>Helianthus rigida</i>	stiff sunflower	1	0.5		
	x	27	<i>Heliopsis helianthoides</i>	ox-eye	1	1	1	
	x	28	<i>Lespedeza capitata</i>	round-headed bush clover		0.5	0.5	
x		29	<i>Leucanthemum vulgare</i>	shasta daisy		0.5		
	x	30	<i>Liatris ligulistylis</i>	northern plains blazing star	0.5	0.5	0.5	
	x	31	<i>Lobelia siphilitica</i>	great blue lobelia	1			
x		32	<i>Lotus corniculatus</i>	birds-foot trefoil		1	0.5	
x		33	<i>Mellilotus alba</i>	white sweet clover	1			
		34	<i>Mentha arvensis</i>	common mint			0.5	
	x	35	<i>Monarda fistulosa</i>	wild bergamot		2	2	
		36	<i>Nepeta cataria</i>	catnip			0.5	
x		37	<i>Potentilla recta</i>	sulfur cinquefoil	1			
		38	<i>Pseudognaphalium obtusifolium</i>	sweet everlasting	0.5			
	x	39	<i>Pycnanthemum virginianum</i>	Virginia mountain mint		0.5	0.5	
	x	40	<i>Ratibida pinnata</i>	gray-headed coneflower	1	1	1	

	x	41	<i>Rudbeckia hirta</i>	black-eyed susan	3	1	2	
		42	<i>Rumex crispus</i>	curly dock			0.5	
		43	<i>Scrophularia lanceolata</i>	lance-leaved figwort		0.5	0.5	
	x	44	<i>Silphium laciniatum</i>	compass plant		0.5	0.5	
		45	<i>Solidago canadensis</i>	Canada goldenrod	1	2	2	
		46	<i>Solidago gigantea</i>	late goldenrod		1	1	
		47	<i>Solidago rigida</i>	stiff goldenrod		0.5	0.5	
		48	<i>Solidago speciosa</i>	showy goldenrod	1	0.5		
	x	49	<i>Symphyotrichum ericoides</i>	heath aster	1	0.5	1	
	x	50	<i>Symphyotrichum laeve</i>	smooth aster		0.5		
	x	51	<i>Symphyotrichum novae-</i>	New England aster			0.5	
	x	52	<i>Thlaspi arvense</i>	field pennycress			0.5	
	x	53	<i>Verbascum thapsus</i>	mullein	1		1	
	x	54	<i>Verbena hastata</i>	blue vervain	1	1		
		55	<i>Verbena stricta</i>	hoary vervain	1	1	1	
		56	<i>Verbena urticifolia</i>	white vervain	1			
	x	57	<i>Zizia aurea</i>	golden alexanders		0.5	0.5	
					21	44		
	x		<i>Lonicera tatarica</i>	Tatarian honeysuckle			0.5	
15	39							

Total for 2020-22
 69 Total spp recorded
 43 Native species
 39 Native forbs
 18 No. non-native spp
 30 No. seeded spp detected
 77 % of seeded spp found (of 39 total seeded)

Need to Increase spring spp: lupine, columbine, penstemon, onion. Also increase milkweed, hyssop

Native Prairie Vegetation Survey (SGP-M)

NON-Native	Scientific name	Common Name	2008	9/11/18	6/10/19	8/19/21	6/9/22
	Forbs		5%	35%	3	2	3
	<i>Achillea millefolium</i>	yarrow	0.5	1			
	<i>Ageratina rugosum</i>	white snakeroot		0.5	0.5	0.5	0.5
	<i>Ambrosia psilostachya</i>	western ragweed		2	1	1	1
	<i>Asclepias syriaca</i>	common milkweed		1	1	0.5	0.5
	<i>Asclepias verticillata</i>	whorled milkweed			1	0.5	0.5
	<i>Asclepias viridiflora</i>	green milkweed			0.5	0.5	0.5
x	<i>Berteroa incana</i>	hoary allysum			1	0.5	1
x	<i>Centaurea maculosa</i>	spotted knapweed	0.5	1	0.5	0.5	0.5
	<i>Conyza canadensis</i>	mare's tail			0.5	0.5	
	<i>Crocanthemum bicknellii</i>	frostweed				0.5	0.5
	<i>Erigeron strigosus</i>	daisy fleabane				0.5	
	<i>Euphorbia glyptosperma</i>	ribseed				0.5	
	<i>Hedeoma hispida</i>	false pennyroyal					0.5
x	<i>Hypericum perforatum</i>	Common St Johnswort			0.5		
	<i>Lepidium densiflorum</i>	peppergrass		0.5			
	<i>Liatris punctata</i>	dotted blazing star		1	1	1	1
	<i>Lithospermum carolinense</i>	hairy puccoon	0.5	1	2	2	2
	<i>Lithospermum incisum</i>	narrowleaf puccoon			0.5		0.5
	<i>Mirabilis nyctaginea</i>	Wild 4 o'clock		0.5	0.5	1	0.5
	<i>Monarda fistulosa</i>	bergamot			2	0.5	0.5
	<i>Oxalis stricta</i>	yellow wood sorrel					0.5
	<i>Penstemon grandiflorus</i>	Large-flowered penstemon	0.5	0.5	0.5	1	2
	<i>Physalis heterophylla</i>	clammy ground-cherry		1			
	<i>Physalis virginiana</i>	Virginia ground cherry			0.5		
	<i>Potentilla sp</i>	5-leaf, palmate, long hairs			0.5		
	<i>Pseudognaphalium obtusifolium</i>	sweet everlasting		0.5		0.5	
	<i>Ratibida pinnata</i>	yellow coneflower			0.5		0.5
x	<i>Rumex acetosella</i>	common sheep sorrel			1		0.5
	<i>Solidago canadensis</i>	Canada goldenrod		0.5	0.5		0.5
	<i>Syphyotrichum pilosus</i>	frost aster		0.5			
	<i>Tradescantia occidentalis</i>	spiderwort			0.5		0.5
x	<i>Tragopon dubius</i>	goats beard			0.5		0.5
X	<i>Verbascum thapsus</i>	common mullein	0.5	0.5	0.5		0.5
	<i>Verbena stricta</i>	hoary vervain			0.5	0.5	0.5
	<i>Verbena urticifolia</i>	white vervain					0.5
	Graminoids		80%	55%	4	3	2
	<i>Andropogon gerardii</i>	big bluestem		1	1	0.5	0.5
	<i>Bouteloua curtipendula</i>	side-oats grama		1		1	50%
	<i>Bouteloua hirsuta</i>	hairy grama				0.5	
x	<i>Bromus inermis</i>	smooth brome			0.5	0.5	0.5
X	<i>Bromus tectorum</i>	cheatgrass	4	1	1		
	<i>Carex grisea</i>						0.5
	<i>Carex muhlenbergia</i>	muhly sedge					0.5
	<i>Carex pensylvanica var. digyna</i>	Sun-loving sedge				1	0.5
	<i>Carex sp</i>	stout, globular head		1			
	<i>Cyperus lupulina</i>	common hop sedge				0.5	
	<i>Cyperus sp</i>					0.5	
	<i>Dichanthelium oligosanthes</i>	Scribner's panic grass	1	2	2		2
	<i>Digitaria cognata</i>	fall witch grass		1			
	<i>Elymus canadensis</i>	Canada wild rye				0.5	
	<i>Panicum virgatum</i>	Switch Grass				0.5	
	<i>Paspalum setaceum</i>	beadgrass				1	
X	<i>Poa pratensis</i>	Kentucky bluegrass	1	1	1	1	1
	<i>Schizachrium scoparium</i>	little bluestem	0.5	1	2	2	
x	<i>Setaria pumila</i>	yellow foxtail				0.5	
	Woody			3%	1	1	1
	<i>Acer negundo</i>	boxelder sdlg			0.5		
	<i>Amorpha canescens</i>	leadplant		0.5	0.5		0.5
	<i>Fraxinus pensylvanica</i>	green ash sdlg			0.5		0.5
	<i>Juniperus virginiana</i>	red cedar- seedling		0.5			
x	<i>Lonicera tatarica</i>	Tatarian honeysuckle				1	
	<i>Quercus macrocarpa</i>	bur oak - seedling				0.5	0.5
	<i>Quercus rubra</i>	Red oak - seedling		0.5	0.5		0.5
	<i>Rubus ideaus</i>	red raspberry			1	edges	1
x	<i>Ulmus pumila</i>	Siberian elm - seedling		0.5	0.5		0.5
	<i>Vitis riparia</i>	wild grapevine				0.5	0.5
12		Native grass & forb spp	4	18	20	25	24
		% change			11%	25%	-4%
		Non-native forbs&grams	4	5	10	6	8

2022 notes:
 Stunning post-burn flowers in June.

Need to treat invasive woody plants (done, 2022).

Broadcast native seed after woody removal (done Dec 2022. May need more).

Collect native seed in fall, re-broadcast on edges.

Native Prairie Vegetation Survey (SGP-N) (last burned May 2019)

NON-Native	Scientific name	Common Name	6/10/19	8/19/21	6/9/22
	Forbs		3	2	2
	<i>Achillea millefolium</i>	yarrow	0.5	0.5	1
	<i>Ageratina rugosum</i>	white snakeroot		0.5	0.5
x	<i>Alliaria petiolata</i>	garlic mustard	0.5		
	<i>Ambrosia psilostachya</i>	western ragweed	2		
	<i>Asclepias syriaca</i>	common milkweed	0.5	1	1
x	<i>Berteroa incana</i>	hoary allysum	1	0.5	1
x	<i>Brassica rapa</i>	field mustard	0.5		1
	<i>Centaurea maculosa</i>	spotted knapweed		0.5	
	<i>cf Helianthus helianthoides</i>	early sunflower	0.5		
	<i>Conyza canadensis</i>	mare's tail		0.5	0.5
	<i>Crocanthemum bicknellii</i>	frostweed		0.5	
	<i>Galium aparine</i>	cleavers			0.5
x	<i>Gallium mollugo</i>	false baby's breath		0.5	1
	<i>Gallium sp</i>	bedstraw	0.5		0.5
	<i>Hackelia virginiana</i>	Virginia stickseed	0.5	0.5	
x	<i>Hypericum perforatum</i>	Common St Johnswort		0.5	
x	<i>Leonurus cardiaca</i>	motherwort	0.5	0.5	
	<i>Liatris punctata</i>	dotted blazing star		0.5	
	<i>Lithospermum carolinense</i>	hairy puccoon	1	0.5	1
x	<i>Lotus corniculatus</i>	bird's foot trefoil		0.5	0.5
	<i>Mirabilis nyctaginea</i>	Wild 4 o'clock			0.5
	<i>Monarda fistulosa</i>	bergamot			0.5
X	<i>Nepeta cataria</i>	catnip	0.5	0.5	0.5
	<i>Oxalis stricta</i>	yellow wood sorrel			0.5
	<i>Penstemon grandiflorus</i>	Large-flowered penstemon	0.5	0.5	0.5
	<i>Physalis heterophylla</i>	clammy ground-cherry	0.5	0.5	
	<i>Pseudognaphalium obtusifolium</i>	sweet everlasting		0.5	
	<i>Ranunculus sp</i>	buttercup			
	<i>Solidago canadensis</i>	Canada goldenrod	1	0.5	0.5
	<i>Tradescantia occidentalis</i>	spiderwort			0.5
	<i>Urtica dioica</i>	stinging nettle	1		
X	<i>Verbascum thapsus</i>	common mullein	0.5	0.5	0.5
	Graminoids		3	3	4
	<i>Andropogon gerardii</i>	big bluestem		1	1
	<i>Bouteloua curtipendula</i>	side-oats grama		1	0.5
	<i>Bouteloua hirsuta</i>	hairy grama	1	0.5	
X	<i>Bromus tectorum</i>	cheatgrass	1		1
	<i>Carex muhlenbergii</i>	Muhly sedge			1
	<i>Carex pensylvanica var. digyna</i>	Sun-loving sedge	3	3	3
	<i>Carex sp</i>	stout, globular head			
	<i>Cyperus lupulina</i>	common hop sedge		0.5	
	<i>Dichanthelium oligosanthes</i>	Scribner's panic grass			0.5
	<i>Digitaria cognata</i>	fall witch grass		1	
	<i>Panicum virgatum</i>	Switch Grass		0.5	
X	<i>Poa pratensis</i>	Kentucky bluegrass		1	2
	<i>Schizachrium scoparium</i>	little bluestem		1	
	<i>Stipa spartea</i>	porcupine grass			0.5
	<i>Unk native grass sp</i>				
	Woody			2	2
	<i>Amorpha canescens</i>	leadplant	1	0.5	0.5
	<i>Celtis occidentalis</i>	hackberry		0.5	
	<i>Fraxinus pensylvanica</i>	green ash sdlg	0.5	0.5	
x	<i>Lonicera tatarica</i>	Tatarian honeysuckle	0.5		2
	<i>Prunus serotina</i>	black cherry	0.5	0.5	0.5
	<i>Quercus macrocarpa</i>	bur oak			0.5
	<i>Quercus rubra</i>	Red oak - seedling	1	1	1
x	<i>Rhamnus cathartica</i>	common buckthorn	0.5	1	2
	<i>Ribes missouriensis</i>	Missouri gooseberry	0.5	0.5	
	<i>Rubus ideaus</i>	red raspberry	2	2	2
x	<i>Ulmus pumila</i>	Siberian elm - seedling	0.5	0.5	0.5
	<i>Vitis riparia</i>	wild grapevine		0.5	
14		Native grass & forb spp	13	20	20
		% change		54%	0%
		Non-native forbs&grams	7	9	7

2022 notes:
 Still dominated by native sedges – would be good to see more diversity.

Need to treat invasive woody plants (done, 2022).

Need to treat Galium mullogo (done, 2022).

Broadcast native seed after woody removal (done Dec 2022. May need more).

Volunteer tasks: lop mullein, pull Berteroa

Native Prairie Vegetation Survey (SGP-O) (burned March 2021)

NON-Native	Scientific name	Common Name	6/10/19*	2021	6/9/22
	Forbs			2	2
	<i>Achillea millefolium</i>	yarrow	0.5	0.5	0.5
	<i>Ageratina rugosum</i>	white snakeroot		0.5	0.5
	<i>Ambrosia psilostachya</i>	western ragweed	2	1	1
	<i>Antennaria plantaginifolia</i>	plantain-leaved pussytoes			0.5
	<i>Asclepias syriaca</i>	common milkweed	0.5	1	1
x	<i>Berteroa incana</i>	hoary allysum	0.5	0.5	0.5
x	<i>Cannabis sativa</i>	hemp		0.5	
x	<i>Centaurea maculosa</i>	spotted knapweed	0.5	0.5	0.5
	cf <i>Helianthus helianthoides</i>	early sunflower	0.5		
	<i>Cirsium discolor</i>	field thistle		0.5	
	<i>Conyza canadensis</i>	mare's tail			0.5
	<i>Corydalis aurea</i>	golden corydalis			
	<i>Crepis tectorum</i>	yellow hawkweed			0.5
	<i>Crocanthemum bicknellii</i>	frostweed		0.5	0.5
	<i>Dalea candida</i>	white prairie clover		0.5	
	<i>Delphinium exaltata</i>	prairie larkspur			0.5
	<i>Erigeron strigosus</i>	daisy fleabane		0.5	
	<i>Galium aparine</i>	cleavers			0.5
	<i>Galium mulgo</i>	false babys breath			0.5
	<i>Hedoma hispida</i>	false pennyroyal			1
	<i>Lespedeza capitata</i>	round-headed bush clover		0.5	
	<i>Liatris punctata</i>	dotted blazing star		1	1
	<i>Lithospermum carolinense</i>	hairy puccoon	1	1	1
x	<i>Lotus corniculatus</i>	bird's foot trefoil		0.5	0.5
	<i>Mirabilis nyctaginea</i>	Wild 4 o'clock		1	0.5
	<i>Oxalis stricta</i>	yellow wood sorrel	0.5	0.5	0.5
	<i>Penstemon gracilis</i>	slender penstemon	0.5		0.5
	<i>Penstemon grandiflorus</i>	Large-flowered penstemon	0.5	0.5	0.5
	<i>Physalis virginiana</i>	Virginia ground cherry		0.5	0.5
	<i>Pseudognaphalium obtusifolium</i>	sweet everlasting		0.5	
x	<i>Rumex acetosella</i>	common sheep sorrel	0.5		0.5
	<i>Solidago gigantea</i>	late goldenrod		0.5	
	<i>Tradescantia occidentalis</i>	spiderwort	0.5		0.5
X	<i>Verbascum thapsus</i>	common mullein	0.5	0.5	0.5
	Graminoids		4	4	4
	<i>Bouteloua curtipendula</i>	side oats grama			1
	<i>Bouteloua gracilis</i>	blue grama		0.5	
	<i>Bouteloua hirsuta</i>	hairy grama	0.5	1	0.5
x	<i>Bromus inermis</i>	smooth brome	2	1	2
X	<i>Bromus tectorum</i>	cheatgrass			
	<i>Carex muhlenbergii</i>	Muhly sedge			1
	<i>Carex pensylvanica</i> var. <i>digyna</i>	Sun-loving sedge		2	2
	<i>Cyperus lupulina</i>	common hop sedge		0.5	
	<i>Cyperus</i> sp			0.5	
	<i>Dichanthelium oligosanthes</i>	Scribner's panic grass	1	2	2
	<i>Digitaria cognata</i>	fall witch grass	0.5		
	<i>Paspalum setaceum</i>	beadgrass		0.5	
X	<i>Poa pratensis</i>	Kentucky bluegrass	3		1
	<i>Schizachnium scoparium</i>	little bluestem	0.5	1	1
	<i>Setaria pumila</i>	yellow foxtail		0.5	
	<i>Sporobolus heterolepis</i>	prairie dropseed		0.5	
	<i>Stipa spartea</i>	porcupine grass		0.5	1
	Woody			1	1
	<i>Amorpha canescens</i>	leadplant	0.5	0.5	0.5
	<i>Celtis occidentalis</i>	hackberry		0.5	
	<i>Fraxinus pensylvanica</i>	green ash sdlg	0.5	0.5	0.5
x	<i>Lonicera tatarica</i>	Tatarian honeysuckle		0.5	0.5
	<i>Parthenocissus inserta</i>	Virginia creeper			0.5
	<i>Quercus rubra</i>	Red oak - seedling	0.5	0.5	0.5
x	<i>Rhamnus cathartica</i>	common buckthorn	0.5	0.5	0.5
	<i>Rubus ideaeus</i>	red raspberry	1	0.5	0.5
	<i>Toxicodendron rydbergii</i>	poison ivy	0.5	0.5	
x	<i>Ulmus pumila</i>	Siberian elm - seedling		0.5	0.5
	<i>Vitis riparia</i>	wild grapevine		0.5	0.5
	<i>Zanthoxylum americana</i>	prickly ash	0.5		
12		Native grass & forb spp	13	27	25
		% change		108%	-7%
		Non-native forbs&grams	6	7	9
	* Cover Classes: + (0-1%), 1 (1-5%), 2 (5-25%), 3 (25-50%), 4 (50-75%), 5 (75-100%).				

2022 notes:
First prairie larkspur!

Need to treat invasive woody plants (done, 2022).

Collect seed in fall and re-broadcast in woody removal areas.

Could do fall spray of brome and Poa.

Need to broadcast native seed after woody removal (done Dec 2022. May need more).

APPENDIX C. BIRD SURVEY DATA

Bird Species Recorded at Flint Hills Resources Bluff Property, 2009 - 2022

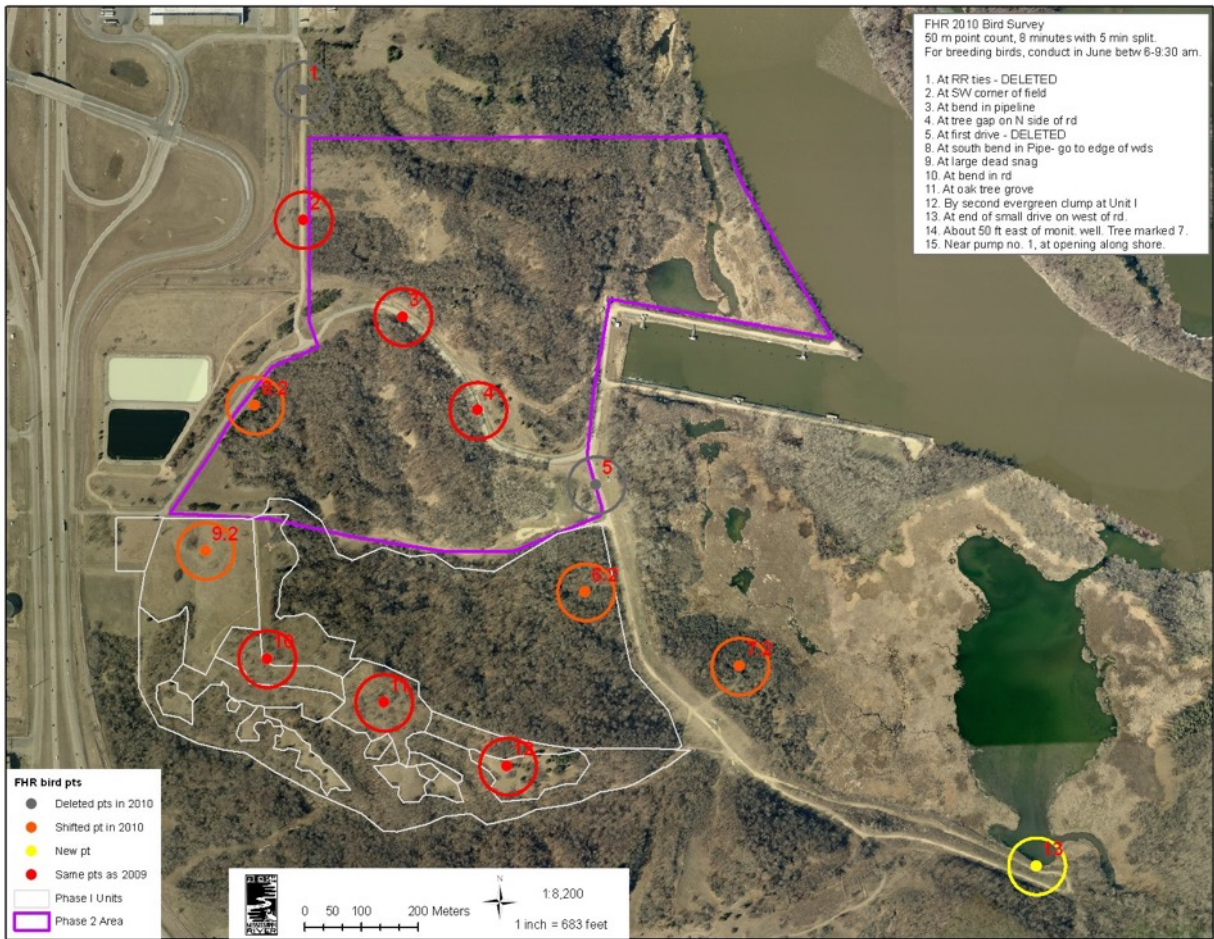
Species of Greatest Conservation Need (Minnesota Department of Natural Resources) are RED font.

New species found each year are highlighted orange. Species that have no data shown, were noted at the spring bird hike.

Breeding bird surveys - Maximum of 2 visits in June, 12 point counts, 8 minutes. 50m radius, 250m apart.

Common name	Code	May Bird hikes	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2021	2022	Annual Avg	Likely breeding spp
1 Alder flycatcher							1									0.1	x
2 American Crow	AMCR	x	2	6	4	2	2	1	3	1	2	4	5	5	4	3.2	x
3 American Goldfinch	AMGO	x	19	9	8	13	5	11	4	8	10	9	17	14	16	11.0	x
4 American Kestrel	AMKE		2		1									1		0.3	x
5 American Redstart	AMRE	x	12	5	8	11	13	13	14	19	12	13	14	21	14	13.0	x
6 American Robin	AMRO	x	7	6	10	7	6	4	5	12	8	3	6	3	7	6.5	x
7 American white pelican	AMPE	x														0.0	
8 Bald Eagle	BAEA	x										2		1		0.2	x
9 Baltimore Oriole	BAOR	x	5	7	8	4	3	1	2	3	4	7	6	6	1	4.4	x
10 Barn swallow	BASW	x														0.0	
11 Barred owl	BAOW				1											0.1	x
12 Bay breasted warbler	BBWA	x														0.0	
14 Black tern	BLTE	x														0.0	
13 Black-and-white warbler	BAWW	x														0.0	
15 Black-billed cuckoo	BBCU	x												1		0.1	x
16 Black-capped Chickadee	BCCH	x	2	8	4	7	12	1	4	6	8	2	1	2	2	4.5	x
17 Black-throated Green Warbler	BTNW	x														0.0	
18 Blackburnian Warbler	BLWA	x														0.0	
19 Blackpoll warbler	BPWA	x														0.0	
20 Blue grosbeak	BLGR	x														0.0	
21 Blue Jay	BLJA	x	4	4	7	5	6	2	1	3	3	5	2	8	3	4.1	x
22 Blue-gray Gnatcatcher	BGGN	x	5	5	1	5	6	1	3	6	4	2	2	4	3	3.6	x
23 Blue-headed vireo	BHVI	x						1						1		0.2	x
24 Blue-winged warbler	BWWA								1	1						0.2	x
25 Bobolink	BOBO	x														0.0	
26 Broad-winged hawk	BWHA	x														0.0	x
28 Brown thrasher	BRTH	x			1				1	5	1	1				0.7	x
27 Brown-headed Cowbird	BHCO	x	29	10	11	6	11	11	8	14	14	13	7	17	18	13.0	x
29 Canada goose	CAGO	x											1			0.1	x
30 Cape May warbler	CMWA	x														0.0	
31 Carolina wren	CAWR	x														0.0	
32 Cedar Waxwing	CEWA	x	4	13	19	10	5	15	10	6	7	7	12	13	3	9.5	x
33 Chestnut-sided Warbler	CSWA	x														0.0	
34 Chimney swift	CHSW	x				5	3	1	1	2	2	1				1.2	x
35 Chipping Sparrow	CHSP	x	7	2	2	4	5	5	5	1	2	5	1	2	2	3.3	x
36 Clay-colored Sparrow	CCSP	x	4	5	2	3	7	5	6	4	6	3	2	2	5	4.2	x
37 Cliff swallow	CLSW					3										0.2	
38 Common Yellowthroat	COYE	x	1	9	13	10	9	9	10	9	9	11	1	10	7	8.3	x
39 Cooper's hawk	COHA	x				1					2					0.2	x
40 Dark-eyed junco	DEJU	x														0.0	
41 Dickcissel	DICK									2	4			1		0.5	x
42 Double-crested cormorant	DCCO	x												1		0.1	
43 Downy Woodpecker	DOWO	x	1	1	3	1		2	1	3				2	2	1.2	x
44 Eastern bluebird	EABL	x	4	1	4	4	2	3	3	3	1	1		1	1	2.2	x
45 Eastern Kingbird	EAKI	x	1	2	2	2	1			1	2	1		2		1.1	x
46 Eastern meadowlark	EAME	x	2				2		1					1		0.5	x
47 Eastern Phoebe	EAPH	x	6	1	2	1			1	1	1					1.0	x
48 Eastern Towhee	EATO	x	3	3	3	7	5	4	4	6	3	6	4	7	6	4.7	x
49 Eastern wood pewee	EAWP	x	6	4	3	9	5	4	4	4	5	5	4	8	4	5.0	x
50 European Starling	EUST	x	1		1											0.2	x
51 Field Sparrow	FISP	x	7	4	7	10	4	7	10	7	5	7	3	7	7	6.5	x
52 Golden-winged warbler	GWWA	x														0.0	
53 Grasshopper sparrow	GRSP	x														0.0	
54 Gray Catbird	GRCA	x	7	8	4	10	7	6	6	8	12	13	1	11	9	7.8	x
55 Great Blue Heron	GBHE	x		4		1			1							0.5	
56 Great Egret	GREG	x	1	20					2		4					2.1	
57 Great-crested Flycatcher	GCFL	x	6	3	6	5	6	2		2	2		1	4	2	3.0	x
58 Hairy woodpecker	HAWO	x	1	1		1		1	1	1	1	3	1		3	1.1	x

	Common name	Code	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2021	2022	Annual Avg	Likely breeding species	
59	Harris sparrow	x														0.0		
60	House Finch	HOFI	x	2						1	1		1		1	0.5	x	
61	House Wren	HOWR	x	14	12	8	14	15	6	13	15	12	13	13	12	12.2	x	
62	Indigo Bunting	INBU	x	7	6	8	7	5	7	6	7	5	7	5	5	6.2	x	
63	Killdeer	KILL	x					1		1		1	2		1	0.5	x	
64	Lark Sparrow	LASP	x													0.0		
65	Least Flycatcher	LEFL	x						2		1					0.2	x	
66	Magnolia warbler	MAWA	x													0.0		
67	Mallard	MALL	x						1							0.1	x	
68	Marsh wren	MAWR		4	5		2				2	2			2	1.3	x	
69	Mourning Dove	MODO	x	1		3	1	1		1	1	1		1	1	0.9	x	
70	Mourning Warbler	MOWA	x						1							0.1	x	
71	Nashville Warbler	NAWA	x													0.0		
72	Northern cardinal	NOCA	x	7	7	4	6	3	2	3	11	4	4	3	5	4.9	x	
73	Northern Flicker	YSFL	x	1	1	2	2		1	1	2	1	1			0.9	x	
74	Northern harrier	NOHA														0.0		
75	Northern parula	NOPA	x													0.0		
76	Northern Rough-winged Swallow	NRWS	x	1	1	1		2	1		1	6		2	23	2	3.1	x
77	Olive-sided flycatcher	OSFL	x													0.0		
78	Orange-crowned warbler	OCWA	x													0.0		
79	Orchard oriole	OROR	x		1	2	1	3			3		1			0.8	x	
80	Osprey	OSPR	x													0.0		
81	Ovenbird	OVEN	x	5	1	4	2	3		1	1		2		1	1.5	x	
82	Palm Warbler	PAWA	x													0.0		
83	Pileated Woodpecker	PIWO	x	1			1		1					1	1	1	0.5	x
84	Red-bellied woodpecker	RBWO	x			3	1	1	1	1			3	2	3	1	1.2	x
85	Red-eyed Vireo	REVI	x	3	3	3	6	4	2	3	4	3	2		2	5	3.1	x
86	Red-headed woodpecker	RHWO	x													0.0		
87	Red-tailed Hawk	RTHA	x			1	2				1	1			1	0.5	x	
88	Red-winged Blackbird	RWBL	x	3	3	7	4	3	7	13	2	6	2	1	18	8	5.9	x
89	Ring-billed Gull	RBGU	x													0.0		
90	Ring-necked pheasant	RNPH	x													0.0		
91	Rose-breasted Grosbeak	RBGR	x	8	6	3	1	5	4	3	5	5	3	4	5	4	4.3	x
92	Ruby-crowned kinglet	RCKI	x													0.0		
93	Ruby-throated Hummingbird	RTHU	x	2				2		1	1	1			3	0.8	x	
94	Sandhill crane	SACR	x									2				2	0.3	x
95	Savannah Sparrow	SAVS	x													0.0		
96	Scarlet tanager	SCTA	x		1		1	1	1	1					1	1	0.5	x
97	Sedge wren	SEWR	x		1											0.1	x	
98	Sharp-shinned Hawk	SSHA	x	1		1										0.2	x	
99	Song Sparrow	SOSP	x	14	12	6	8	10	10	13	11	13	10	12	10	11	10.8	x
100	Swainson's Thrush	SWTH	x													0.0		
101	Swamp Sparrow	SWSP			1	2	1	1	1	1		1	1	1		0.8	x	
102	Tennessee Warbler	TEWA	x													0.0		
103	Tree Swallow	TRES	x	5	3	2	27	1	1	2	1	3	4	3		9	4.7	x
104	Turkey vulture	TUVU	x													0.0		
105	Warbling vireo	WAVI	x	1	2	2	1	2			1				4	1	1.1	x
106	Western Meadowlark	WEME	x													0.0		
107	White-breasted Nuthatch	WBNU	x		4	2	2	2	1		2	2	2	1	2	1.5	x	
108	White-crowned sparrow	WCSP	x													0.0		
109	White-throated sparrow	WTSP	x													0.0		
110	Wild Turkey	WITU	x	3					3	2	4	3	2		8	1.9	x	
111	Willow flycatcher	WIFL							1							0.1	x	
112	Wilson's Warbler	WIWA	x													0.0		
113	Wood duck	WODU			6		27	1							6	21	4.7	x
114	Wood thrush	WOTH	x	1			1								4	1	0.5	x
115	Yellow Warbler	YWAR	x	5	6	4	6	5	8	8	5	10	8	8	18	19	8.5	x
116	Yellow-bellied Sapsucker	YBSA	x						1		1	1	1		1	0.5	x	
117	Yellow-billed cuckoo	YBCU				1					3	1				0.4	x	
118	Yellow-headed blackbird	YHBL	x												1	2	0.2	x
119	Yellow-rumped Warbler	MYWA	x													0.0		
120	Yellow-throated vireo	YTVI	x		1		1	4	2	1	2	1	1	4	1	4	1.7	x
	No. Birds			2243	2233	2220	2282	2216	2184	2207	222	220	198	153	2311	2262	1557.4	
	No. Species		108	48	47	49	51	46	43	51	49	52	45	36	51	47	47.3	77
	No. new species			3	6	2	2	1	4	1	0	1	1	2			1.9	
	No. SGCN			6	4	6	4	5	4	5	7	6	4	3	9	5	5.3	13



Survey dates: 2010: 6/10, 6/30; 2011: 6/6, 6/28; 2012: 6/11, 6/27; 2013: 6/4, 7/1 2014: 6/12, 6/23;
 2015: 6/9, 6/18. 2016: 6/7, 6/28. 2017: 6/12, 6/27. 2018: 6/20, 6/26. 2019: 6/9, 6/17. 2021: 6/8, 6/21.
 2022: 6/9, 6/29