2025 Ecological Activities Report

Landscape view of DD1a, the unit that underwent forest to prairie conversion starting in 2017.

Pine Bend Bluffs Property

Prepared for:

Flint Hills Resources

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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 2025. This restoration work has been ongoing for 26 years, thanks to Flint Hills Resources' continued commitment to funding this important work. Over 200 acres of forest, prairie and savanna have been restored, and associated wildlife have rebounded, including a federally endangered bumblebee and 14 other species of greatest conservation need (SGCN). In 2025, this site was again awarded Gold certification by the Wildlife Habitat Council for excellence in biodiversity enhancement and conservation. The long-term goal of this project is to restore and maintain all of the accessible, non-aquatic areas of the FHR bluffland, about 400 acres.

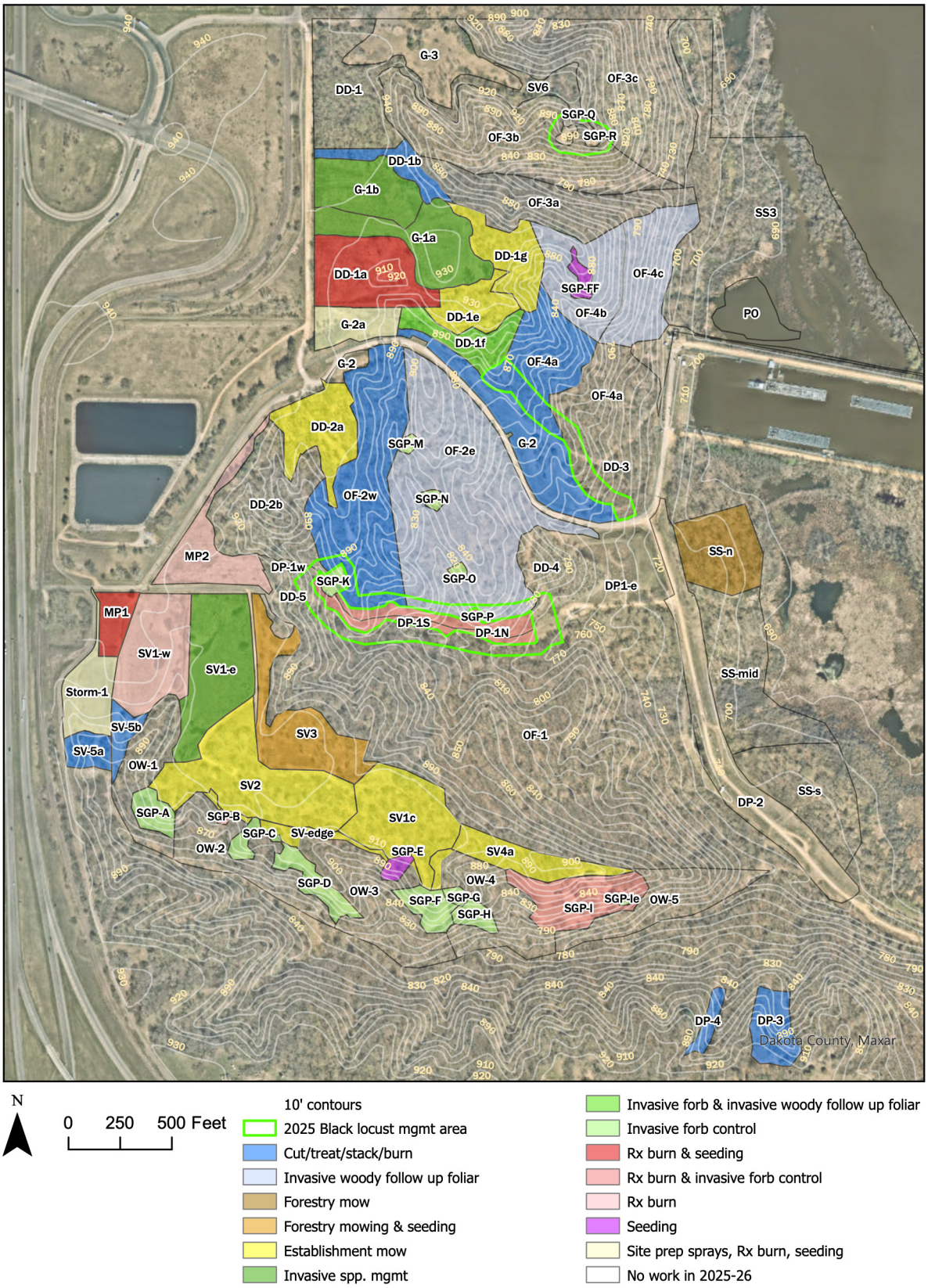
A summary of the 2025 ecological activities is shown below.

Acres	Habitat	Activity
77	Oak woodland / forest	Initial woody invasive species removal, follow up management, seeding and monitoring
38	Oak savanna	Management (Rx burn, spot spray invasive species, forestry mow, enhancement seeding)
20	Restored prairie	Management (spot spray invasive forbs, cut/treat woody, Rx burn, interseeding, forestry mow)
18	Native remnant prairie	Management (spot mow, spot spray, invasive woody removal, girdling, Rx burn)

153 Total Acres Monitored or Managed in 2025

Volunteer events: FHR employee participation in 2025 included 47 participants at the spring kick-off, 13 volunteers at 2 field events, and 17 volunteers in 2 ecological monitoring programs. In addition, 124 community and employee volunteers attended community events in August and October. There was a total of 201 volunteers for the year, representing over 779 hours spent enhancing and monitoring bluffland habitat and wildlife.

Figure 1. Map of Flint Hills Resources Pine Bend Bluffs Ecological Work 2025



FOREST/WOODLAND RESTORATION – 77 Acres

OF1, 43.8 acres

Management in this unit began in 2007 and has been occurring sporadically as the need arises. Invasive shrub cover is relatively low in this unit, so there has not been a need to devote resources to management here for several years. However, there is a large population of mature black locust trees in this unit. Black locust is challenging to manage because it is clonal. To get rid of it, the entire clone needs to be treated with herbicide and removed at the same time. Because these trees are so large, this would be a huge expense that would not necessarily increase habitat value enough to justify removal over other priorities at the property. In 2024, FMR explored options for organizing a timber harvest, which ultimately did not come to fruition because the material was not deemed salable.

Black locust is present in many units across the site. After exploring options for removal, we have decided to allocate resources to managing black locust along the perimeter of sensitive areas while we wait for the development of future tools, such as fungal biocontrol. This includes units like the bluff prairies, restored prairies, and savanna units. Ensuring that black locust does not encroach on these areas is important for maintaining these habitats and is economically feasible rather than managing black locust across the entire site. Our goal moving forward is to stop the spread of the locust and clear it out of once-open areas where it has already encroached.

OF2 east, 15 acres

There have been several years of habitat management in this unit, dating back to 2012. Most habitat management tasks have included invasive shrub removal and garlic mustard treatment. The approach up until this point has been to maintain this unit as an oak forest. However, the canopy cover is relatively sparse, so light conditions have been high and invasive plants have thrived, despite several years of management efforts. It is not sustainable to manage invasive shrubs every 3-4 years repeatedly in the same unit.
We began a new management approach in this unit in 2024. The goal is to restore this unit to a more open savanna system that can be managed with prescribed fire. Several areas already have good patches of fuel (grasses, sedges, or oak leaves), but it is not currently continuous enough to carry fire.

In 2022, 2023, and 2024, invasive shrubs, including buckthorn, honeysuckle, and Siberian elm, were managed on approximately 8 acres of the unit through a combination of forestry mowing and cut-and-stump treatment. In 2025, volunteers again cut an additional half-acre of buckthorn and piled the material at a public event in August. In September, resprouts and seedlings from the 2024 removal areas were foliar-sprayed. In the winter, large buckthorn was cut, the stumps were treated, and the cut material was piled in a 4-acre expansion area. This work shifted the boundary between OF2e and OF2w to better align with the natural

valley that now bisects the unit. Piles were burned in early 2026. Additionally, downed woody debris and snags throughout OF2e were cut, stacked, and burned to reduce woody fuel within the unit and better facilitate prescribed fire moving forward. All removal areas were seeded with a graminoid-only seed mix to introduce competition and fuel to the unit. In 2026, we will develop a boundary for a prescribed burn within the unit, in partnership with restoration contractors, to prepare for a spring 2027 prescribed fire. Shifting the timeline to spring allows for a "hotter" prescribed fire, which will help manage invasive woody resprouts and invigorate the native plant community.

Image 1: A pile of invasive woody shrubs located in the valley between OF2e and OF2w. The red line denotes the boundary between two units. Invasive woody material was removed from OF2e.

OF3a, 5.5 acres

2024 was the first year working in OF3. It was split into subunits, a and b, to more easily manage based on geography. The dividing line between the two units is a large ravine. OF3a is a north-facing slope on the south side of the unit.

Invasive shrubs were cut, stumps treated, stacked and pile burned on 5.5 acres. This work originally started in March 2024 and was completed in February 2025. Buckthorn was the dominant species managed. It was largely concentrated at the top of the slope adjacent to DD1g, with individuals scattered throughout the remainder of the unit. This area was monitored for resprouting in 2025. Significant resprouting did not occur, and subsequently, no management actions are planned for this unit in 2026.

OF4 – 9.1 acres

2024 was the first year working in OF4. It was split into subunits based on topography and progress towards restoration implementation. There is a ravine dividing OF4a from OF4b and c. The east-west split between OF4b and OF4c is related to the density of invasive woody material, with OF4b having denser material that required more follow-up work in 2025 than OF4c.

Image 2: An open-grown bur oak tree daylighted in OF4a after invasive woody species removal. This indicates the unit was previously a savanna, with more light reaching the understory.

Several tasks were completed in this unit in 2025. In October, follow-up foliar spraying of buckthorn resprouts and seedlings was completed in subunits B and C. In the winter, the final acre of subunit B was cut, stump treated, and piled. This area was seeded with a native grass seed mix to reintroduce competition and suppress buckthorn seedling germination. The western edge of OF4a was included in the 2025 annual volunteer brush haul event. Volunteers hauled material cut in 2024 to piles along the access drive between DD1a and DD1f. The work boundary in subunit A was further expanded eastward by contractors. Large buckthorn was cut, the stump treated, and piled in the winter. Flat areas were forestry mowed to save on cost. Piles were burned in the winter to dispose of woody material. In 2026, follow-up foliar spraying and seeding are planned for subunit A.

SSn, 3.3 acres

This was the location of the fall volunteer brush haul event in 2022 and 2023. In 2024, follow-up foliar treatment of buckthorn and honeysuckle resprouts in the volunteer removal area was completed in early October. A native grass-dominated seed mix was broadcast-seeded in the unit in November to increase competition and limit reinvasion in the area. In 2025, the remaining piles in the unit were managed by forestry mowing on frozen ground in the winter. Additional seed will be broadcast in the forestry mowed area in 2026.

Image 3: Brush piles from the 2023 community brush haul event were forestry-mowed.

SAVANNA RESTORATION – 38 Acres

SV1e, 4.7 acres

A prescribed fire was conducted in April 2024, before rusty patched bumble bee emergence. The burn invigorated the growth of the native grasses and forbs. In 2025, this unit was managed for invasive herbaceous species (Canada thistle, spotted knapweed, bird ‘s-foot trefoil). Overall, the presence of invasive species is extremely low in this unit, with very small populations (less than 20 square feet) persisting on the edges. Otherwise, this unit was left as a habitat refugia in 2025. Similar work is planned for 2026.

SV1w, 4 acres

This unit was burned, and drill seeded along with MP2 in May 2023. In 2024 and 2025, spot treatment of Canada thistle occurred along the edge of the unit nearest the access road. Plants were sprayed with herbicide before flowering. Otherwise, this unit was left to grow and served as a habitat refugia for pollinators and wildlife within the larger savanna system as more intensive management occurred in other units. In the winter of 2025-26, a 0.5-acre patch of honeysuckle in the southern half of the unit was forestry-mowed. This small area will be managed with follow-up foliar spraying and interseeding in 2026.

Image 4: A long-standing patch of honeysuckle was forestry mowed, creating a future opportunity to interseed forbs and increase species diversity in SV1w.

SV2, SV1c, SV4a, 14 acres

These savanna units have been managed ecologically for many years. In the recent past, there have been spot treatments of invasive herbaceous and woody species as resources have been devoted to restoring other units at the blufflands. Over time, native shrub cover consisting of red osier dogwood, brambles, raspberries, and gooseberries has expanded and created a thicket in the absence of fire. Unfortunately, the expansion of shrubs reduced the amount of native grass in the understory, and there was no longer enough fuel to successfully carry a prescribed fire. Oak savannas require regular prescribed burning to maintain an open understory; otherwise, they transition to woodlands over time.

Image 5: A sea of bee balm blooming in a pocket of SV2 with good native species coverage.

To get these units back onto an oak savanna trajectory, they were forestry mowed in the winter of 2024-25. Forestry mowing mulches up the shrubs and allows light to reach the soil surface. This was done on frozen ground to avoid compaction or rutting. After the units were mowed, a native seed mix was broadcast. The seed mix contained mostly grasses to compete with shrub regrowth and allow the unit to carry fire. There were some forbs mixed in to provide pollinator resources. In 2025, the units were mowed high to allow light to reach the soil surface, which helps the seeds germinate. Some sections of these units look great – native, herbaceous plants dominate them. We discovered remnant populations of Virginia bluebells (*Mertensia virginica*) and American germander (*Teucrium canadense*) in areas where they had not previously been identified. Additionally, the rusty patched bumblebee, a federally endangered bee, was found in SV2, which indicates that this unit has high habitat value.


Figure 6 (left): An image of SV4 after forestry mowing. SV4 has the highest canopy cover among restored SV units. Figure 7 (right): A carpet of American germander bloomed during July after forestry mowing.

Other sections had mixed results. The patches dominated by shrubs previously were slow to establish. These patches will be monitored in 2026, and an additional spring mow is planned in the shrubby areas if necessary. Additionally, there are large swaths of invasive reed canary grass dominating up to 30% of SV1c and SV2. This invasive, cool-season grass is typically present in wetlands. It was likely planted here as a pasture grass and has persisted over time. Reed canary grass is notoriously challenging to manage. It requires heavy herbicide use and several management actions per season over a few years to reduce population size, without any guarantee that the population will be eradicated. At this point, there is still native species diversity present in areas not dominated by reed canary grass, so heavy-handed management is not advised. Monitoring the spread of reed canary will be important, and actions may be taken in the future if native species diversity declines.

Figure 8: Results of forestry mowing after spring-green-up in SV1c. Dark green patches are invasive cool-season grasses, including Kentucky bluegrass and reed canary grass.

SV3, 4.2 acres

During the growing seasons of 2024 and 2025, this unit was left as a refuge for pollinators and other wildlife. Invasive species were spot-treated, but otherwise the unit was left alone. In the winter of 2025-26, the southern half of the unit was forestry mowed to reduce shrub cover. Similar to SV1c, SV2 and SV4, approximately half of this unit was completely taken over by red osier dogwood, smooth sumac, invasive honeysuckle, and buckthorn. Forestry mowing, followed by seeding of a native-graminoid dominated seed mix, will help jumpstart the conversion from shrub to grass cover, which ultimately will facilitate managing with prescribed fire. The north half of the unit, where the chimney swift house is located, was left as a refuge.

Image 9: SV3 after winter forestry mowing.

SV5, 1.6 acres

The Phase III NRMP identifies SV5 as a priority 1 unit for habitat restoration. SV5 has characteristics of an oak savanna. There are large bur oak trees in the canopy, but the understory was completely dominated by woody invasive species. The unit was split into sub-units, A and B, because there is a utility corridor right through the center of the unit. In the winter of 2025-26, invasive woody shrubs and small trees were cut, the stumps treated with herbicide, and piled. In SV-5a, half of the piles were burned and half of the piles were forestry mowed. In SV-5b, all of the piles were forestry mowed. The volume of material removed throughout SV5 was significant. A native, graminoid-dominant buckthorn replacement seed

mix was hand broadcast after woody removal to begin to reintroduce competition in the understory. In 2026, follow-up foliar spraying of invasive woody resprouts and seedlings is planned. There will likely be 2-3 years of follow-up foliar spraying needed to manage the buckthorn and honeysuckle. After native grass cover is established, the units will be managed with prescribed fire and interseeding.

Image 10: Brush piles created from invasive woody removal in SV5-a.

DD1e, DD1g, DD2a, 7.2 acres

The transformation of these units over the last several years has been significant. All areas started as a dense thicket of buckthorn. With consistent effort, the buckthorn has been largely removed, and native grasses have established in the understory. In native savanna communities, the dominant tree species is typically bur oak. The tree canopy in these units is boxelder. Despite not being the typical species, these units do provide the canopy structure of a savanna, though future restoration may add bur oaks to gaps to continue the transition to savanna.

The current goal for management activities is to increase native forb diversity in these units and reintroduce prescribed fire. They were seeded with a forb enhancement mix in November of 2024. In 2025, the units were establishment mowed one time to allow light to reach newly germinating seedlings. Mowing also decreased invasive species seed production because plants were mowed prior to flowering. In 2026, these units will be surveyed for establishment of the seed mix, and invasive species will continue to be spot-managed as needed.

DD1f, 2 acres

Large-scale invasive woody removal occurred in 2023. In 2024, garlic mustard was treated in the spring, but the window for follow-up foliar spraying of buckthorn and honeysuckle was missed. The unit was seeded with a buckthorn replacement seed mix in the winter. In 2025, garlic mustard was again treated in the spring. Buckthorn and honeysuckle were foliar-sprayed in September. Plants that were too large for foliar treatment were brush cut and stump treated. In 2026, this unit will be monitored for seed mix establishment success, and invasive species will be spot managed.

Image 11: View of DD1f looking south and east, downslope. The shrub layer was thick with buckthorn, honeysuckle, and Siberian elm, but after 3 years of dedicated effort, it is now dominated by native grasses.

The annual community volunteer brush haul occurred in this unit as well as in G2. Large, tree-sized buckthorn was cut and stump treated with herbicide at the end of September. Volunteers hauled brush to piles along the border between DD1f and DD1a. This resulted in an additional 0.5 acres being cleared. At this point, the large, invasive shrubs have been removed from this unit. Native groundcover is beginning to establish. The next restoration step is to remove the invasive Siberian elms within the tree canopy. At this point, removal is not a top priority because it is cost-prohibitive and involves significant coordination because of limited access. However, as the native species in the understory get more established, and prescribed burning is reintroduced in this unit, we will revisit the removal of Siberian elm canopy trees.

PRAIRIE RESTORATION –20 acres

DD1a, 4 acres

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 clear-cut in early 2017, then forestry mowed, followed by herbaceous weed treatment and seeding in fall 2018. The unit was first burned in 2021. Invasive species management is performed annually.

The unit was burned in the spring of 2025, prior to rusty patched bumblebee emergence. Fuel consumption was excellent. A forb enhancement seed mix was broadcast on black soil after the prescribed burn to add early and late season blooming species to the restoration. During the summer, the unit saw a burst of productivity, including some native grass establishment in areas that had previously been dominated by Canada goldenrod. Invasive weed management continued, but was limited to small pockets of spotted knapweed, birdsfoot trefoil, and crown vetch along the road. A vegetation survey was conducted in August, in combination with G1a and G1b, as these units are now one large, contiguous prairie.

Image 12: Canada tick trefoil and Maximillian sunflower tower over neighboring plants in DD1a.

G1a, G1b, 7 acres

These units began as grassland that was primarily smooth brome, with an abundance of honeysuckle and small Siberian elm trees. Restoration started in 2015 and 2017, respectively, and regular management actions, including invasive species management, prescribed burns, and enhancement seeding, have occurred since.

Image 13: Several native prairie species (Culver's root, bee balm, yellow coneflower) blooming in G1a in late July.

Invasive weed management continued in 2025. It was isolated to spot-mowing and hand pulling small pockets (less than 20 square feet) of invasive plants, including non-native thistles, bird's-foot trefoil, spotted knapweed, sweet clover, and honeysuckle. Seed reduction strategies, including weed whipping before seed formation, were targeted. Continued annual maintenance is recommended to keep populations of invasive weeds low and protect the quality of the restoration. A vegetation survey was conducted in August, in combination with DD1a, as these units are now one large, contiguous prairie.

G2a, 2.1 acres

G2a is a subunit of the larger G2 unit. In 2024, the need to split off this 2.1-acre section was identified because the area was dominated by invasive shrubs, cool-season grasses and other herbaceous invasive species, in comparison with the remainder of G2, which is a remnant dry prairie.

Over the last 2 years, significant improvements have been made in G2a. In 2025, the unit was broadcast-sprayed twice with herbicide to eliminate the weed-seed bank. Invasive shrubs were cut, and the stumps were treated in the pine section of the unit. In October, volunteers hauled the invasive shrubs to piles located along the access road between G2a and DD1a. Volunteers also lopped treated Siberian elm, green ash, honeysuckle, and buckthorn on the eastern edge of the unit. In November, a prescribed burn was attempted in the unit, although there was not enough thatch to carry the burn well. Approximately 25% of the total area was burned. In the winter, the unit was seeded with a custom dry prairie seed mix. The goal of restoration in this unit is to extend prairie acres from the pipeline along the road in the south to the northern edge of the property line. In 2026, this unit will be mowed and monitored for native species establishment.

Image 14: G2a at the end of winter. In 2025, this unit was treated was prep sprayed, burned, and seeded with a native seed mix.

DD1b, 1.2 acres

Invasive woody removal began in this unit in 2025. Invasive shrubs were removed with a combination of forestry mowing, as well as cut, stump treat, stack and burn in the winter. This work is prioritized as part of the expansion of prairie acres north, from G1b to the northern property line. In 2026, follow-up foliar treatment of invasive woody resprouts and broadcast seeding of a native grass seed mix is planned. Additional tree removal may occur in this unit pending funding prioritization. The tree canopy consists of girdled Siberian elm trees (standing dead) and other ruderal species, ultimately prioritized for removal.

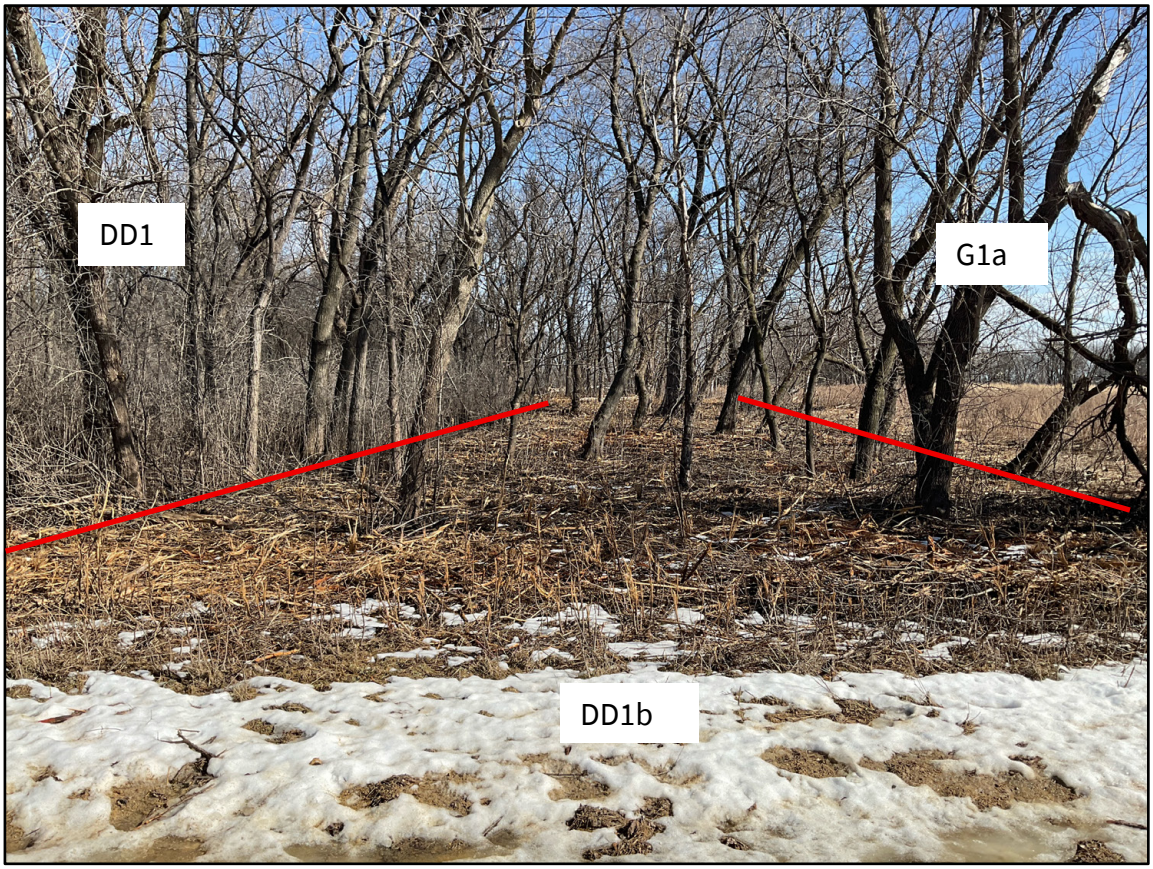


Image 15: DD1b, a long, linear unit, after initial forestry mowing. The gradient between DD1 on the left, DD1b in the middle, and G1a on the right shows the trajectory of restoration in this area, starting with a disturbed deciduous woodlot to a diverse restored prairie.

MP1, 1 acre

Management in this unit started in 2018 with invasive species spot spraying. Since it has undergone invasive woody removal and invasive herbaceous removal at various intervals, it was burned in 2023 and again in the spring of 2025. The burn carried extremely well, and more than 90% of the thatch layer was consumed. A forb-rich native seed mix was broadcast

on black soil after the prescribed burn to increase forb diversity. The unit will be monitored in the future for additional forb establishment.

Image 16: Warm-season grasses consumed during the spring prescribed burn in MP1.

Image 17: The beginning of spring-green up in MP1 after the prescribed burn.

MP2, 3 acres

This unit was first seeded in 2013. It has taken some years to get good establishment of native prairie species. It has improved dramatically over the years and is now 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. Invasive grasses were over-sprayed in 2022 to reduce cover. This unit was burned in May 2023 and again in April 2025. The burn carried well, consuming over 90% of the thatch. During the growing season, invasive species, including leafy spurge, spotted knapweed, Canada thistle, and bird's-foot trefoil, were spot-

mowed and spot-sprayed. The unit will continue to be monitored and managed when necessary.

Storm-1, 2.1 acres

Storm-1 was a priority 1 unit identified within the Phase III NRMP. Restoration enhancement work began in 2025 on this unit. This unit is positioned south of MP1 and west of SV-1. It is graded as a dry stormwater basin, likely collecting runoff from the adjacent Mississippi River Greenway and Highway 52. There were some native species present in the unit, including puccoon, but the dominant cover was smooth brome and spotted knapweed.

Image 18: An abundance of whorled milkweed blooming in Storm-1 in July.

In 2025, cool-season grasses were sprayed with a grass-only herbicide in June. This first spray was highly effective. A second spray was planned, but ultimately was not implemented because the brome did not green up following the first spray. In the fall, the unit was broadcast seeded with a native dry prairie seed mix. The goals are to increase habitat value to the extent possible in the unit without harming any remnant seed bank that may be present

in the soil. In 2026, the unit will be establishment mowed to allow light to reach the soil surface and the native seedlings. Additionally, invasive species along the western edge of the unit will be spot-sprayed and mowed to reduce invasive species cover.

REMNANT NATIVE PRAIRIE – 18 ac

SGPs A,B,C,D,E,F,FF,G,H,I,K,M,N,O,P

ALL SGP UNITS

Invasive weeds, including trefoil, thistles, crown vetch and knapweed, were spot-treated or pulled throughout the summer in all SGP units. Overall, the presence of invasive species in these units is very low. Annual management and subsequent monitoring have been critical in maintaining these high-quality, remnant habitats. The same level of management and monitoring will be continued in 2026.

Image 19: SGP-C greening up in mid-summer after the spring burn.

SGP-C

This unit was burned in the spring of 2025, prior to rusty patched bumblebee emergence. The burn carried well, consuming over 90% of the thatch. Vegetation in this unit was monitored in July as part of annual prairie monitoring. To our surprise, there was a large population of ground plum evenly distributed across the entire unit. Over the last several years, we worked with Dakota County to grow ground plums from seed collected on site, and then planted small plants in the fall of 2023 to try to increase the prevalence of this species within the bluff prairies. SGP-C was not included as a seed collection site or a recipient of plug planting. Rather, this population of ground plums likely persisted in the soil seed bank and was released by the prescribed fire. There are no records of this unit being burned dating back to

2011. This is just one example of how important prescribed fire is to maintaining this habitat, and the ecological benefits that can be gained by implementing a regular burning regime.

Image 20: A ground plum plant (circled in blue) in SGP-C that emerged from the seed bank after the spring burn. The red arrow points to the ground plum fruit.

SGP-E

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. Monitoring in 2022 and 2023 was poor due to the droughts, but at a glance, this prairie has not appeared to have rebounded after initial clearing in 2019. A mow was conducted in July 2024 to increase light availability to the soil surface. Upon monitoring after the mow, it appears the native prairie seedbank is likely lost. The unit was snow-seeded with

a custom dry prairie seed mix in the winter of 2025-26 and will be monitored for establishment in 2026.

SGP-FF

Unit SGP-FF was largely overrun with invasive woody encroachment. In 2023, all woody species aside from oaks were cut, stumps treated, and stacked in the woods to allow sunlight to reach the soil surface. In 2024, this unit was monitored for native seedbank reestablishment. Similar to SGP-E, it appears the native seedbank is lost. The unit was mowed in July of 2024, but very few native species have reemerged. The unit was snow-seeded with a custom dry prairie seed mix in the winter of 2025-26 and will be monitored for establishment in 2026.

SGP-I

This unit was also burned in 2025. Two-thirds of the unit was burned in the spring, prior to rusty-patched bumblebee emergence. The last third of the unit was burned in November before snow cover. Overall, the burns carried well and more than 75% of the thatch was burned. The forb community will be monitored in 2026 to see if any additional species were released after burning.

Image 21: The results of a fall burn in SGP-I. The burn carried well, and more than 90% of the fuel was consumed.

SGPs Q,R

These units were identified in the Phase III NRMP as high priority for restoration. This area was historically one large, sand-gravel prairie. After many years of woody encroachment, there are only two small pockets remaining. The native plant community is degraded, but some remnant species persist. The goal for restoration is to connect the two pockets, expand the remnant prairie area, and revitalize the native plant community through invasive species management, prescribed burning and interseeding.

Woody shrub removal occurred in the winter of 2025-26. All invasive and native woody shrubs were cut, stumps treated, stacked and burned. This included woody material within the SGP units, as well as within a 1-acre buffer between and surrounding the units. Burn piles were stacked on the perimeter surrounding the SGPs, so as not to cause burn scares within the prairie area that is being restored. Additionally, mature black locust trees were girdled and treated with herbicide to prevent resprouting. In 2026, any resprouted material will be brush cut and stump treated. Foliar spraying is not planned to reduce the potential for non-target impacts. The area will also be seeded with a native seed mix in the winter of 2026-27.

Image 22: The expanded remnant of SGP-R after invasive woody removal in winter 2025.

DP-1, 2.5 acres

Management activities in DP-1 have largely aligned with management in other SGP units. The unit is monitored and managed annually for invasive species, including hand pulling spotted knapweed, mullein and bird's foot trefoil. Sometimes, spot-spraying occurs when necessary. In 2025, this unit was burned in November. The conditions were perfect for carrying prescribed fire, and more than 90% of the thatch was consumed. It will be exciting to monitor vegetation response in 2026. The last time this unit was burned was in 2018. Additionally, black locust was girdled and treated with herbicide in a 50-foot buffer surrounding the north and south subunits. This buffer will be monitored for resprouting in 2026, and suckers will be cut and stump treated if needed.

Image 23: The snake hibernacula in DP-1 surrounded by black soil after a fall burn in the unit.

DP-3, 1.6 acres

DP-3 was identified as a priority 1 unit for restoration activities within the Phase III NRMP. This dry prairie exists within what was a ski-hill run. The native plant community is present in sunny areas of the prairie. In 2025, a third species of puccoon (fringed) was found in this dry prairie. Additionally, another population of James' polanisia, the state-endangered plant found across other units, was found in this unit. The first step towards expanding dry prairie habitat within the unit was to remove invasive woody shrubs. Buckthorn, honeysuckle, and Siberian elm were cut, stump treated, and piled outside of the unit in winter 2025-26. Piles were then burned to consume woody material. In 2026, invasive herbaceous species will be hand-pulled and spot-treated throughout the summer. Re-sprouted woody material will be cut and stump treated. Additional monitoring efforts will help prioritize next steps within this unit.

DP-4, 0.5 acres

Similar to DP-3, this unit was identified as a priority 1 unit for restoration activities within the Phase III NRMP. Although this unit is not as high-quality as DP-3, there are still pockets of remnant dry prairie species and potential for expansion of this remnant. This unit is on the same restoration timeline as DP-3 to increase efficiency and save cost. Invasive woody species were managed in the winter of 2025-26, and invasive herbaceous management will begin in the growing season of 2026.

G2, 4.1 acres

Intermittent restoration work has occurred in G2 over the years. There is remnant prairie habitat in this unit, but access is challenging because of the pipeline infrastructure. However, renewed interest in managing this unit began in 2024 when vegetation surveys revealed another population of James' polanisia, a state-endangered plant, within this unit. In 2025, management of this and G2a was subdivided to reflect varying steps needed in restoration. An in-depth vegetation survey and count of individuals in the James' polanisia population was conducted in July and August. Additionally, invasive and native shrubs were managed within the unit. Shrubs were cut and stump treated. Piles were created in dense areas, and material was left as slash in sparse areas. In 2026, the plan is to manage invasive herbaceous species in this unit alongside management of similar species in other prairie units. Additionally, some areas of sumac, particularly those around the population of James' polanisia, will be brush cut to reduce woody encroachment on remnant prairie areas.

Image 24: Purple prairie clover and whorled milkweed bloom in July in G2.

RARE PLANT SURVEY

The annual survey for the state endangered **James's polanisia** (JP) was completed at the sand-gravel prairie units on August 4th. The populations were surveyed in SGP-F, SGP-I, and G2 using the same methods as previous years. The plants were found in three locations in 2024, so those were the units that were surveyed. An additional population was found in DP-3 in 2025 and will be surveyed in 2026. Unfortunately, it is likely that five of the other historical locations may no longer harbor any plants (SGP-A, D, H, I_mid, I_west). The populations have highly fluctuated over time. Most recently, in 2023-25, they are rebounding. This could be because summers have been particularly hot and dry. JP thrives in open, sandy pockets. The general absence of moisture could be leading to the expansion of these sandy pockets.

JP was detected for the first time in unit G2 during a routine vegetation survey in 2024. The population was mapped, but individuals were not counted at the time it was detected. This population was monitored for the first time in 2025 and is now included as part of the routine annual survey and reported in the table below.

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	2023	2024	2025
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	7/18, 7/31	7/31	8/4
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	203	271	573
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	74	142	403
SGP-I_mid	-	3	-	Dozens	-	1	0	67	0	0	0	0	0	0	0		0	0			
SGP-I_west	Present	-	5	Unknown	3	9	12	71	0	0	0	0	3	0	0		0	0			
G2																				Present	457
		45		88	133	85	443	796	207	843	95	8	50	66	471	35	29	59	277	413	976
% change from previous yr					51%	-36%	421%	80%	-74%	307%	-89%	-92%	525%	32%	614%	-93%	-17%	103%	369%	49%	136%

Table 1: Data table describing population counts of James's polanisia in specific bluff prairies located at FHR. Surveys normally occur in July and August. In 2025, there is a boom of individuals in SGP-F, with the highest population number recorded.

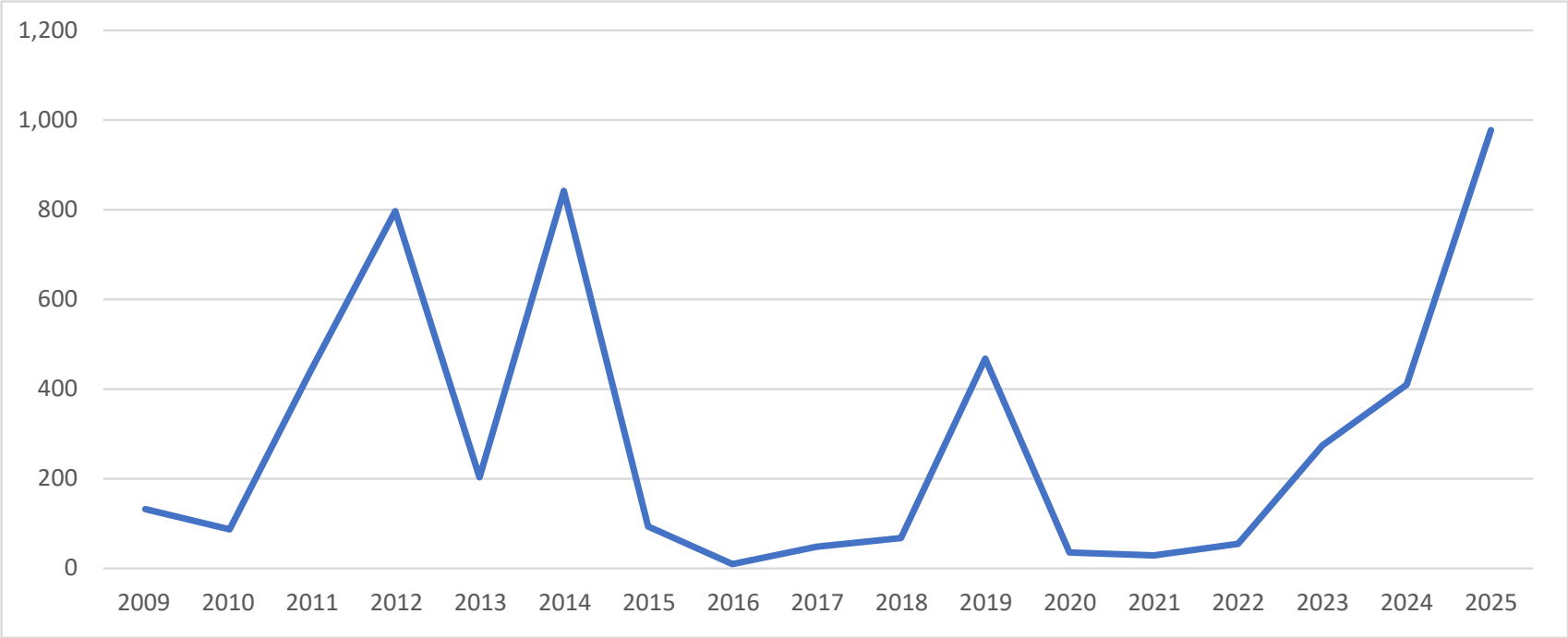


Figure 2: Graph visualizing population fluctuations of James's polanisia at all FHR bluff prairies over time. Time in years is on the X axis, and the total number of individuals is on the Y axis. There was an all-time record of individuals recorded in 2025, likely due to the discovery of a new population in G2.

EMPLOYEE ENGAGEMENT AND VOLUNTEER EVENTS

EMPLOYEE EDUCATION EVENTS

KICKOFF BREAKFAST

On May 8, 47 employees attended the employee education and kickoff breakfast event. The event was held outside near the corner of SV3 and MP2. FMR staff spoke about restoration efforts at the blufflands over the last 25 years and answered employee questions about water quality, river health, and habitat restoration. Then, employees assisted with broadcast seeding native species collected at the 2024 employee seed collection event in SV1c and SV2. Additionally, people lopped buckthorn and honeysuckle from the area immediately surrounding bur oak trees that were missed during winter forestry mowing.

EMPLOYEE VOLUNTEER RESTORATION EVENTS

PRAIRIE MAINTENANCE

On July 24, five employee volunteers participated in a prairie tending event (10 volunteer hours). They hand-pulled bull thistle, musk thistle, mullein, and spotted knapweed from the DD1a unit.

SEED COLLECTION

On October 9, eight FHR employees collected prairie seed from units G1a, G1b, and DD1a (16 volunteer hours). Species collected included yellow coneflower, rattlesnake master, field thistle, hoary vervain, monarda, stiff goldenrod, common milkweed, big bluestem and Indiangrass. The seed will be broadcast in SV3, which was forestry mowed.

EMPLOYEE VOLUNTEER ECOLOGICAL MONITORING

MONARCH MONITORING

In 2025, the monarch monitoring program underwent a few substantial changes to revitalize its scientific utility and employee engagement opportunities. The program switched from using the Monarch Joint Venture's Monarch Larva Monitoring Program protocol (MLMP) to using its Integrated Monarch Monitoring Program protocols (IMMP). This change provides better data portal support and additional protocol options, in addition to supporting the larva monitoring protocol previously conducted. This standardization also enables the Flint Hills Resources Pine Bend Bluffs property to be included as a site in FMR's Pollinator Evaluation Program (PEP), enabling cross-site comparisons. In concert with this change of monitoring protocol, we added additional monitoring units in 2025, including remnant bluff prairies not previously monitored for milkweed and monarchs (Figure 3).

Eight employees participated in the eight-year monarch monitoring program. The season started with a two-hour training on June 5. Volunteers surveyed eight plots in, expanding into 6 new areas of the bluffland. They returned weekly through early September for approximately 14 weeks and recorded eggs and larvae at their designated plots, following the

established protocols of the Monarch Joint Venture's Integrated Monarch Monitoring Program (IMMP). New this year, several employees also chose to survey their plots for adult monarchs, using an additional protocol provided through IMMP. Each volunteer surveyed about 50 plants each week, and the total volunteer hours were about 112. In 2025, employees monitored multiple species of milkweed, including common, green, butterfly, and whorled, the last of which is very abundant in the remnant bluff prairies at the property (Image 25).

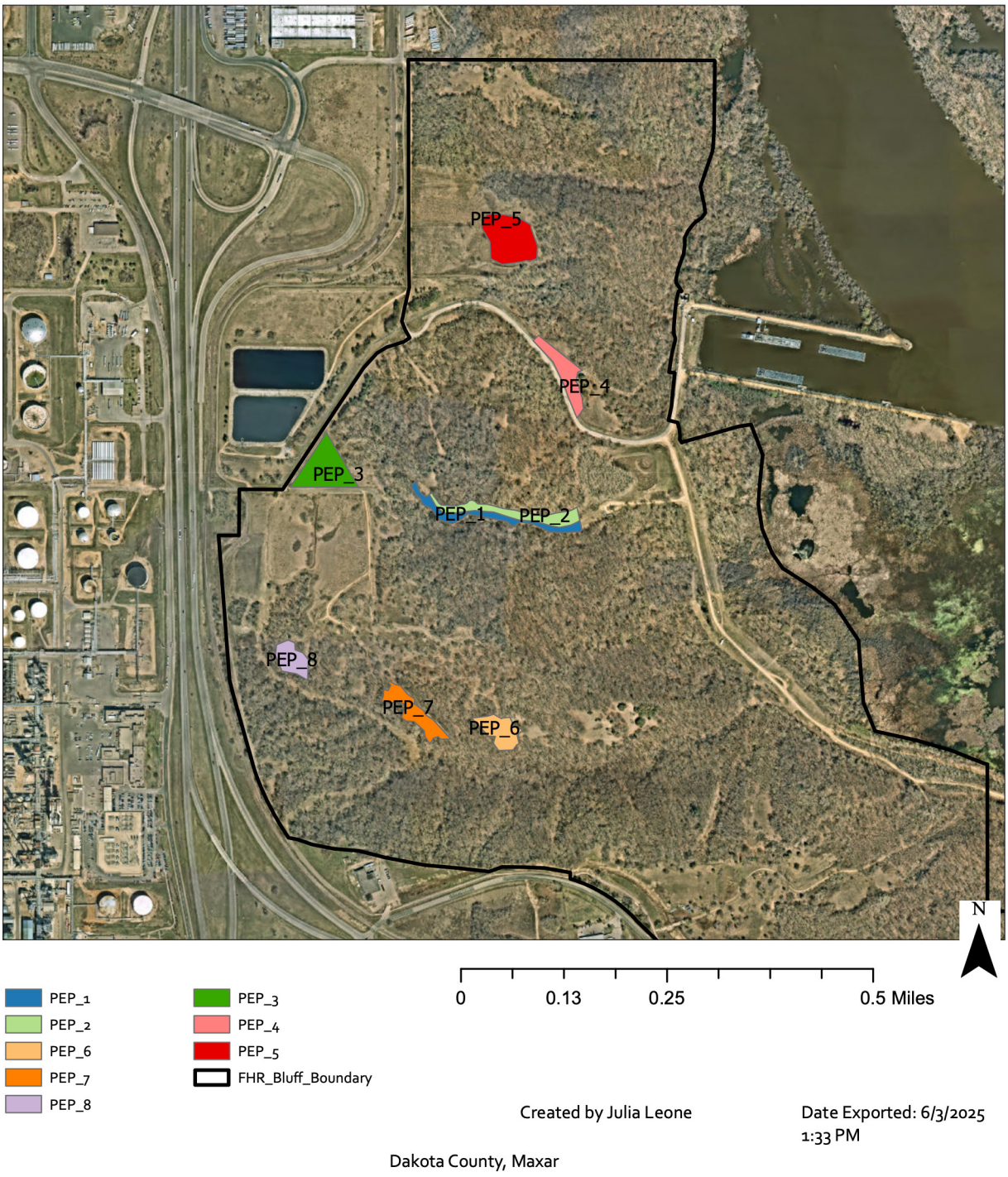


Figure 3. Map of additional PEP plots established in 2025.

Image 25: Monarch butterfly caterpillar on whorled Milkweed in plot 4, a remnant prairie monitored for monarchs for the first time in 2025.

Employees submitted their data directly to the Monarch Joint Venture IMMP database; all data are publicly available and contribute to broad monarch research and conservation initiatives. Data in visualizations were aggregated across all plots. Monarch densities per milkweed plant increased slightly from 2024 to 2025 (Figure 4). Most promisingly, monarch densities and observations increased towards the end of the summer. A higher number at the end of the season indicates a stronger population going into the next winter compared to the population that survived the last winter.

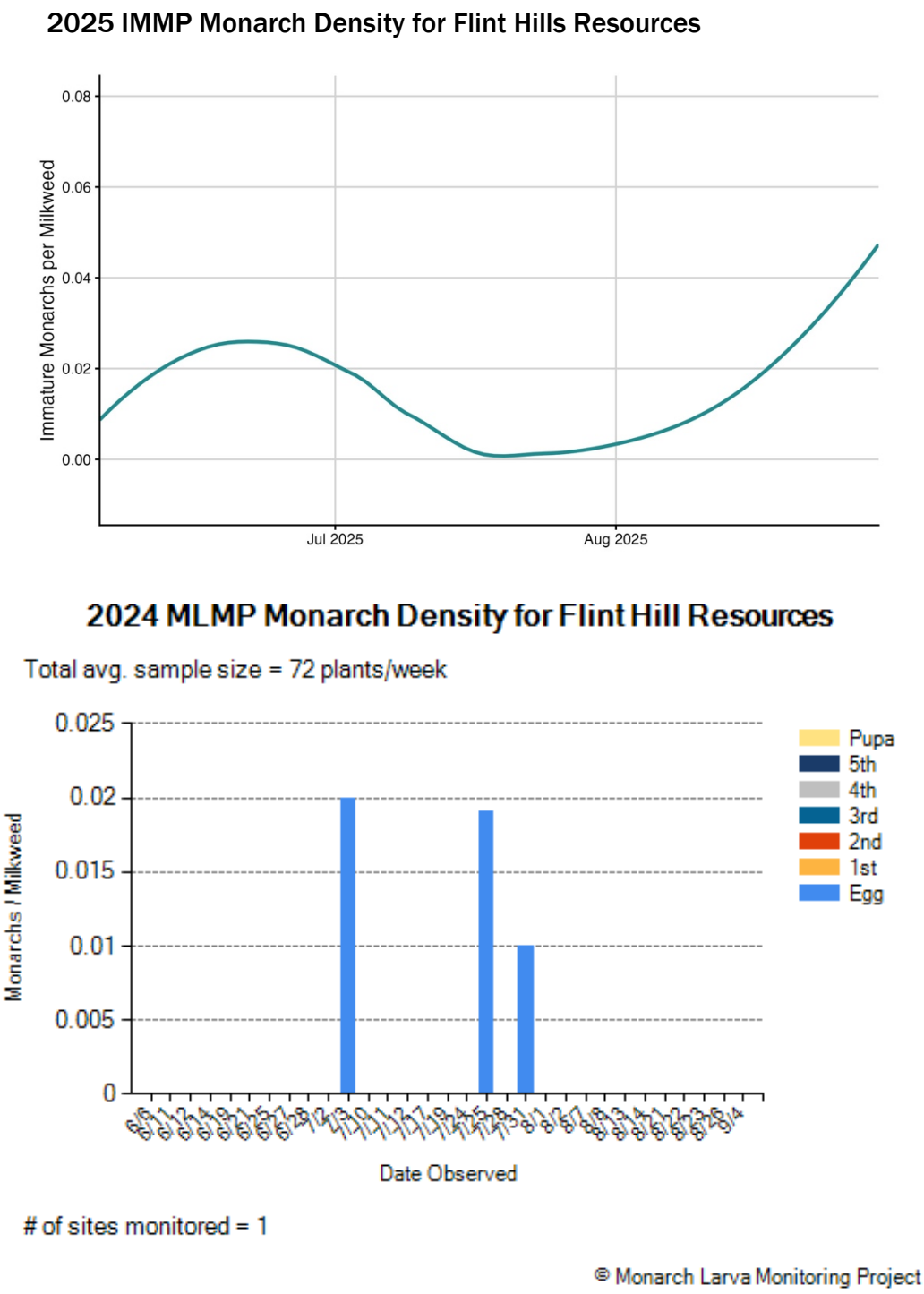


Figure 4: Graphs visualizing monarch egg and larval densities at FHR in 2025 compared to 2025. Survey dates are on the X axis, and the number of monarchs per surveyed milkweed plant is on the Y axis. Despite different protocols and visualization methods, MLMP results from 2024 and IMMP results from 2025 show comparable data.

The North American monarch butterfly population continues to decline due to multiple threats, including habitat loss, climate change, disease, and parasitism. In December 2024, the U.S. Fish and Wildlife Service (USFWS) proposed listing monarchs as threatened under the Endangered Species Act.

Monarch monitoring at Flint Hills Pine Bend Bluffs demonstrates the importance of the bluffland habitat and the vital resources it provides monarchs, among many other animals. The goal is to continue monarch monitoring in 2026.

WILDLIFE MONITORING

Nine employees and two FMR interns participated in the third year of wildlife camera monitoring. The season started with a 2-hour training on July 10. Volunteers were assigned to teams of two and monitored ten wildlife cameras between mid-July and late-November 2025. Jake Flett of Flint Hills acted as a lead volunteer once again and provided expertise and assisted with volunteer team coordination and camera set-up, take-down, and maintenance. Volunteers contributed approximately. 182 hours checking cameras, downloading and processing images, and recording and sharing data; 3472 wildlife sightings were documented. Cameras captured images of wildlife using the Flint Hills Pine Bend bluffs for habitat and included observations of whitetail deer, squirrels, turkeys, foxes, raccoons, coyotes, sandhill cranes, red-tailed hawks, opossums, and more (Figure 5).

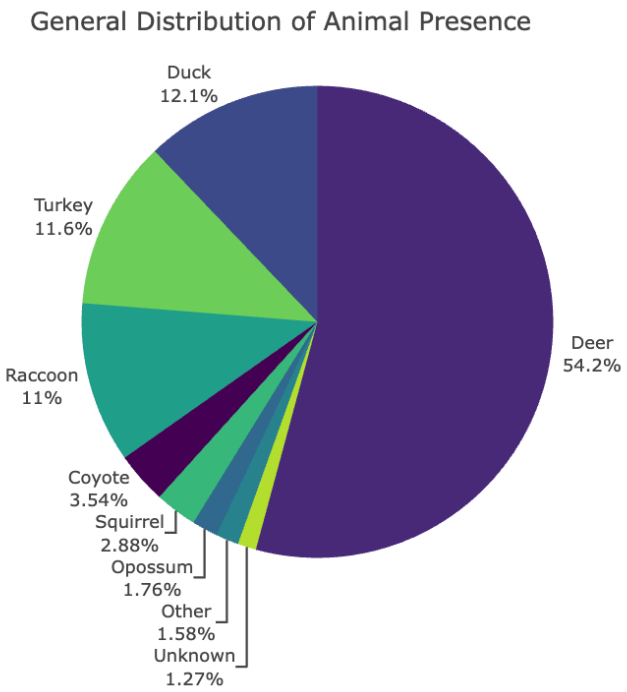


Figure 5: Pie-chart displaying distribution of animal species observed on wildlife cameras from July-November 2025.

Several significant improvements were made to the wildlife camera monitoring program in 2025. One was the purchase and deployment of ten new cell trail cameras. These were proposed as a solution to the challenges of theft and SD card data loss, and proved highly successful. Two other improvements were made to the program's experimental design, allowing for more robust scientific inference from the collected data. Cameras were distributed across three habitat types (woodland, prairie/savanna, wetland) to allow comparisons of wildlife use among them. Results show clear habitat associations for many species (Figure 6). We also deployed scent lures on half of the cameras to attract carnivores and compare animal distribution between scented and unscented cameras. Trees near the lure-cameras were painted with salmon oil weekly between mid-July and late-November 2025. We observed a difference in species composition between scented and unscented cameras (Figure 7).

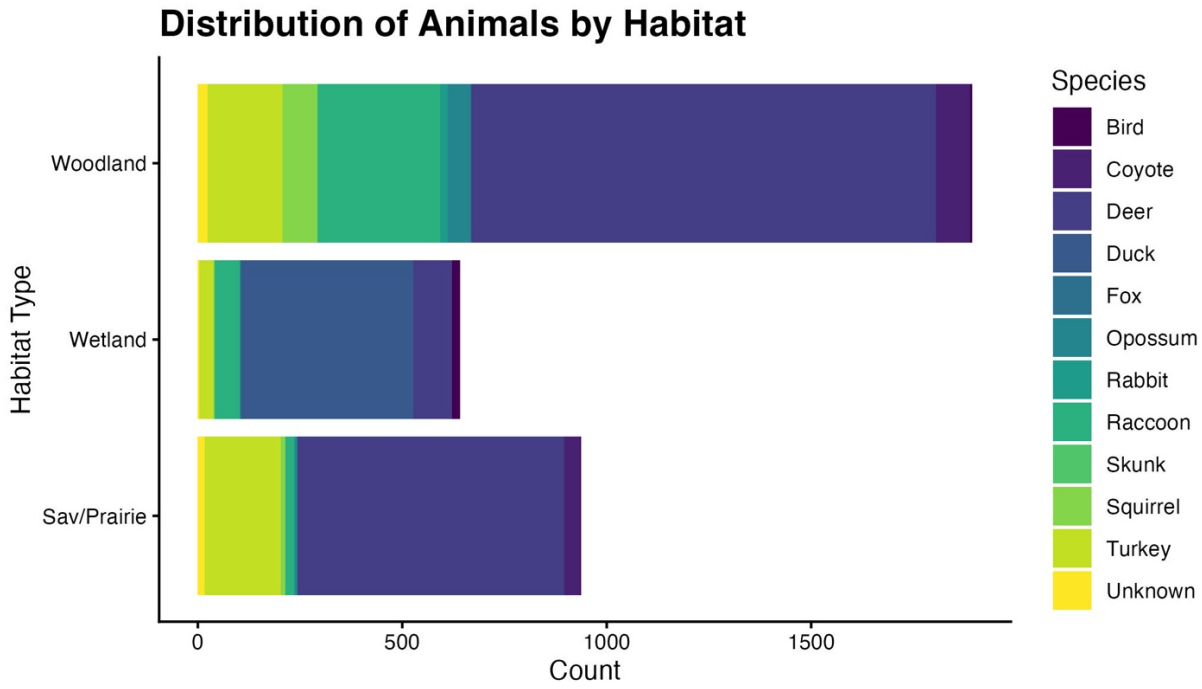


Figure 6: Graph showing the distribution of animal species between three habitat types observed on wildlife cameras from July-November 2025, with the number of animal observations along the x-axis.

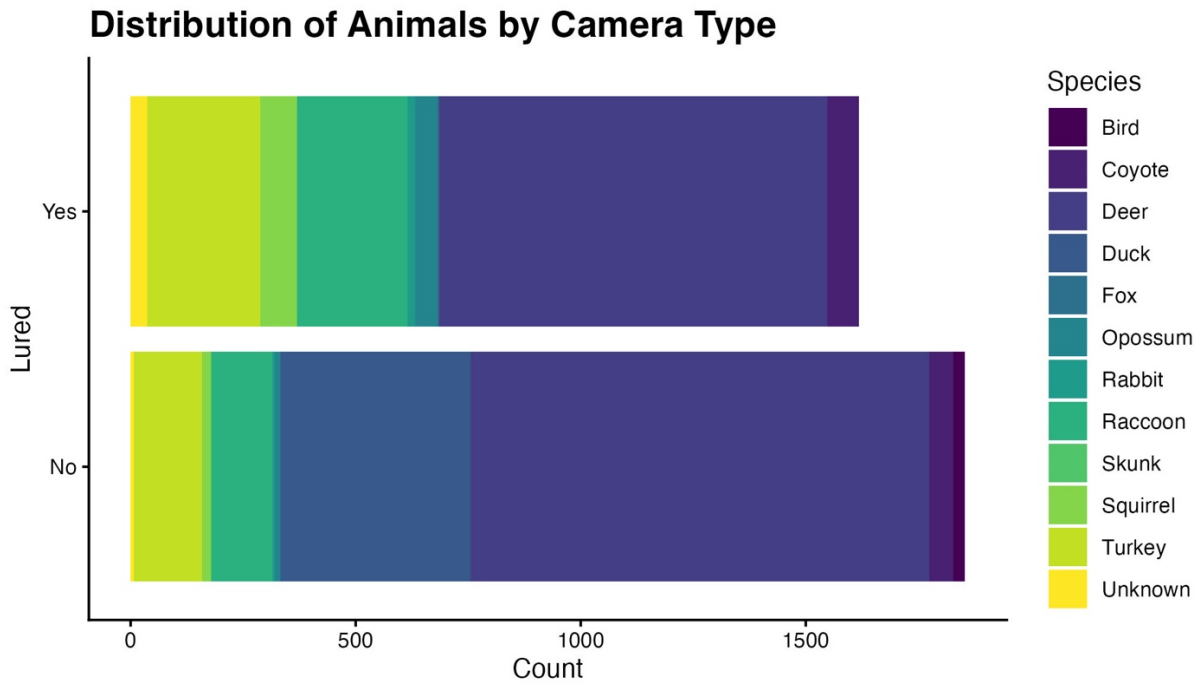


Figure 7: Graph showing the distribution and composition of animal species between salmon-oil lured and unlured cameras, with the number of animal observations along the x-axis.

The wildlife camera monitoring program continues to provide employee opportunities to contribute to participatory science and experience the bluffland habitat firsthand. With recent improvements to the program, we foresee another successful year ahead in 2026.

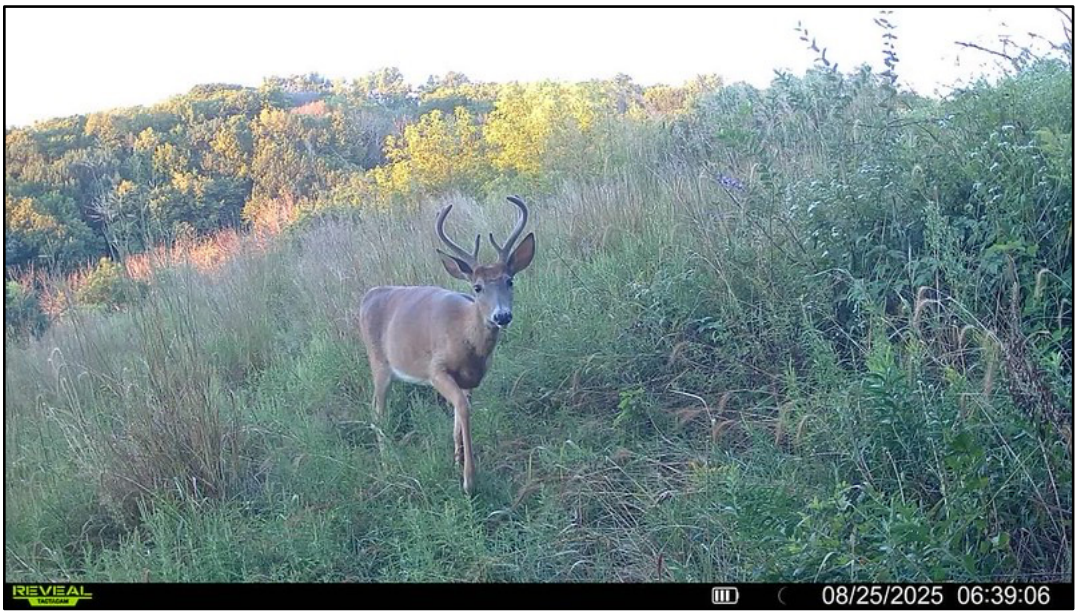


Image 26: An example of wildlife captured on camera in August 2025 (white tailed deer).

COMMUNITY VOLUNTEER EVENTS

SUMMER BUCKTHORN LOPPING

2025 was the second year of holding a summer buckthorn lopping event. On August 21, 35 employees and volunteers gathered to lop buckthorn in OF2. The buckthorn in this unit has been particularly difficult to manage because of the steep terrain and open canopy. Volunteers climbed up the slope, loppers in hand, and cut material for two hours. All material was then piled in burn piles for disposal in the winter. This would not have happened without volunteer support due to the high costs of contracted labor working on slopes. Overall, 0.5 acres of buckthorn were removed. A follow-up foliar treatment of resprouts was performed in September after the event. This area was also seeded with a native grass buckthorn replacement mix.

Image 27: A volunteer lops shrubs during the event.

Image 28: Volunteers pose for a post-event photo in a bluff prairie adjacent to OFe.

FALL BRUSH HAUL

89 community volunteers participated in the annual community volunteer event on October 4, 2025 (267 volunteer hours). Half of the volunteers hauled invasive woody shrubs from an oak woodland unit, while the other half hauled invasive shrubs from beneath pine trees in a prairie unit for three hours. The event expanded on invasive woody removal that had taken place in this area before moving down to the lowland forest.

The brush from both areas was hauled to piles just off the access drive through the prairie. These piles were later removed and taken off-site by Asplundh. This work paved the way for a prescribed burn and seeding of the prairie unit in the fall. Starting restoration in this unit would not have been possible without volunteer support.

Image 29: A volunteer hauls brush to piles.

BREEDING BIRD SURVEYS

Background

FMR has been conducting annual breeding bird surveys nearly every year for the past seventeen years (no survey in 2020 due to COVID-19). The combined total of all species that have been observed during both spring migration and breeding bird surveys is 126, with 111 species recorded during migration and 85 during breeding surveys (Appendix C). In 2025, 51 species were observed in the breeding survey, which was the second-highest number recorded. The annual average was 47. The number of birds recorded in the 2025 was 254, somewhat higher than the average of 223. One new species, barn swallow, was recorded.

The 2025 breeding bird surveys were completed on June 2 and 19, at the same ten points and using the same point count methods that have been used over the years (8 min, 50 m radius). The points are located in a variety of habitats – restored prairie, forest, and wetland adjacent. All species seen or heard were recorded, both within 50m of the point and beyond.

Survey results

The most abundant species in 2025, with 15-18 birds recorded, were brown-headed cowbird, American redstart, American robin, and gray catbird (**Appendix A**). Other abundant species were house wren, Indigo bunting, American goldfinch and yellow warbler. All are habitat generalist species, common in forest edges as well as suburban housing areas, and 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 can have very negative impacts on the breeding success of many other bird species, especially the neotropical migrants.

Numbers for individual species can vary from year to year, just as part of the variability of the survey process. Such changes may not be meaningful. We did note that a few species were more abundant than usual. Indigo buntings were almost twice as abundant as other years, and chimney swift, gray catbird, great-crested flycatcher were also more numerous than usual. Species that seemed notably less abundant were all grassland birds - song sparrow, field sparrow and clay-colored sparrow. This may be a reflection of the overall population declines of grassland bird species.

Species of greatest conservation need (SGCN) is a designation assigned by the Department of Natural Resources to species that have had significant population declines. The total number of SGCNs recorded at the FHR property in all years is 14. The annual average is 5.3, and five were recorded in 2025 (Table 2). Field sparrow and eastern towhee are the most regularly occurring SGCNs, with five or six birds on average each year. Northern rough-winged swallows are seen most years as well as chimney swifts. Most of the other species have been

recorded sporadically over the years, although sedge wren was only recorded once. It was especially good to see the presence of several brown thrashers, a grassland species that has been absent for the past five years. Yellow-headed blackbirds were a new addition five years ago and have been present each year since then. The presence of several SGCNs at the Pine Bend Bluff property each year is a good testament to the value that the habitat provides.

Table 2. Sixteen-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	2023	2024	2025	Avg /yr
1	American Kestrel	2		1									1					0.3
2	Black-billed cuckoo												1					0.1
3	Brown thrasher			1				1	5	1	1						3	0.8
4	Chimney swift				5	3	1	1	2	2	1				4	3	5	1.7
5	Dickcissel								2	4			1					0.5
6	Eastern meadowlark	2				2		1					1		1			0.5
7	Eastern Towhee	3	3	3	7	5	4	4	6	3	6	4	7	6	7	9	2	4.9
8	Field Sparrow	7	4	7	10	4	7	10	7	5	7	3	7	7	7	10	4	6.6
9	Northern Rough-winged Swallow	1	1	1		2	1		1	6		2	23	2	4	7		3.4
10	Sedge wren		1															0.1
11	Trumpeter swan															2		0.1
12	Wood thrush	1			1								4	1				0.5
13	Yellow-billed cuckoo			1					3	1								0.3
14	Yellow-headed blackbird												1	2	2	1	1	0.4
	No. birds	16	9	14	23	16	13	17	26	22	15	9	46	18	25	32	15	19.8
	No. species	6	4	6	4	5	4	5	7	7	4	3	9	5	6	6	5	5.4

Each year in the fall, the chimney swift house is checked to see if it was used. Typically, just one pair of birds will nest in a chimney, but it can be used by dozens of birds for roosting. The house at FHR was built by employee volunteer Jack Seibenaler and installed in fall 2012. The house was used for the first time in 2017 and has been used several years since then. More swifts were recorded in 2025 than most years, which may indicate the swift house is in use again this year. The house should be checked in fall after the swifts have departed.

Overall the breeding bird population at the FHR bluff property appears to be stable over the years, with a fairly consistent number of species (species richness) and number of SGCNs detected (Figure 8).

When diversity was calculated (Figure 9), it showed a slight decline over the 15 survey years, with an especially low count in 2019. Bird populations fluctuate annually for a variety of reasons, so some annual variations are expected. It is also well-known that many species are declining throughout their range, so these results may reflect what is happening on a larger regional scale. However, if 2019 was an anomaly for whatever reason and we eliminate that data, then the diversity trend is quite stable over time (Figure 10). At least in terms of diversity and richness, the FHR bird community appears to be stable. Continued habitat management is warranted so that the site continues to provide good resources for breeding birds.

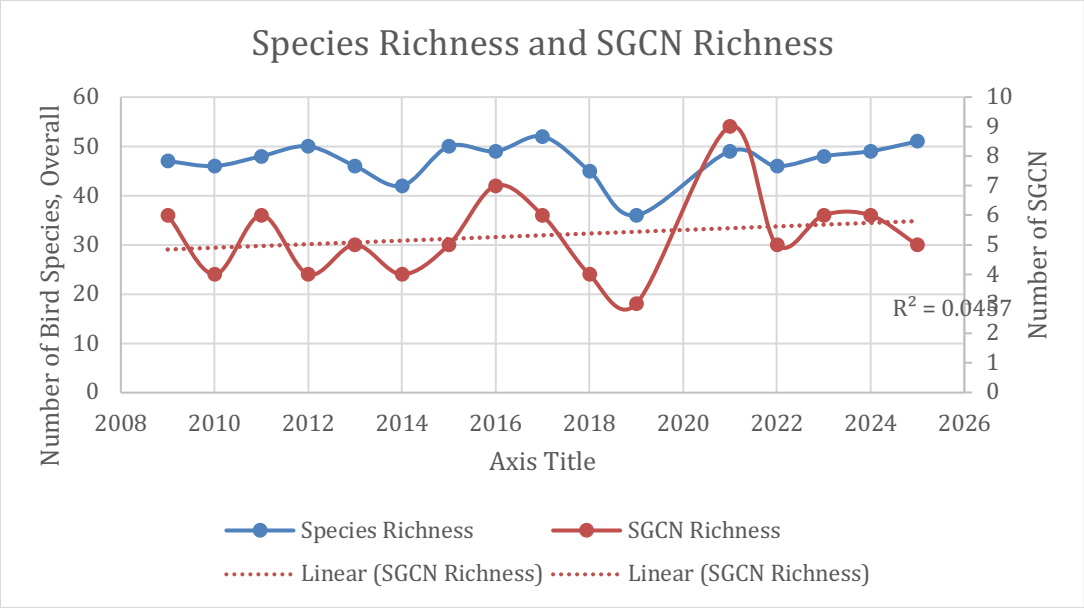


Figure 8: Species richness and SGCN richness trends have been stable over the years.

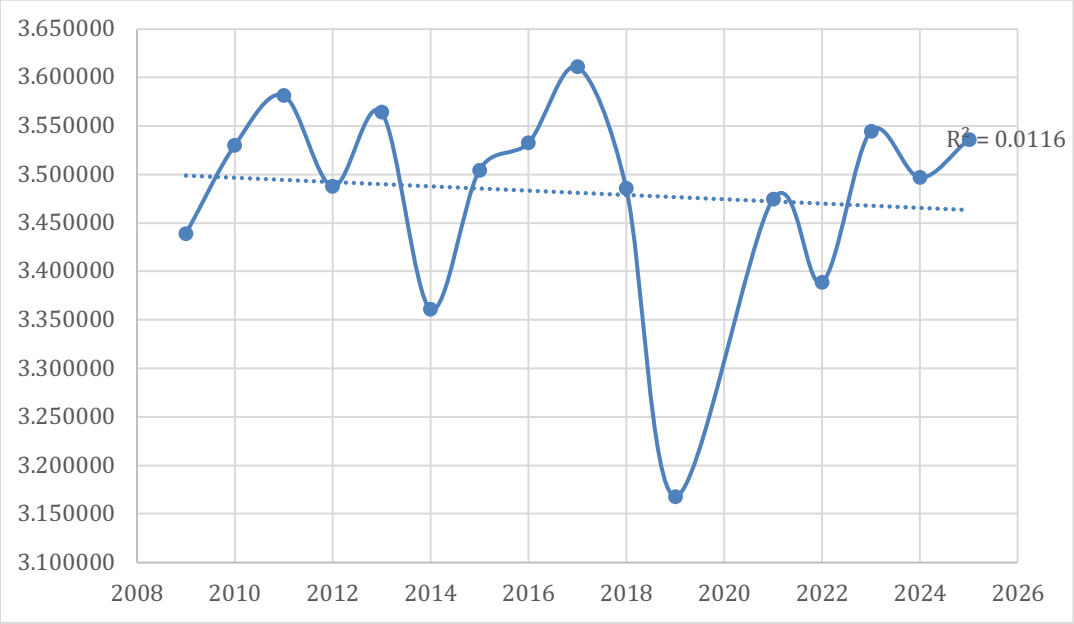


Figure 9: Bird diversity has fluctuated over the years, with a slightly downward trend over time.

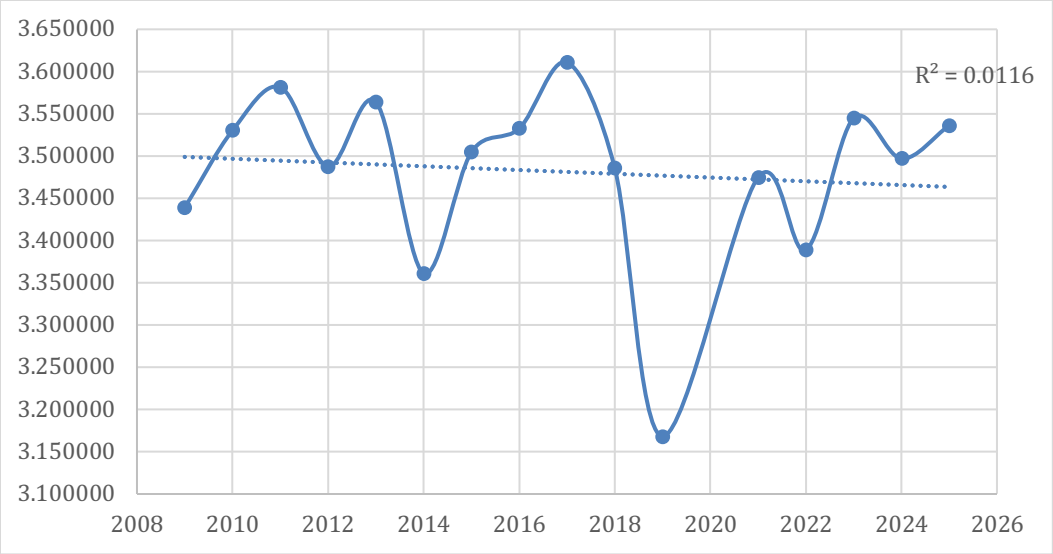


Figure 10: Without the anomalous 2019, the diversity is steady over the years.

POLLINATOR SURVEYS

Image 30: Federally endangered rusty patched bumble bee on bee balm in July 2025.

BACKGROUND

In 2019, FMR conducted the first pollinator surveys of remnant and restored prairie at the Flint Hills Resources bluffland property. These surveys have continued for the past seven years. Pollinator surveys in 2025 focused on bumble bee and butterfly diversity and abundance; these pollinator groups can be more readily identified by sight in the field compared to many other pollinator groups, leading to more reliable data that can be used to track trends over time.

This report details pollinator observations and data collected during the 2025 field season (Appendix D). The data can be used to better assess the success of the restoration process, monitor current pollinators and habitat quality, and help improve future habitat for pollinators.

SURVEY METHODS

Pollinator surveys were completed in five plots within the FHR bluffland property (Figure 11) and targeted bumble bees and butterflies (including skippers). All units were surveyed in four rounds over the growing season on June 4 and 5, July 28 and 29, August 14 and 20, and September 3, 2025.

Bumble bees were surveyed using a standardized, time-constrained, 30-minute, non-destructive, meandering walk throughout each plot. We standardized the time spent surveying each unit in 2024 in accordance with the widely adopted standardized protocol used in a new USGS-led long-term rusty-patched bumble bee long-term monitoring project, to allow for better data comparison across projects. We have taken this change of effort into account when discussing trends over time at the bluffland. Bumble bees were only recorded if observed foraging on flowering plants.

Butterflies were surveyed along three 50-meter transects using a standardized, modified Pollard transect walk. All butterflies within a 5m imaginary box in front of the observer were recorded, along with their activity (flying, foraging, mating, etc). Additional butterfly species were added to the species list during a 30-minute meandering walk.

Bumble bees and butterflies were identified by sight, catch-and-release, or photo ID. Flower associations for foraging pollinators were recorded. During bumble bee surveys, a GPS unit was used to avoid meandering through areas of the unit already surveyed that day and to avoid meandering into adjacent units. The same individual surveyor recorded all bumble bee and butterfly observations. Surveys were conducted between 900 hrs and 1730 hrs on clear-weather days, when temperatures were above 55 degrees Fahrenheit, to favor insect activity. All observations were recorded with the most detailed taxonomic level available, based on trained observer ID. When needed, photo verification and field-guide references were used.

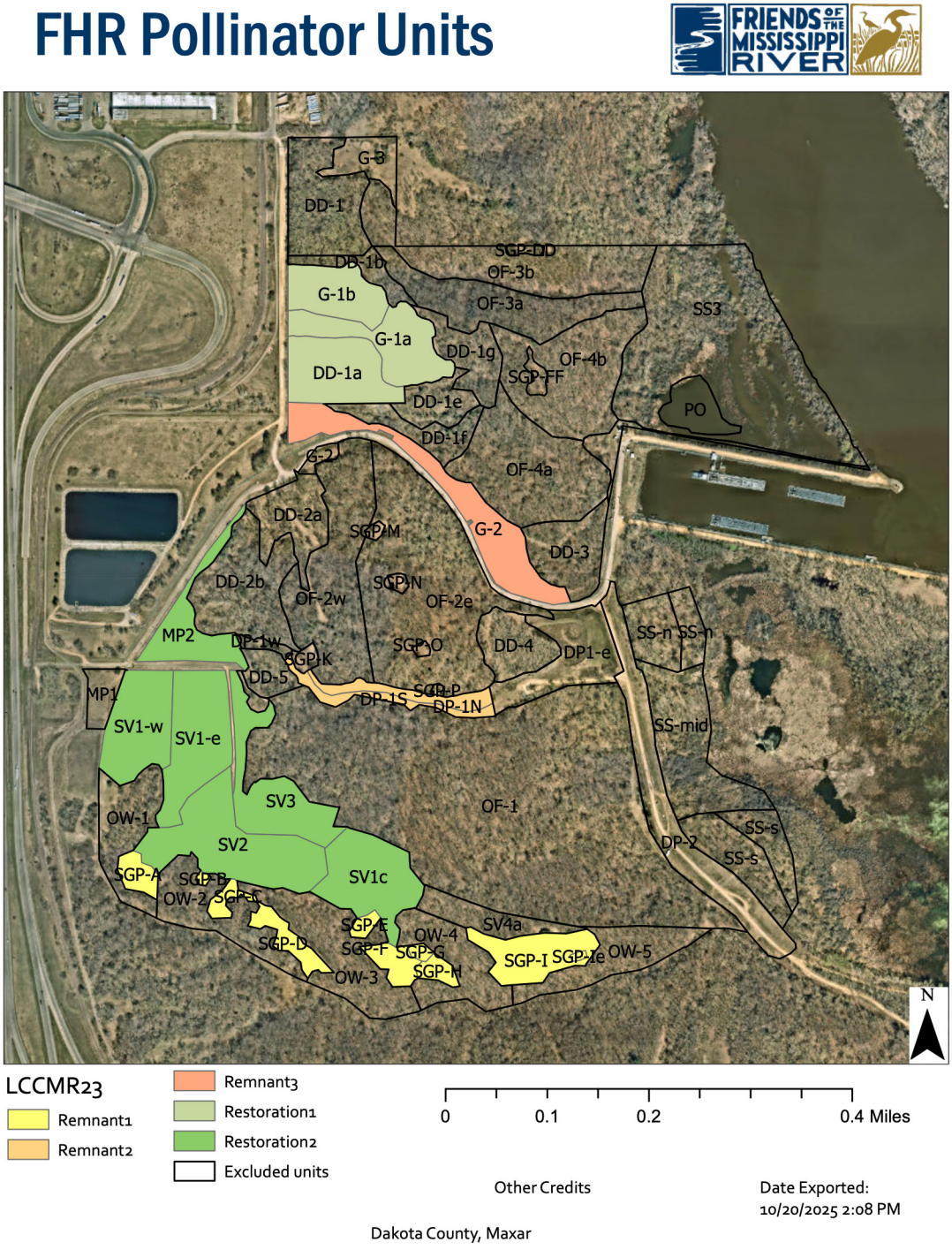


Figure 11: Map of remnant and restored prairie plots where pollinators were surveyed in 2025.

RESULTS

BUMBLE BEES

Two hundred seventy-four bumble bees were observed in 2025, an increase in abundance from 2024. The majority of these (230) were recorded in restored prairie units, compared to remnant prairie units (44). Bumble bee diversity did not differ between remnant and restored units in 2025. The most abundant species was *Bombus impatiens*, which accounted for over half of the bumble bee observations, a trend consistent with 2024 surveys, and bumble bee surveys across other sites in 2025 (Figure 12). Bumble bee diversity increased at Flint Hills Pine Bend Bluffs in 2025 (Table 3), from ten to twelve species, most notably with the observation of the federally endangered rusty patched bumble bee (*Bombus affinis*).

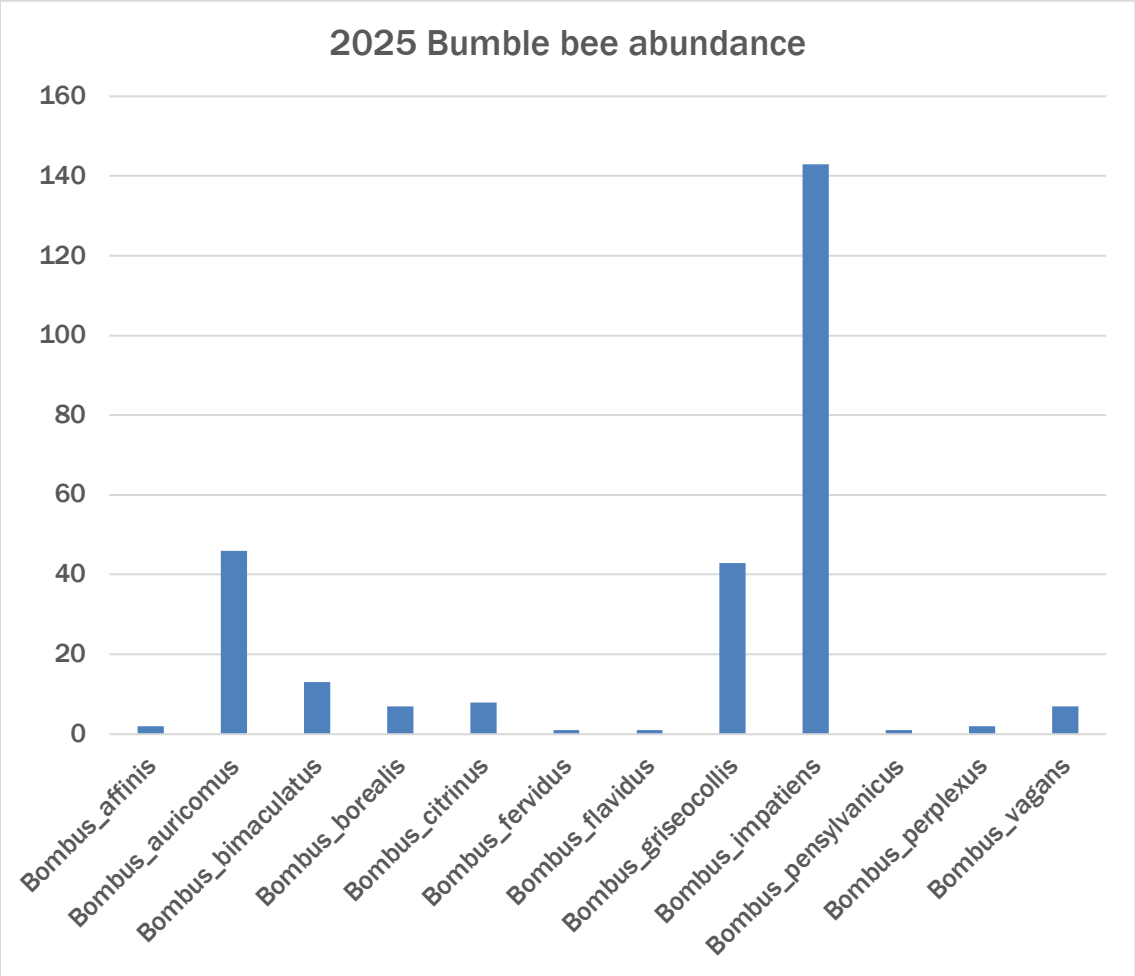


Figure 12: Bumble bee species abundances observed in 2025.

SCIENTIFIC NAME	COMMON NAME	2024 COUNT	2025 COUNT
*Bombus affinis**	Rusty patched bumble bee		2
Bombus auricomus	Black and gold bumble bee	16	46
Bombus bimaculatus	Two-spotted bumble bee	5	13
Bombus borealis	Boreal bumble bee	5	7
Bombus citrinus	Lemon cuckoo bumble bee	1	8
Bombus fervidus	Yellow bumble bee		1
Bombus flavidus	Golden cuckoo bumble bee		1
Bombus griseocollis	Brown-belted bumble bee	39	43
Bombus impatiens	Common eastern bumble bee	124	143
Bombus pensylvanicus	American bumble bee	1	1
Bombus perplexus	Confusing bumble bee	10	2
Bombus rufocinctus	Red-belted bumble bee	1	
Bombus sandersoni	Sanderson's bumble bee	1	
Bombus vagans	Half-black blumble bee	4	7
TOTAL		207	274

Table 3: List of bumble bee species and their relative abundances observed in 2024 and 2025.
** The Rusty patched bumble bee Bombus affinis), is federally endangered*

SCIENTIFIC NAME	COMMON NAME	2024 COUNT	2025 COUNT
*Ancyloxypha numitor**	Least Skipper		
Asterocampa celtis	Hackberry Emperor	1	
*Celastrina neglecta**	Summer Azure		
Cercyonis pegala	Common Wood Nymph	2	
Coenonymph tullia+	Common Ringlet		1
Colias eurytheme	Orange Sulphur	9	3
Colias philodice	Clouded Sulphur		3
Cupido comyntas	Eastern Tailed Blue	2	8
Danaus plexippus	Monarch	7	35
Epargyreus clarus	Silver Spotted Skipper	4	1
Nymphalis antiopa	Mourning Cloak	1	
Papilio cresphontes	Giant Swallowtail	1	1
Papilio glaucus+	Eastern Tiger Swallowtail		2
Phyciodes tharos	Pearl Crescent	3	3
Pieris rapae	Cabbage White	2	25
Polygonia comma	Eastern Comma	2	
Satyrodes eurydice	Eyed Brown	1	
Speyeria cybele	Great Spangled Fritillary	3	6

Vanessa atalanta	Red Admiral	2	
*Vanessa cardui**	Painted Lady		
Vanessa spp	Unknown Vanessa butterfly		1
TOTAL	40	40	90

Table 4: List of butterfly species and their relative abundances observed in 2024 and 2025.
** Butterfly species recorded at the property prior to 2024.*
+ Species not previously documented at the property.

Twelve butterfly species were observed in 2025, and abundance increased significantly (Table 4), returning to levels seen in 2023 and earlier. Monarch butterflies were the most abundant butterfly recorded in 2025 (Image 31), a sign that the property is providing good host plant (milkweed) and nectar resources. The non-native habitat generalist cabbage white butterfly was next most abundant.

Image 31: Monarch butterfly nectaring on field thistle at the Flint Hills Resources Bluffs property in August 2025.

Pollinators were observed foraging on 24 species of flowering plant, with the highest total number of observations on bee balm (*Monarda fistulosa*), followed by field thistle (*Cirsium discolor*), figwort (*Scrophularia lanceolata*), and Canada goldenrod (*Solidago canadensis*) (Figure 13). Different pollinator groups preferentially visited different flowers; only 4 flower species were visited by both bees and butterflies in our dataset. Thirteen flower species were exclusively visited by bees, and seven species were visited exclusively by butterflies.

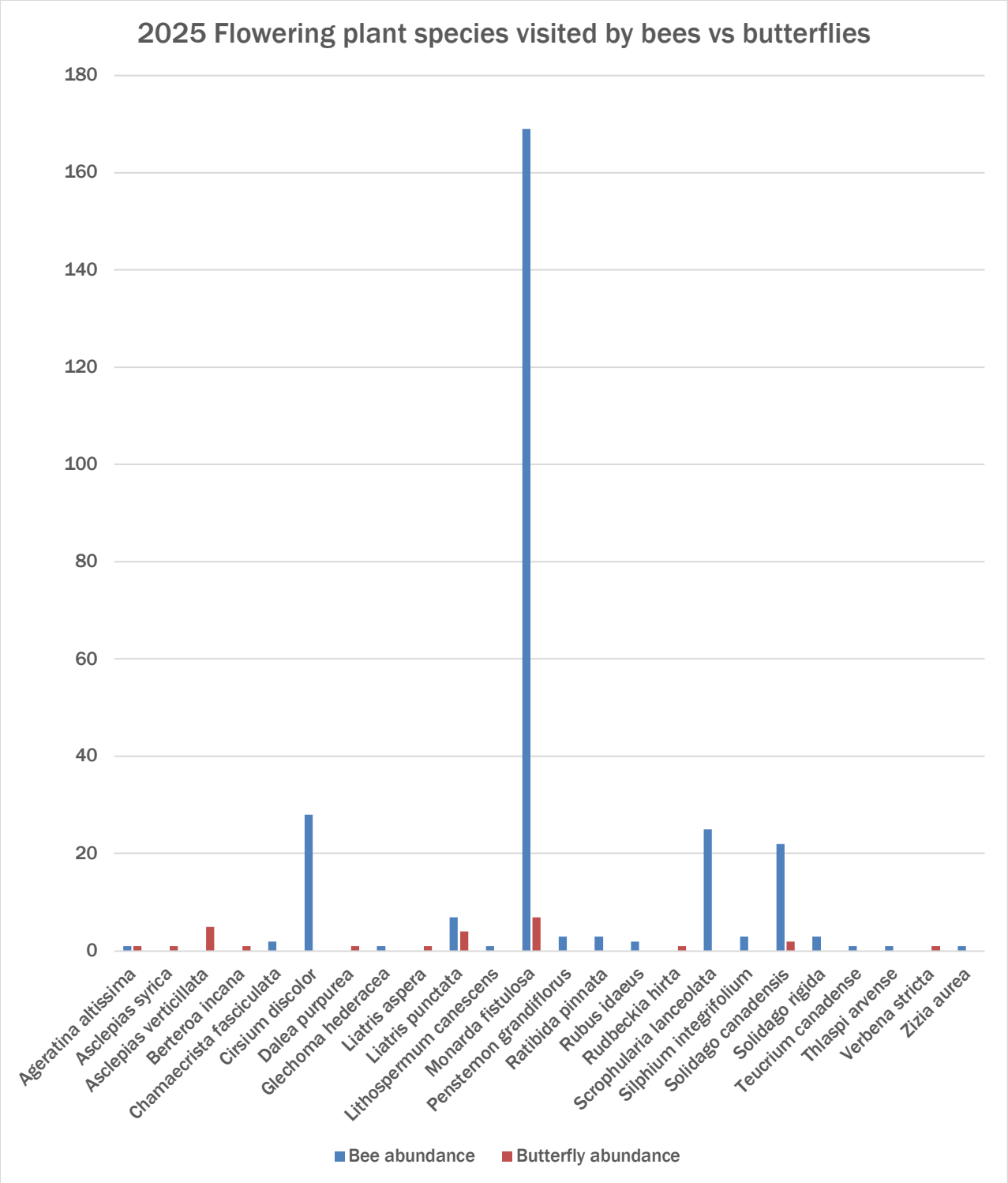


Figure 13: Flowering plant species that pollinators were observed foraging on at the Flint Hills Resources Pine Bend Bluffs property in 2025. Counts represent the number of individual bumble bees (blue) and butterflies (orange) that visited each flower species.

DISCUSSION

Image 32: Male brown belted bumble bee (Bombus griseocolis) on blazing star in August 2025.

Bumble bee diversity and abundance were both high in 2025. As in 2024, we observed significant differences in bumble bee abundance between restored and remnant prairie units. Five times as many individuals were observed in restored compared to remnant prairie. This pattern can be explained in part by the floral association data we collected. Bee balm is a favorite food source for bumble bees in mid-summer, and is abundant in restorations. Over half of the bumble bees we observed during surveys were foraging on bee balm (169), most of which was in restorations. Field thistle and figwort, the next most visited flowers by bumble bees during our surveys, were also found predominantly in restorations. While these bluff prairies may provide fewer preferential foraging resources for bumble bees, they still provide essential nesting habitat for bees and many other wildlife species.

We observed two federally endangered rusty-patched bumble bees during 2025 surveys (Table 3); this species was last recorded at the property in 2020. The property possesses high-quality habitat (i.e., diverse floral resources, loose soil with small animal burrows, forest edge, and savanna), so it was an encouraging sign to see this rare species present at the

property again. Detection of rare species is always challenging, as their scarcity reduces the likelihood of observation during surveys. Rusty-patched bumble bees may have been present over the past several years but not detected. We continue to enhance resources throughout the property, which will improve habitat for rusty patched bumble bees.

Butterfly diversity decreased slightly in 2025 compared to 2024, while abundance more than doubled. Insect populations are known for their high year-to-year variability, so tracking populations across multiple years is important. We know that butterfly populations across the United States are suffering due to a number of threats. A report published by the Xerces Society in March 2025 documented a loss of more than one-fifth of butterflies since 2000. Simultaneously, the monarch butterfly is under consideration for listing status as a "threatened" species under the Endangered Species Act, as of Dec 2024. The presence and relative abundance of monarch butterflies and milkweed are positive signs that the bluffland property is providing habitat for this iconic and declining pollinator species. As noted in the employee volunteer monarch monitoring section of this report, at least one species of milkweed is present in each pollinator survey plot at the bluffland, which is a hopeful sign for future years; the presence of milkweed is essential since it is the only host plant for monarch butterflies during their larval stages.

Skipper butterflies, especially those that feed on native grasses during their larval stages, were again noticeably absent during pollinator surveys in 2025. Several once-common Minnesota species are now federally endangered (Poweshiek skipperling) or threatened (Dakota skipper) and many others are in decline and now considered prairie obligate. While it is unclear what is driving the low numbers at the bluffland property, habitat loss and fragmentation in the landscape are considered leading causes of decline. The efforts to restore additional acres of habitat and increase habitat connectivity at the bluffland may help restore skipper populations and provide additional habitat for other butterfly species.

We continue to monitor bumble bees and butterflies so that we can better enhance habitat for pollinators at the property.

Image 33: Abundant floral resources in Restoration 2 during August pollinator surveys in 2025.

REFERENCES

Pollard, E. (1977). Method for assessing changes in abundance of butterflies. *Biological Conservation*, **12**, 115–134.

APPENDIX A. SEEDING IN 2025

BUCKTHORN REPLACEMENT SEED MIX

OF2e, OF4b (5 ACRES)

Scientific Name	Common Name	% of Mix	PLS lbs/ac	Total PLS lbs	Origin	Seeds/SF
Andropogon gerardii	Big Bluestem	2.50	0.30	1.50	Dakota Co, MN	1.10
Bouteloua curtipendula	Side-oats Grama	9.00	1.08	5.40	Pope Co, MN	3.95
Bromus pubescens	Hairy Wood Chess	3.00	0.36	1.80	Stearns Co, MN	1.00
Carex brevior	Plains Oval Sedge	2.00	0.24	1.20	Sherburne Co, MN	2.56
Carex molesta	Troublesome Sedge	2.00	0.24	1.20	Rice Co, MN	2.20
Elymus canadensis	Canada Wild Rye	9.00	1.08	5.40	Benton Co, MN	2.06
Elymus hystrix	Bottlebrush Grass	18.00	2.16	10.80	Rice Co, MN	6.03
Elymus villosus	Silky Wild Rye	18.00	2.16	10.80	Morrison Co, MN	4.36
Elymus virginicus	Virginia Wild Rye	25.00	3.00	15.00	Houston Co, MN	4.63
Schizachyrium scoparium	Little Bluestem	9.00	1.08	5.40	Clay Co, MN	5.95
Sorghastrum nutans	Indian Grass	2.50	0.30	1.50	Dakota Co, MN	1.32
						35.17

DRY PRAIRIE RESTORATION SEED MIX 1

Storm-1, G2a (3 ACRES)

Scientific Name	Common Name	PLS lbs/ac	Total PLS lbs	Origin	Seeds/SF
Andropogon gerardii	Big Bluestem	0.30	1.11	Dakota Co, MN	1.10
Bouteloua gracilis	Blue Grama	0.25	0.93	Clay Co, MN	3.67
Carex brevior	Plains Oval Sedge	0.18	0.65	Sherburne Co, MN	1.86
Carex molesta	Troublesome Sedge	0.10	0.37	Rice Co, MN	0.92
Cyperus schweinitzii	Schweinitz's Flatsedge	0.10	0.37	Sherburne Co, MN	1.56
Elymus trachycaulus	Slender Wheat Grass	0.60	2.22	Rice Co, MN	1.52
Elymus canadensis	Canada Wild Rye	0.40	1.48	Benton Co, MN	0.76
Eragrostis spectabilis	Purple Love Grass	0.02	0.09	Sherburne Co, MN	2.47
Koeleria macrantha	Junegrass	0.05	0.19	Benton Co, MN	3.21
Schizachyrium scoparium	Little Bluestem	1.00	3.70	Dakota Co, MN	5.51
Sorghastrum nutans	Indian Grass	0.35	1.30	Dakota Co, MN	1.54
Sporobolus compositus	Rough Dropseed	0.20	0.74	Rice Co, MN	2.20
Sporobolus cryptandrus	Sand Dropseed	0.05	0.19	Sherburne Co, MN	3.67
Allium stellatum	Prairie Onion	0.12	0.44	McLeod Co, MN	0.48
Amorpha canescens	Leadplant	0.18	0.65	Dakota & Rice Co, MN	1.03
Asclepias syriaca	Common Milkweed	0.10	0.37	Meeker Co, MN	0.15
Astragalus canadensis	Canada Milk Vetch	0.30	1.11	Lac Qui Parle Co, MN	1.87
Baptisia alba	White Wild Indigo	0.20	0.74	Olmstead Co, MN	0.12
Baptisia bracteata	Cream Wild Indigo	0.10	0.37	Goodhue Co, MN	0.05
Chamaecrista fasciculata	Partridge Pea	0.58	2.13	Houston Co, MN; Allamakee Co, IA	0.57
Coreopsis palmata	Prairie Coreopsis	0.10	0.37	Dakota & Rice Co, MN	0.37
Dalea candida	White Prairie Clover	0.55	2.04	Dakota & Rice Co, MN	3.84
Dalea purpurea	Purple Prairie Clover	0.60	2.22	Dakota & Rice Co, MN	3.31
Drymocallis arguta	Prairie Cinquefoil	0.03	0.11	Dakota & Rice Co, MN	2.53
Echinacea angustifolia	Narrow-leaved Coneflower	0.05	0.19	Renville, Stevens & Yellow Medicine Co, MN	0.13
Helianthus pauciflorus	Stiff Sunflower	0.15	0.56	Kossuth Co, IA	0.22
Helianthus occidentalis	Western Sunflower	0.04	0.15	Kossuth Co, IA	0.21
Liatris aspera	Rough Blazing Star	0.10	0.37	Dakota & Rice Co, MN	0.59
Liatris punctata	Dotted Blazing Star	0.08	0.30	Rice Co, MN	0.21
Lupinus perennis	Wild Lupine	0.05	0.19	Sherburne Co, MN	0.02
Monarda punctata	Spotted Bee Balm	0.08	0.30	Isanti Co, MN	2.64
Oenothera biennis	Common Evening Primrose	0.05	0.19	Faribault Co, MN	1.65
Pseudognaphalium obtusifolium	Sweet Everlasting	0.02	0.06	Isanti Co, MN	5.21
Silphium laciniatum	Compass Plant	0.10	0.37	Dakota & Rice Co, MN	0.02
Solidago rigida	Stiff Goldenrod	0.08	0.28	Rice Co, MN	1.13
Rosa arkansana	Prairie Rose	0.08	0.28	Sherburne & Otter Tail Co, MN	0.02
Solidago nemoralis	Gray Goldenrod	0.02	0.07	Dakota & Rice Co, MN	2.20
Symphyotrichum ericoides	Heath Aster	0.03	0.09	Kossuth Co, IA	1.84
Symphyotrichum laeve	Smooth Blue Aster	0.11	0.41	Dakota & Rice Co, MN	2.22
Symphyotrichum sericeum	Silky Aster	0.05	0.19	Dakota Co, MN	0.48
Tradescantia bracteata	Long-bracted Spiderwort	0.10	0.37	Dakota Co, MN	0.37
Tradescantia occidentalis	Western Spiderwort	0.10	0.37	Clay Co, MN	0.33
Verbena stricta	Hoary Vervain	0.15	0.56	Sherburne Co, MN	1.54
					65.38

DRY PRAIRIE RESTORATION SEED MIX 2

Storm-1, G2a (3 ACRES)

Description	Quantity	# Seeds	/Sq-FT	% Ct	% Wt
Anemone cylindrica (Thimbleweed)	3.700 OZ	148,000	0.9	4.67	1.72
Antennaria neglecta (Prairie Pussytoes)	0.463 OZ	127,188	0.8	4.01	0.21
Asclepias tuberosa (Butterfly Weed)	3.700 OZ	15,910	0.1	0.50	1.72
Brickellia eupatoriodes (False Boneset)	3.700 OZ	81,400	0.5	2.57	1.72
Froelichia floridana (Cottonweed)	1.850 OZ	13,875	0.1	0.44	0.86
Gentiana flavida (Cream Gentian)	7.400 OZ	1,480,000	9.2	46.69	3.44
Lespedeza capitata (Round-headed Bush Clover)	7.400 OZ	70,300	0.4	2.22	3.44
Symphyotrichum oblongifolium (Aromatic Aster)	1.850 OZ	148,000	0.9	4.67	0.86
Symphyotrichum oolentangiense (Sky Blue Aster)	4.625 OZ	323,750	2.0	10.21	2.15
Symphyotrichum pilosum (Frost Aster)	0.185 OZ	25,900	0.2	0.82	0.09
SubTotal	34.873 OZ 2.180 LB	2,434,323		76.79	16.20

Description	Quantity	# Seeds	/Sq-FT	% Ct	% Wt
Bouteloua curtipendula (Side-oats Grama)	11.100 LB	710,400	4.4	22.41	82.51
Carex muehlenbergii (Sand Bracted Sedge)	1.850 OZ	18,500	0.1	0.58	0.86
Stipa viridula (Green Needle Grass)	0.925 OZ	6,938	0.0	0.22	0.43
SubTotal	180.375 OZ 11.273 LB	735,838		23.21	83.80

DRY PRAIRIE RESTORATION ENHANCEMENT SEED MIX -3

G2a (1 ACRE) – AREA UNDER PINE TREES

Scientific Name	Common Name	% of Mix	PLS lbs/ac	Total PLS lbs	Origin	Seeds/SF
Andropogon gerardii	Big Bluestem	3.00	0.30	0.30	Dakota Co, MN	1.10
Bouteloua curtipendula	Side-oats Grama	5.00	0.50	0.50	Pope Co, MN	1.83
Bromus pubescens	Hairy Wood Chess	5.00	0.50	0.50	Stearns Co, MN	1.40
Carex brevior	Plains Oval Sedge	3.00	0.30	0.30	Sherburne Co, MN	3.20
Carex molesta	Troublesome Sedge	3.00	0.30	0.30	Rice Co, MN	2.75
Elymus canadensis	Canada Wild Rye	15.00	1.50	1.50	Benton Co, MN	2.87
Elymus hystrix	Bottlebrush Grass	17.00	1.70	1.70	Benton & Wright Co, MN	4.75
Elymus trachycaulus	Slender Wheat Grass	15.00	1.50	1.50	Rice Co, MN	3.80
Elymus villosus	Silky Wild Rye	20.00	2.00	2.00	Morrison Co, MN	4.04
Schizachyrium scoparium	Little Bluestem	8.00	0.80	0.80	Clay Co, MN	4.41
Sorghastrum nutans	Indian Grass	3.00	0.30	0.30	Dakota & Rice Co, MN	1.32
Ageratina altissima	White Snakeroot	0.50	0.05	0.05	Benton Co, MN	3.31
Agastache foeniculum	Fragrant Giant Hyssop	0.85	0.09	0.09	Benton Co, MN	2.81
Anemone virginiana	Tall Thimbleweed	0.50	0.05	0.05	Fillmore & Houston Co, MN	0.51
Thalictrum dioicum	Early Meadow Rue	0.30	0.03	0.03	Vernon Co, WI	0.08
Symphyotrichum lateriflorum	Calico Aster	0.50	0.05	0.05	Benton Co, MN	4.59
Achillea millefolium	Yarrow	0.35	0.04	0.04	Faribault Co, MN	2.25
						45.01

FUEL LOADING SAVANNA SEED MIX

SV5, (1.6 ACRES)

Scientific Name	Common Name	% of Mix	PLS lbs/ac	Total PLS lbs	Origin	Seeds/SF
Andropogon gerardii	Big Bluestem	5.50	0.66	3.83	Dakota Co, MN	2.42
Bouteloua curtipendula	Side-oats Grama	12.00	1.44	8.35	Pope Co, MN	5.26
Bromus kalmii	Prairie Brome	8.00	0.96	5.57	Dakota Co, MN	2.82
Elymus hystrix	Bottlebrush Grass	6.00	0.72	4.18	Benton & Wright Co, MN	2.01
Elymus villosus	Silky Wild Rye	5.00	0.60	3.48	Morrison Co, MN	1.21
Elymus trachycaulus	Slender Wheat Grass	10.00	1.20	6.96	Rice Co, MN	3.04
Elymus virginicus	Virginia Wild Rye	7.00	0.84	4.87	Houston Co, MN	1.30
Koeleria macrantha	Junegrass	0.75	0.09	0.52	Benton Co, MN	5.79
Sporobolus compositus	Rough Dropseed	2.60	0.31	1.81	Rice Co, MN	3.44
Schizachyrium scoparium	Little Bluestem	23.00	2.76	16.01	Rice Co, MN	15.21
Sorghastrum nutans	Indian Grass	6.00	0.72	4.18	Dakota Co, MN	3.17
Carex blanda	Eastern Woodland Sedge	0.50	0.06	0.35	Rice Co, MN	0.28
Carex molesta	Troublesome Sedge	1.50	0.18	1.04	IEP - Z1 Northern IA	1.65
Carex sprengelii	Long-beaked Sedge	1.00	0.12	0.70	Sherburne Co, MN	0.44
Achillea millefolium	Yarrow	0.10	0.01	0.07	Faribault Co, MN	0.77
Agastache foeniculum	Fragrant Giant Hyssop	0.20	0.02	0.14	Benton Co, MN	0.79
Anemone canadensis	Canada Anemone	0.15	0.02	0.10	Benton Co, MN	0.05
Aquilegia canadensis	Columbine	0.50	0.06	0.35	Kandiyohi Co, MN	0.84
Baptisia alba	White Wild Indigo	0.40	0.05	0.28	Olmsted Co, MN	0.03
Baptisia bracteata	Cream Wild Indigo	0.40	0.05	0.28	Goodhue Co, MN	0.02
Coreopsis palmata	Prairie Coreopsis	0.20	0.02	0.14	Dakota & Rice Co, MN	0.09
Dalea purpurea	Purple Prairie Clover	3.00	0.36	2.09	Dakota & Rice Co, MN	1.98
Dalea candida	White Prairie Clover	2.00	0.24	1.39	Dakota & Rice Co, MN	1.67
Desmodium canadense	Showy Tick-trefoil	1.50	0.18	1.04	McLeod Co, MN	0.36
Gentiana flavida	Creamy Gentian	0.10	0.01	0.07	Allamakee Co, IA	0.62
Liatris aspera	Rough Blazing Star	0.50	0.06	0.35	Dakota & Rice Co, MN	0.35
Lupinus perennis	Wild Lupine	0.40	0.05	0.28	Sherburne Co, MN	0.02
Oenothera biennis	Common Evening Primrose	0.25	0.03	0.17	Faribault Co, MN	0.99
Solidago rigida	Stiff Goldenrod	0.25	0.03	0.17	Rice Co, MN	0.45
Solidago speciosa	Showy Goldenrod	0.25	0.03	0.17	Dakota & Rice Co, MN	1.05
Symphyotrichum lateriflorum	Calico Aster	0.10	0.01	0.07	Benton Co, MN	1.10
Symphyotrichum laeve	Smooth Blue Aster	0.40	0.05	0.28	Dakota & Rice Co, MN	0.97
Veronicastrum virginicum	Culver's Root	0.05	0.01	0.03	Dakota & Rice Co, MN	1.76
Zizia aptera	Heart-leaved Alexanders	0.40	0.05	0.28	Rice Co, MN	0.21

SAND GRAVEL PRAIRIE RESTORATION SEED MIX

SGP-E, SGP-FF (0.6 ACRES)

Scientific Name	Common Name	% of Mix	PLS lbs/ac	Total PLS lbs	Origin	Seeds/SF
Bouteloua curtipendula	Side-oats Grama	15.00	1.50	0.90	Pope Co, MN	5.48
Bromus kalmii	Prairie Brome	5.00	0.50	0.30	Dakota Co, MN	1.47
Carex bicknellii	Bicknell's Sedge	5.00	0.50	0.30	IEP - Z1 Northern IA	3.12
Carex brevior	Plains Oval Sedge	5.00	0.50	0.30	Sherburne Co, MN	5.33
Cyperus schweinitzii	Schweinitz's Flatsedge	2.00	0.20	0.12	Sherburne Co, MN	3.13
Elymus trachycaulus	Slender Wheat Grass	10.00	1.00	0.60	Rice Co, MN	2.53
Eragrostis spectabilis	Purple Love Grass	0.50	0.05	0.03	Sherburne Co, MN	5.14
Koeleria macrantha	Junegrass	1.50	0.15	0.09	Benton Co, MN	9.64
Schizachyrium scoparium	Little Bluestem	15.00	1.50	0.90	Clay Co, MN	8.26
Sporobolus cryptandrus	Sand Dropseed	1.00	0.10	0.06	Sherburne Co, MN	7.35
Achillea millefolium	Yarrow	0.20	0.02	0.01	Faribault Co, MN	1.29
Agastache foeniculum	Fragrant Giant Hyssop	0.50	0.05	0.03	Benton Co, MN	1.65
Allium stellatum	Prairie Onion	2.00	0.20	0.12	McLeod Co, MN	0.81
Amorpha canescens	Leadplant	2.00	0.20	0.12	Dakota & Rice Co, MN	1.18
Asclepias verticillata	Whorled Milkweed	1.25	0.13	0.08	Stearns, Nicollet, & Le Sueur Co, MN	0.51
Astragalus canadensis	Canada Milk Vetch	2.50	0.25	0.15	Lac Qui Parle Co, MN	1.56
Baptisia bracteata	Cream Wild Indigo	1.70	0.17	0.10	Goodhue Co, MN	0.09
Coreopsis palmata	Prairie Coreopsis	0.20	0.02	0.01	Rice Co, MN	0.07
Dalea candida	White Prairie Clover	6.50	0.65	0.39	Dakota & Rice Co, MN	4.54
Dalea purpurea	Purple Prairie Clover	6.75	0.68	0.41	Dakota & Rice Co, MN	3.72
Drymocallis arguta	Prairie Cinquefoil	0.50	0.05	0.03	Dakota & Rice Co, MN	4.22
Echinacea angustifolia	Narrow-leaved Coneflower	2.00	0.20	0.12	Renville, Stevens & Yellow Medicine Co, MN	0.51
Gentiana puberulenta	Downy Gentian	0.10	0.01	0.01	Rice Co, MN	0.18
Helianthus pauciflorus	Stiff Sunflower	1.00	0.10	0.06	Dakota Co, MN	0.15
Heliopsis helianthoides	Common Ox-eye	4.00	0.40	0.24	Dakota Co, MN	0.93
Lespedeza capitata	Round-headed Bushclover	1.00	0.10	0.06	Kossuth Co, IA	0.29
Liatris aspera	Rough Blazing Star	0.60	0.06	0.04	Dakota & Rice Co, MN	0.35
Liatris punctata	Dotted Blazing Star	0.60	0.06	0.04	Rice Co, MN	0.15
Lupinus perennis	Wild Lupine	0.75	0.08	0.05	Sherburne Co, MN	0.03
Monarda punctata	Spotted Bee Balm	1.00	0.10	0.06	Isanti Co, MN	3.31
Oenothera biennis	Common Evening Primrose	1.25	0.13	0.08	Faribault Co, MN	4.13
Pseudognaphalium obtusifolium	Sweet Everlasting	0.10	0.01	0.01	Isanti Co, MN	3.47
Solidago nemoralis	Gray Goldenrod	0.25	0.03	0.02	Dakota & Rice Co, MN	2.75
Solidago missouriensis	Missouri Goldenrod	0.25	0.03	0.02	Sherburne Co, MN	2.34
Symphyotrichum laeve	Smooth Blue Aster	0.50	0.05	0.03	Dakota & Rice Co, MN	1.01
Symphyotrichum sericeum	Silky Aster	0.25	0.03	0.02	Dakota Co, MN	0.24
Tradescantia bracteata	Long-bracted Spiderwort	1.00	0.10	0.06	Dakota Co, MN	0.37
Verbena stricta	Hoary Vervain	1.00	0.10	0.06	Sherburne Co, MN	1.03
Zizia aptera	Heart-leaved Alexanders	0.25	0.03	0.02	Rice Co, MN	0.11
						92.45

APPENDIX B. VEGETATION SURVEYS

DD1-A and G1 VEGETATION SURVEY

Forestry mowed 2017. Sprayed June 2018. Seeded fall 2018. Spot-sprayed weeds 2020. Rx burn and supplemental seeding 2021. Invasive weed control annually since 2022.

FHR Units DD1a, G1a, G1b

Non-native	Seeded	Scientific Name	Common Name	9/4/20	7/8 & 8/19/21	7/13/22	9/9/23	8/2/24	7/24/25
		Graminoids		**3**	**3**	**3**	**5**	**4**	**3**
	x	*Andropogon gerardii*	big bluestem			0.5	0.5	3	3
	x	*Bouteloua curtipendula*	side-oats grama	1	0.5	0.5	0.5		0.5
x		*Bromus inermis*	Smooth brome				0.5	0.5	
		Carex blanda	common woodland sedge		0.5		0.5		
		Carex cristatella	crested sedge			0.5			
x		*Dactylis glomerata*	Orchard grass					0.5	
	x	*Elymus canadensis*	Canada wild rye	2	1	1	1	2	2
	x	*Elymus hystrix*	bottlebrush grass						
	x	*Elymus trachycaulus*	slender wheatgrass		1				
		Elymus virginicus	Virgina wild rye					0.5	
		Eragrostis spectabilis	Purple lovegrass					0.5	0.5
x		*Eriochloa villosa*	hairy cupgrass	1					
x		*Hordeum jubatum*	foxtail barley		0.5				
		Panicum virgatum	switchgrass			1	0.5	3	3
x		*Phalaris arundinacea*	Reed canary grass				0.5	0.5	1
x		*Phleum pratense*	Timothy				0.5		
x		*Phragmites australis subsp. Americanus*	American common reed					0.5	0.5
x		*Poa pretensis*	Kentucky bluegrass		0.5	0.5			0.5
	x	*Schizachyrium scoparium*	little bluestem	1	1	1	1	0.5	1
x		*Setaria pumilla*	yellow foxtail	2	2	1	1	1	0.5
	x	*Sorghastrum nutans*	Indian grass				1	2	2
	x	*Sporobolis heterolepis*	prairie dropseed						
			Total	**5.0**	**8.0**	**8.0**	**11.0**	**12.0**	**11.0**
		Forbs		**3**	**4**	**4**	**4**	**3**	**3**
		Abutilon theoprasti	Velvet leaf						1
		Achillea millefolium	yarrow	1	1		1	1	1
	x	*Agastache foeniculum*	Anise hyssop	0.5				0.5	
		Ageratina altissima	white snakeroot	0.5			0.5	0.5	
	x	*Allium stellatum*	prairie wild onion						
		Ambrosia artemisiifolia	common ragweed		1			1	1
	x	*Amorpha canescens*	lead plant						
		Antennaria neglecta	Field pussytoes						0.5
	x	*Aquilegia canadensis*	columbine						
x		*Arctium minus*	common burdock	0.5	1		0.5		0.5
x		*Artemisia absinthium*	absinthe wormwood			0.5	0.5	0.5	
		Artemisia dracunculus	Tarragon						0.5
	x	*Artemisia ludoviciana*	prairie sage	0.5	0.5		0.5	0.5	1
	x	*Asclepias syriaca*	common milkweed		0.5	0.5	0.5	1	1
	x	*Asclepias tuberosa*	butterflyweed		0.5				

	x	*Asclepias verticillata*	whorled milkweed						
		Aster pilosus	frost aster	1			0.5		
	x	*Astragalus canadensis*	Canada milk vetch		1				
	x	*Baptisia alba*	white wild indigo						
		Barbarea orthoceras	American yellow rocket						1
x		*Berteroa incana*	hoary alyssum	0.5	0.5	1	0.5	1	1
x		*Cannabis sativa*	hemp		0.5				0.5
x		*Carduus nutans*	musk thistle		0.5	0.5		0.5	1
x		*Centaurea stoebe*	spotted knapweed		1		0.5	0.5	0.5
	x	*Chamaecrista fasciculata*	partridge pea	0.5	0.5				0.5
x		*Cirsium arvense*	Canada thistle		2	1	0.5	0.5	1
		Cirsium discolor	field thistle	2	0.5		0.5	0.5	1
x		*Cirsium vulgare*	bull thistle	1					
		Conyza canadensis	horseweed	1					
	x	*Dalea candida*	white prairie clover		0.5	1	0.5		
	x	*Dalea purpurea*	purple prairie clover		0.5				
x		*Daucus carota*	Queen Anne's lace	0.5		0.5	0.5	0.5	
	x	*Desmodium canadense*	Canada tick trefoil				0.5	0.5	0.5
		Erigeron sp	Daisy fleabane	1	0.5			1	1
	x	*Eryngium yuccifolium*	rattlesnake master					0.5	0.5
		Euphorbia corollata	Flowering spurge					0.5	
	x	*Galium boreale*	northern bedstraw		0.5			0.5	
		Hackelia virginiana	Virginia stickseed	2					
	x	*Helianthus maximiliani*	Maximilian's sunflower	1	1	1	1	0.5	0.5
	x	*Heliopsis helianthoides*	ox-eye	1	0.5	1		0.5	0.5
x		*Hypericum perforatum*	common St. Johnswort		0.5	0.5			
	x	*Lespedeza capitata*	round-headed bush clover		1		0.5	0.5	
x		*Leucanthemum vulgare*	shasta daisy		0.5				1
		Liatris aspera	Rough blazing star					0.5	
	x	*Liatris ligulistylis*	northern plains blazing star				0.5	0.5	0.5
	x	*Liatris pycnostachya*	prairie blazing star		0.5				
		Linaria vulgaris	Butter and eggs						0.5
		Lobelia siphilitica	Blue lobelia					0.5	
x		*Lotus corniculatus*	birds-foot trefoil		1	0.5			0.5
x		*Melilotus alba*	white sweet clover	0.5				0.5	1
x		*Melilotus officinalis*	Yellow sweet clover				0.5		1
		Mirabilis nyctaginea	Wild Four O'Clock					0.5	
	x	*Monarda fistulosa*	wild bergamot	1	1	1	1	2	2
x		*Pastinaca sativa*	wild parsnip		0.5	0.5			0.5
	x	*Penstemon grandiflorus*	large-flowered beard tongue						
x		*Potentilla recta*	sulfur cinquefoil			0.5			
	x	*Pycnanthemum virginianum*	Virginia mountain mint			0.5		0.5	1
	x	*Ratibida pinnata*	gray-headed coneflower	2	2	2	2	2	2
	x	*Rudbeckia hirta*	black-eyed susan	2	1	1		1	1
		Rudbeckia triloba	brown-eyed susan					0.5	
x		*Rumex crispus*	curly dock		0.5	0.5		0.5	0.5
	x	*Scrophularia lanceolata*	lance-leaved figwort		0.5	1	0.5		
		Securigera varia	Crown vetch					0.5	0.5
x		*Silene latifolia*	white campion		0.5			0.5	
		Silphium inntegrifolium	Rosinweed				0.5	0.5	0.5
	x	*Silphium laciniatum*	compass plant		0.5		0.5	0.5	0.5
		Sisymbrium altissimum	Tall tumble mustard						1
		Solidago canadensis	Canada goldenrod	3	3	2	2	3	3
		Solidago gigantea	late goldenrod		1				
	x	*Solidago rigida*	stiff goldenrod	1	1		1	1	1

	x	*Solidago speciosa*	showy goldenrod						
		Symphyotrichum ericoides	White heath aster				0.5		
	x	*Symphyotrichum laeve*	smooth aster	1					
	x	*Symphyotrichum novae-angliae*	New England aster				0.5		
	x	*Tradescantia ohiensis*	Ohio spiderwort					0.5	
		Urtica dioica	stinging nettle		0.5			0.5	0.5
x		*Verbascum thapsus*	common mullein	1	0.5	0.5	0.5	0.5	0.5
	x	*Verbena stricta*	hoary vervain	1	1	1	1	0.5	1
		Verbena urticifolia	white vervain	1	0.5				0.5
	x	*Veronicastrum virginicum*	Culver's root					0.5	0.5
		Viola sp	violet	0.5					
	x	*Zizia aurea*	golden alexanders	1	1	1		0.5	0.5
	44		**Total**	**28**	**41**	**23**	**29**	**44**	**45**
			non-native	**6**	**13**	**11**	**11**		
		Woody							
		Lonicera spp.	Invasive honeysuckle						0.5
x		*Rhamnus cathartica*	common buckthorn		0.5		0.5	0.5	
		Rubus ideaus	red raspberry			0.5	1	0.5	0.5
		Rubus occidentalis	black raspberry						0.5
		Quercus bicolor	swamp white oak (regen)				0.5		
x		*Ulmus pumila*	Siberian elm		0.5				0.5
		Parthenocissus quinquefolia	Virginia creeper					0.5	0.5
		Celtis occidentalis	Hackberry					0.5	1
		Quercus macrocarpa	Bur oak					0.5	0.5
		Acer negundo	Boxelder					0.5	
		Vitis riparia	Riverbank grape					0.5	
30			**non-native**	**0**	**2**	**1**	**3**	**6**	**7**

ALL SV UNITS VEGETATION SURVEY

Invasive species control from 2019 – 2025.

FHR SV Units 2011-2025

	Non-native	*Scientific name*	Common Name	All SV 7/24/25	All SV 8/9/24	All SV 9/4/20	All SV 9/10/18
	Groundcover, 0 to 1 m						
		Forbs, vines		**3**	**3**	**4**	**3**
1		*Achillea millefolium*	yarrow	1			0.5
2		*Ageratina altissima*	white snakeroot	1	0.5	1	1
3		*Alliaria petiolata*	garlic mustard	1	0.5		
4		*Allium stellatum*	Prairie wild onion				0.5
5		*Ambrosia artemisiifolia*	common ragweed		0.5		
6		*Ambrosia psilostachya*	western ragweed	1			
7		*Amorpha canescens*	Lead-plant				
8		*Anemone canadensis*	Canada anemone				
9		*Anemone cf cylindrica*	thimbleweed				
10		*Apocynum cannabinum*	dogbane				0.5
11		*Aquilegia canadensis*	Columbine	0.5			
12	X	*Arctium minus*	common burdock	0.5			
13		*Artemisia dracunculus*	Tarragon	1			
14		*Asclepias syriaca*	common milkweed	1			1
15		*Asclepias tuberosa*	butterflyweed				0.5
16		*Asclepias verticillata*	Whorled milkweed	0.5	0.5		
17	X	*Berteroa incana*	hoary alyssum	1	0.5		
18		*Calystegia sepium*	Hedge bindweed	0.5			

19		*Campanula americana*	tall bellflower	0.5			
20	X	*Cannabis sativa*	hemp	0.5	0.5		
21		*Carduus nutans*	Musk thistle	0.5	0.5		
22	X	*Centaurea maculosa*	spotted knapweed		0.5		
23		*Cerastium spp.*	Water chickweed	0.5			
24		*Chenopodium album*	Lamb's quarters	0.5			
25	X	*Chrysanthemum leucanthemum*	oxeye daisy				
26	X	*Cirsium arvense*	canada thistle	1	0.5	2	
27		*Cirsium discolor*	field thistle	1	0.5	1	0.5
28	X	*Cirsium vulgare*	bull thistle				
29		*Circaea canadensis*	Enchanter's nightshade	1			0.5
30		*Convulvus sp*	bindweed				
31		*Conyza canadensis*	Canadian horseweed	0.5			
32		*Coreopsis palmata*	prairie coreopsis				
33		*Dalea purpurea*	Purple prairie-clover				
34		*Desmodium canadense*	Showy Tick Trefoil				
35		*Desmodium glutinosum*	Pointed-leaf Tick-trefoil	0.5			
36		*Euphorbia corollata*	Flowering spurge	0.5			
37		*Eryngium yuccifolium*	Rattlesnake master	0.5	0.5		
38		*Galium aparine*	cleavers				
39		*Galium boreale*	Northern Bedstraw				
40		*Geum aleppicum*	yellow avens				
41	X	*Glechoma hederacea*	creeping charlie	2	0.5	2	1
42		*Grindelia squarrosa*	Gumweed		0.5		
43		*Hackelia virginiana*	Virginia stickseed	2	0.5	1	
44		*Heliopsis helianthoides*	False sunflower	0.5			
45		*Helianthus pauciflorus*	Stiff sunflower				0.5
46		*Helianthus sp*	sunflower				0.5
47		*Hesperis matronalis*	Dame's rocket	0.5			
48		*Houstonia longifolia*	bluet				
49	X	*Hypericum perfoliatum*	common St. Johnswort	0.5	0.5		
50	X	*Iris germanica*	Bearded iris		0.5		
51		*Lactuca canadensis*	Wild lettuce	0.5			
52	X	*Lamium amplexicaule*	Henbit				
53		*Laportea canadensis*	Wood nettle	0.5			
54	X	*Leonurus cardiaca*	motherwort	1	0.5	1	1
55		*Lespedeza capitata*	round-headed bush clover	1	0.5		
56		*Leucanthemum vulgare*	oxeye daisy	0.5			
57		*Liatris ligulistylis*	Mewdow blazingstar		0.5		
58	X	*Linaria vulgaris*	butter and eggs		0.5		
59	X	*Lotus corniculatus*	birdsfoot trefoil	0.5	0.5		
60		*Lupinus perennis*	Wild lupine	0.5			
61	X	*Matricaria matricarioides*	pineapple weed				
62	X	*Medicago lupulina*	black medick				0.5
63	X	*Melilotus alba*	white sweet-clover				
64		*Mertensia virginica*	Virginia bluebells	0.5			
65		*Monarda fistulosa*	bergamot	3	2	2	2
66	x	*Nepeta cataria*	catnip				
67		*Oxalis stricta*	wood sorrel	1			
68		*Parthenocissus inserta*	Virginia creeper	1			
69		*Pastinaca sativa*	Wild parsnip	0.5			
70		*Penstemon grandiflorus*	Large-flowered penstemon				
71		*Physalis virginiana*	Virginia ground cherry	0.5			
72		*Pilea spp.*	Clearweed	1			
73	X	*Plantago major*	plantain				0.5
74		*Polygonatum biflorum*	Solomon's seal				
75		*Polygonum pennsylvanicum*	pink smartweed				
76		*Potentilla sp*	cinquefoil				
77		*Pycnanthemum virginianum*	Mountain Mint				0.5

78		*Ratibida pinnata*	Yellow Coneflower	1	0.5		0.5
79		*Ribes missouriense*	Missouri gooseberry	1			
80		*Rubus ideaus & alleghensis*	raspberry, blackberry	2	1	2	3
81		*Rubus occidentalis*	black raspberry	2	1	2	
82		*Rudbeckia hirta*	Black-eyed Susan	1	0.5		1
83	x	*Rumex crispus*	curly dock	0.5			
84		*Scrophularia lanceolata*	Lance-leaf figwort	0.5	0.5		
85	X	*Silene latifolia*	white campion				
86		*Solidago canadensis*	Canada goldenrod	1	1	3	3
87		*Solidago gigantea*	late goldenrod				1
88		*Solidago graminifolia*	grass-leaved goldenrod				
89		*Solidago rigida*	Stiff Goldenrod				0.5
90		*Symphyotrichum lateriflora*	calico aster			1	
91		*Symphyotrichum novae-angliae*	New England aster				0.5
92		*Symphyotrichum pilosus*	frost aster				0.5
93	x	*Taraxacum officinale*	dandelion				
94		*Teucrium canadense*	Germander	1	0.5		
95		*Tradescantia bracteata*	spiderwort				
96		*Unk forb - perfoliate leaf*					
97		*Unk forb -geranium-like leaf*					
98		*Unk forb-opp lv, long petiole*					
99		*Urtica dioica*	stinging nettle	1			0.5
100	X	*Verbascum thapsus*	common mullein		0.5		
101		*Verbena stricta*	Hoary Vervain	1	0.5		
102		*Verbena urticifolia*	white Vervain	0.5			0.5
103		*Verbascum thapsus*	Mullein	0.5			
104		*Veronicastrum virginicum*	Culver's Root	0.5			0.5
105		*Viola sp.*	violet	2			1
			Total forbs	**57**	**31**	**11**	**28**
		Graminoids		**3**	**3**	**3**	**3**
1	X	*Agropyron (Elytrigia)repens*	quackgrass			1	
2		*Andropogon gerardii*	big bluestem	3	3	2	2
3		*Bouteloua curtipendula*	side-oats grama	0.5	1		
4		*Bromus ciliatus*	Fringed brome		0.5		
5	X	*Bromus inermis*	smooth brome		0.5		
6	X	*Bromus japonicus*	Japanese brome				
7		*Bromus kalmii*	Kalm's brome				
8	X	*Bromus tectorum*	Cheatgrass				
9		*Carex blanda*		2	0.5		
11		*Carex tenera*	(JHusveth ID)				
12		Carex sp - wider than blanda- no fruit					
13		*Elymus canadensis*	Canada Wild Rye	1	0.5	1	
14		*Elymus hystrix*	bottlebrush grass	0.5	0.5		
15		*Elymus virginicus*	Virginia Wild Rye	1			
16		*Panicum virgatum*	Switch Grass		1		
17	X	*Phalaris arundinaceae*	reed canary grass	3	0.5		
18	X	*Phleum pratense*	timothy grass				
19		*Poa palustris*	Fowl bluegrass	0.5			
20	X	*Poa pratensis*	Kentucky bluegrass	2		2	2
21		*Schizachrium scoparium*	little bluestem		0.5		
22	X	*Setaria faberi*	giant foxtail	0.5			2
23	X	*Setaria glauca*	yellow foxtail	0.5			2
24		*Sorghum halepense*	Johnson grass	0.5			
25		*Sorghastrum nutans*	Indian grass	3	2	1	1
			Total gram	**13**	**11**	**5**	**5**
		Woody plants (seedlings, low shrubs)		**2**	**2**		**1**
1		*Acer negundo*	boxelder				
2		*Celtis occidentalis*	Hackberry		0.5		+
3		*Fraxinus pensylvanica*	green ash				+
4		*Juniperus virginiana*	Eastern red cedar	0.5			

5	X	*Lonicera tartarica*	Tartarian honeysuckle	1	1		+
6		*Prunus serotina*	black cherry (native)	1	0.5		1
7		*Parthenocissus quinquefolia*	Virginia creeper				1
8		*Quercus macrocarpa*	bur oak (sdl)	0.5	0.5		+
9		*Quercus rubra*	red oak	0.5			+
10	x	*Rhamnus cathartica*	common buckthorn	0.5	0.5		+
11		*Ribes sp*	Currant/gooseberry				
12	X	*Robinia pseudoacacia*	Black locust	1	0.5		+
13	X	*Rosa multiflora*	Multiflora rose	0.5	0.5		
14		*Rosa sp*	Rose species				+
15		*Ulmus americana*	American elm				
16	x	*Ulmus pumila*	Siberian elm (sdl)				
17		*Vitis riparia*	Wild grapevine	1	0.5		1
18		*Zanthoxylum americanum*	Prickly ash	0.5			
			Total woody	**10**	**8**	**0**	**11**
			Total spp	**80**	**50**	**16**	**44**

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

NATIVE PRAIRIE (SAND GRAVEL PRAIRIE) VEGETATION SURVEYS

	SGP-A		7/24/25	8/8/24	6/21/21
	Scientific name	Common name	Cover Class	Cover Class	Cover Class*
	Graminoids				**4**
1	*Andropogon gerardii*	Big bluestem	2	0.5	1
2	*Bouteloua curtipendula*	Side oats grama	3	1	
3	*Bouteloua hirsuta*	Hairy grama	3		2
4	*Bromus inermis*	Smooth brome		0.5	
5	*Bromus japonicus*	Japanese brome			0.5
6	*Bromus tectorum*	Cheatgrass			2
7	*Carex muhlenbergii*	Muhlenberg's sedge			1
8	*Cyperus schweinitzii*	Schweinitz's flatsedge	0.5	0.5	
9	*Dichanthelium scribnerianum*	Scribner's panic grass	0.5	2	2
10	*Digitaria cognata*	Fall witchgrass			
11	*Elymus canadensis*	Canada wild rye	0.5		
12	*Eragrostris spectabilis*	Purple lovegrass		1	
13	*Heterostipa spartea*	Porcupine grass	1	0.5	1
14	*Koeleria macrantha*	Junegrass	2	0.5	1
15	*Leptoloma cognatum*	Fall Witch-Grass			
16	*Paspalum setaceum*	Hairy beadgrass			
17	*Poa pratensis*	Kentucky bluegrass			2
18	*Schizachyrium scoparium*	Little bluestem	3		2
19	*Sorghastrum nutans*	Indiangrass			1
20	*Sporobolus cryptandrus*	Sand dropseed			1
21	*Sporobolus heterolepis*	Prairie dropseed			
	Forbs				**3**
1	*Achillea millefolium*	Common yarrow		0.5	
2	*Ageratina altissima*	White snakeroot		0.5	
3	*Ambrosia psilostachya*	Western ragweed	3	3	1
4	*Amorpha canescens*	Leadplant	1	0.5	1
5	*Artemesia frigida*	Sagewort	0.5		
6	*Asclepias syriaca*	Common milkweed	0.5	0.5	0.5
7	*Asclepias tuberosa*	Butterfly-weed			0.5
8	*Asclepias verticillata*	Whorled milkweed	2	3	1
9	*Asclepias vidiriflora*	Green milkweed	0.5	0.5	1
10	*Astragalus crassicarpus*	Ground plum		0.5	
11	*Berteroa incana*	Hoary alyssum	0.5	1	2
12	*Centaurea stoebe*	Spotted knapweed		0.5	
14	*Coreopsis palmata*	Prairie coreopsis		0.5	
15	*Dalea purpurea*	Purple prairie clover	0.5	0.5	
16	*Delphinium carolinianum*	Prairie larkspur			0.5
17	*Erigeron strigosus*	Prairie fleabane	1		1
18	*Euphorbia geyeri*	Geyer's spurge			
19	*Hedoma hispida*	Rough false pennyroyal			1
20	*Leonurus cardiaca*	Motherwort		0.5	
21	*Liatris aspera*	blazing star	2		
22	*Liatris punctata*	Blazingstar		1	2
23	*Lithospermum caroliniense*	Hairy puccoon	0.5	1	1
24	*Lithospermum incisum*	Narrow-leaf puccoon		1	1
25	*Medicago lupulina*	Black medick			0.5
26	*Mirabilis nyctaginea*	Wild four o'clock			0.5

27	*Monarda fistulosa*	Wild bergamot	1	0.5	1
28	*Oenothera clelandii*	Cleland's evening primrose		0.5	
29	*Pediomelum esculentum*	Prairie turnip			0.5
30	*Penstemon grandiflorus*	Penstemon	0.5	0.5	1
31	*Physalis heterophylla*	Ground cherry	0.5	0.5	0.5
32	*Pseudognaphalium obtusifolium*	Sweet everlasting		0.5	
33	*Rubus occidentalis*	Black raspberry		0.5	1
34	*Solidago canadensis*	Canada goldenrod	0.5	0.5	2
35	*Solidago nemoralis*	Old field goldenrod	0.5	1	1
36	*Tradescantia bracteata*	Bracted spiderwort	0.5		0.5
37	*Tragopogon dubius*	Goats beard			0.5
38	*Verbascum thapsus*	Mullein		0.5	0.5
	Woody				**2**
1	*Lonicera spp*	Honeysuckle	0.5	0.5	1
2	*Prunus americana*	Wild plum			1
3	*Vitis riparia*	Wild grape			0.5
4	*Quercus macrocarpa*	Bur oak	1	0.5	1
5	*Quercus rubra*	Red oak	1	0.5	
6	*Rhamnus cathartica*	Common buckthorn	0.5	0.5	
7	*Ulmus pumila*	Siberian elm	0.5		1
		Bare soil			1

* Cover Classes for species % vegetation layers: 0.5=0-1%; 1=1-5%; 2=5-25%; 3=25-50%; 4=50-75%; 5=75-100%

Total native grams	**7**	**9**
Total native forbs	**22**	**22**
Total Non-native spp	**85**	**8**

SGP-D		**7/24/25**	**8/8/24**	**2021**	**8/14/18**	**6/3/19**	**8/29/19**	**2019**
	Scientific name	**Common name**	**Cover Class**	**Cover Class***	**Cover Class***	**Cover Class***	**Cover Class***	**Cover Class***	**Cover Class***
	Graminoids				**3**				
1	*Andropogon gerardii*	Big bluestem	1	0.5		2			
2	*Bouteloua curtipendula*	Side oats grama	3	1		1			
3	*Bouteloua hirsuta*	Hairy grama	1	1		2			
4	*Bromus intermis*	Smooth brome	1		1	1			
5	*Bromus tectorum*	Cheatgrass	2	0.5	2	2	3	0.5	3
6	*Carex sp*	sedge					2		2
7	*Carex pensylvanica*	Pennsylvania sedge			1				
8	*Carex muhlenbergii*	Muhly sedge							2
9	*Cyperus schweinitzii*	Schweinitz's flatsedge	0.5	0.5	1	1		0.5	0.5
10	*Dichanthelium scribnerianum*	Scribner's panic grass	0.5	0.5	1		2	1	2
11	*Eragrostris spectabilis*	Purple lovegrass	0.5	1		1			
12	*Heterostipa spartea*	Porcupine grass	2			0.5			
13	*Poa pretensis*	Kentucky bluegrass			1		3	2	3
14	*Schizachyrium scoparium*	Little bluestem	3	1	2	2			
15	*Setaria pumila*	Yellow foxtail		0.5					
16	*Sorghastrum nutans*	Indiangrass				1			
17	*Sporobolus cryptandrus*	sand dropseed						1	1
	Forbs				**3**				

	Ageratina altissima	White snakeroot		0.5					
1	*Ambrosia psilostachya*	Western ragweed	3	3	2	3		2	2
2	*Amorpha canescens*	Leadplant	1	0.5		1			
3	*Artemesia frigida*	Prairie sagewort	0.5	0.5		1			
4	*Asclepias syriaca*	Common milkweed	0.5	0.5	1	1			
5	*Asclepias verticillata*	Whorled milkweed	0.5	2	1				
6	*Asclepias viridiflora*	Green milkweed	0.5		1	1			
7	*Astragalus crassicarpus*	buffalo bean			0.5				
8	*Berteroa incana*	Hoary alyssum	0.5	1		1			
9	*Conyza canadensis*	Canadian horseweed		0.5					
10	*Coreopsis palmata*	Prairie coreopsis		0.5					
11	*Dalea purpurea*	Purple prairie clover	0.5	0.5					
12	*Dalea villosa*	Silky prairie clover		0.5	2	1			
13	*Equisetum arvense*	horsetail			0.5				
14	*Erigeron strigosus*	Daisy fleabane	0.5	0.5	1	1			
15	*Euphorbia dentata*	Toothed spurge			0.5			0.5	0.5
16	*Heterotheca villosa*	Clammy ground cherry		0.5	0.5				
17	*Liatris cf aspera*	rough blazing star	2		0.5				
18	*Liatris punctata*	Blazingstar				1			
19	*Lithospermum caroliniense*	Hairy puccoon		1		1			
20	*Lithospermum incisum*	Fringed puccoon		1	0.5		2	1	2
21	*Mirabilis nyctaginea*	Wild four o'clock			0.5				
22	*Monarda fistulosa*	Wild bergamot	1	0.5	0.5	1			
23	*Penstemon grandiflora*	Penstemon	0.5	0.5	1	1			
24	*Physalis heterophylla*	Ground cherry	0.5			1			
25	*Pseudognaphalium obtusifolium*	sweet everlasting		0.5		0.5			
26	*Sisyrinchium sp*	Blue eyed grass						0.5	0.5
27	*Solidago nemoralis*	Old field goldenrod	2	1	0.5	2	2	0.5	2
28	*Tradescantia bracteata*	Bracted spiderwort	0.5	0.5	0.5		1		1
29	*Tragopogon dubius*	goatsbeard			0.5				
30	*Verbascum thapsus*	Common mullein	0.5		0.5				
	Woody								
1	*Fraxinus pennsylvanica*	Green ash				1			
2	*Juglans nigra*	Black walnut	1	0.5	0.5	1			
3	*Lonicera spp.*	Honeysuckle		0.5					
4	*Prunus serotina*	Black cherry	0.5						
5	*Quercus macrocarpa*	Bur oak	2	0.5	0.5	1			
6	*Rhamnus cathartica*	buckthorn		0.5	0.5				
7	*Vitis riparia*	Wild grape				1			
8	*Ulmus pumila*	Siberian elm	0.5		0.5	1			
	Total native grams			**8**	**4**	**8**			
	Total native forbs			**18**	**18**	**14**			
	Total Non-native spp			**4**	**6**	**4**			

	SGP-F		7/24/25	8/8/24	7/8/21	8/14/18	6/3/19	8/29/19
	Scientific name	Common name	Cover Class	Cover Class*	Cover Class*	Cover Class*	Cover Class	Cover Class
	Graminoids				**4**			
1	*Andropogon gerardii*	Big bluestem	0.5	0.5		1		
2	*Bouteloua curtipendula*	Side oats grama	2	1		1		
3	*Boutelous hirsuta*	Hairy grama	1	1	0.5	2	1	1
4	*Bromus intermis*	Smooth brome		0.5	1	1		
5	*Bromus kalmii*	Prairie brome	2					
6	*Bromus tectorum*	Cheatgrass	0.5	0.5	2	2	2	1
7	*Carex pensylvanica*	Pennyslvania sedge			0.5			1
8	*Cyperus schweinitzii*	Schweinitz's flatsedge				1	0.5	
9	*Dichanthelium scribnerianum*	Scribner's panic grass	1	0.5	2	3	2	2
10	*Digitaria cognata*	Fall witchgrass				1		
11	*Eragrostis spectabilis*	Purple lovegrass		1				
12	*Heterostipa spartea*	Porcupine grass	2		2	1		
13	*Koeleria macrantha*	Junegrass	1	0.5	1	1	2	2
14	*Paspalum setaceum*	Hairy beadgrass				0.5		1
15	*Poa pretensis*	Kentucky bluegrass		0.5	1		2	1
16	*Schizachyrium scoparium*	Little bluestem	2		2	1		
17	*Setaria viridis*	Green Foxtail				1		
18	*Sorghastrum nutans*	Indian grass		0.5				
19	*Sporobolus cryptandrus*	sand dropseed			0.5			1
20	*Sporobolus heterolepis*	Prairie dropseed	2	0.5		1		
	Forbs				**2**			
1	*Ambrosia psilostachya*	Western ragweed	2	3	2	2	1	2
2	*Amporpha canescens*	Leadplant	1		1	1		
3	*Asclepias syriaca*	Common milkweed			1			
4	*Asclepias tuberosa*	butterflyweed				1		
5	*Asclepias verticillata*	Whorled milkweed	2	2	1	1		
6	*Asclepias viridiflora*	Green milkweed		0.5	0.5	1		
7	*Artemisia frigida*	Prairie sagewort	0.5					
8	*Berteroa incana*	Hoary alyssum	1	1				
9	*Conyza canadensis*	Marestail		1		0.5	1	0.5
10	*Corepsis palmata*	Prairie coreopsis		0.5	0.5	1		
11	*Dalea purpurea*	Purple prairie clover	1		1	1		
12	*Dalea villosa*	Silky prairie clover		0.5	0.5	1		
13	*Delphinium carolinianum*	Prairie larkspur				1		
14	*Equisetum sp*	Horsetail		0.5	1	1	1	
15	*Erigeron strigosus*	Daisy fleabane	0.5		0.5	1		0.5
16	*Euphorbia dentata*	Toothed spurge				1		
17	*Hedoma hispida*	rough false pennyroyal			0.5		0.5	1
18	*Liatris aspera*	Rough blazingstar	2	0.5	0.5	1		
19	*Liatris punctata*	Dotted blazingstar			1			
20	*Lithospermum caroliniense*	Hairy puccoon	0.5		1	1		
21	*Lithospermum incisum*	Narrow-leaf puccoon			0.5			
22	*Melilotus alba*	White sweet clover			0.5	1		
23	*Mirabilis nyctaginea*	Wild four o'clock			0.5			

24	*Monarda fistulosa*	Wild bergamot				1		
25	*Oenothera biennis*	Common evening primrose			0.5			
26	*Oenothera clelandii*	Cleland's evening primrose		0.5				
27	*Penstemon grandiflorus*	Penstemon	1	0.5	1	0.5	1	
28	*Physalis heterophylla*	Ground cherry	0.5		0.5	1		
29	*Polanisia jamesii*	James' polanisia			0.5			
30	*Potentilla recta*	Sulphur cinquefoil	0.5					
31	*Pseudognaphalium obtusifolium*	Sweet everlasting		0.5		1		
32	*Rosa arkansana*	Prairie rose			0.5			
33	*Rudbeckia hirta*	Black-eyed susan	0.5					
34	*Securigara varia*	Crown vetch			1			
35	*Solidago missouriensis*	Missouri goldenrod			1			
36	*Solidago nemoralis*	Old field goldenrod	0.5	1		2	2	2
37	*Solidago rigida*	Stiff goldenrod				1		
38	*Tradescantia bracteata*	bracted spiderwort	0.5		0.5		1	
39	*Tragopogon dubius*	Goatsbeard		0.5	0.5	1		
	Woody				**1**			
1	*Celtis occidentalis*	Hackberry				1		
2	*Fraxnus pennsylvanica*	Green ash				1		
3	*Juglans nigra*	Walnut		0.5	1	1		
4	*Prunus serotina*	Black cherry	0.5					
5	*Quercus macrocarpa*	Bur oak			0.5			
6	*Quercus rubra*	Red oak			0.5			
7	*Rhubus occidentalis*	Red raspberry	0.5					
8	*Ulmus pumila*	Siberian elm		0.5				
9	*Zanthoxylum americanum*	Prickly ash			1	1		
		Bare soil			1			
	Total native grams			**8**	**7**	**11**		
	Total native forbs			**12**	**22**	**20**		
	Total Non-native invasive spp			**4**	**6**	**5**		

	SGP-I		**7/24/25**	**8/8/24**	**7/8/21**	**8/14/18**	**6/3/19**	**7/31/19**
	Scientific name	**Common name**	**Cover Class**	**Cover Class**	**Cover Class***	**Cover Class***	**Cover Class**	**Cover Class**
	Graminoids				**4**			
1	*Andropogon gerardii*	Big bluestem	1	0.5	2			
2	*Bouteloua curtipendula*	Side oats grama	2	1		1		
3	*Boutelous hirsuta*	Hairy grama	1	1				
4	*Bromus intermis*	Smooth brome		0.5	1			
5	*Bromus tectorum*	Cheatgrass	2	0.5	2	3	3	4
6	*Carex muhlenbergii*	Muhlenberg's sedge			1			
7	*Cyperus schweinitzii*	Schweinitz's flatsedge	0.5	0.5		1	1	
8	*Dichanthelium scribnerianum*	Scribner's panic grass	1	0.5	2	2	2	1
9	*Eragrostis spectabilis*	Purple lovegrass	1	1				
10	*Heterostipa spartea*	Porcupine grass	2		1			1
11	*Paspalum setaceum*	Hairy beadgrass				1		
12	*Phleum pratense*	Timothy		0.5				

13	*Poa pretensis*	Kentucky bluegrass					0.5	
14	*Schizachyrium scoparium*	Little bluestem	2	1	2	1		
15	*Setaria viridis*	Green foxtail	1	0.5		1		
16	*Sorghastrum nutans*	Indian grass	1					
17	*Sporobolus cryptandrus*	Sand dropseed			1		2	0.5
	Forbs				**2**			
1	*Ambrosia psilostachya*	Western ragweed	2	2	2	2	3	3
2	*Amorpha canescens*	Leadplant			0.5			
3	*Artemesia frigida*	Prairie sagewort	0.5			1		
4	*Asclepias syriaca*	Common milkweed	1		1	0.5	2	0.5
5	*Asclepias verticillata*	Whorled milkweed	1	2	1	1		
6	*Asclepias viridiflora*	Green milkweed	0.5			1		
7	*Asparagus officinalis*	Asparagus	0.5					
8	*Astragalus crassicarpus*	buffalo bean	0.5		1	1		
9	*Berteroa incana*	Hoary alyssum	1	1	0.5	1		
10	*Cannabis sativa*	Hemp		0.5	1			
11	*Carduus nutans*	Musk thistle		0.5	0.5			
12	*Centaurea maculosa*	Spotted knapweed		0.5	1	1		
13	*Cirsium sp*	Thistle				1		
14	*Conyza canadensis*	Marestail		1		0.5	0.5	0.5
15	*Dalea purpurea*	Purple prairie clover	0.5	0.5	1			
16	*Dalea villosa*	Silky prairie clover			1	1		
17	*Erigeron annuus*	Daisy fleabane	1					
18	*Euphorbia virgata*	Leafy spurge	0.5					
19	*Fallopia scandens*	Climbing false buckwheat	0.5					
20	*Liatris aspera*	Rough blazingstar	1	0.5				
21	*Liatris punctata*	Dotted blazingstar		0.5				
22	*Lithospermum caroliniense*	Hairy puccoon		0.5	1	1		
23	*Monarda fistulosa*	Wild bergamot	1	0.5		1		
24	*Nepeta cataria*	Catnip		0.5	0.5			
25	*Penstemon gracilis*	Slender penstemon			0.5	1		
26	*Penstemon grandiflorus*	Large flowered penstemon	0.5	0.5				
27	*Physalis heterophylla*	Ground cherry	1	0.5	0.5	1	0.5	0.5
28	*Polanisia jamesii*	James' polanisia	0.5	0.5	0.5			
29	*Silene csereii*	Balkan Catchfly		0.5			1	
30	*Silene latifolia*	White campion	0.5					
31	*Solidago canadensis*	Canada goldenrod	1			1		
32	*Solidago nemoralis*	Old field goldenrod	1	1				
33	*Tradescantia bracteata*	Bracted spiderwort	0.5		0.5		2	0.5
34	*Tragopogon dubius*	Goatsbeard	0.5			1		
35	*Verbascum thapsis*	Mullein	0.5			1		
36	*Verbena stricta*	Hoary vervain	0.5	0.5				
	Woody				**2**			
1	*Fraxinus pennsylvanica*	Green ash				1		
2	*Juglans nigra*	Black walnut	1	0.5		1		
3	*Lonicera tatarica*	Tatarian honeysuckle	2					
4	*Prunus serotina*	Black cherry	2	0.5				
5	*Quercus ellipsoidalis*	Pin oak		0.5		1		

6	*Quercus macrocarpa*	Bur oak				1		
7	*Quercus rubra*	Red oak	2					
8	*Ribes sp.*	Gooseberry	1	0.5				
9	*Rhamnus cathartica*	Buckthorn	0.5	0.5		1		
10	*Rubus idaeus*	Red raspberry			2			
11	*Rubus occidentalis*	Black raspberry	0.5	0.5	2			
12	*Ulmus pumila*	Siberian elm	0.5			1		
13	*Vitis riparia*	Riverbank grape	0.5					
14	*Zanthoxylum americanum*	Prickly ash	2	0.5	2			
		Bare ground			**2**			
	Total native grams			**8**	**6**	**6**		
	Total native forbs			**14**	**12**	**13**		
	Total Non-native invasive spp			**9**	**8**	**8**		

APPENDIX C. BIRD SURVEY DATA

Bird Species Recorded at Flint Hills Resources Bluff Property, 2009 - 2025

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 - Point count (10 points), 250m apart, 8 minute survey. Totals below are the maximum number from 2 visits in June and include all species seen and heard within and beyond 50m radius.

	Common name	Code	May Bird hikes	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2021	2022	2023	2024	2025	Annual Avg
1	Alder flycatcher							1											1	0.1
2	American Crow	AMCR	x	2	6	4	2	2	1	3	1	2	4	5	5	4	3	1	3	3.0
3	American Goldfinch	AMGO	x	19	9	8	13	5	11	4	8	10	9	17	14	16	16	16	12	11.7
4	American Kestrel	AMKE		2		1									1					0.3
5	American Redstart	AMRE	x	12	5	8	11	13	13	14	19	12	13	14	21	14	20	17	17	13.9
6	American Robin	AMRO	x	7	6	10	7	6	4	5	12	8	3	6	3	7	15	10	15	7.8
7	American white pelican	AMPE	x																	
8	Bald Eagle	BAEA	x										2		1		1			0.3
9	Baltimore Oriole	BAOR	x	5	7	8	4	3	1	2	3	4	7	6	6	1	2	1	3	3.9
10	Barn swallow	BASW	x																1	0.1
11	Barred owl	BAOW				1														0.1
12	Bay breasted warbler	BBWA	x																	
13	Black tern	BLTE	x																	
14	Black-and-white warbler	BAWW	x																	
15	Black-billed cuckoo	BBCU	x												1					0.1
16	Black-capped Chickadee	BCCH	x	2	8	4	7	12	1	4	6	8	2	1	2	2	5	3	7	4.6
17	Black-throated Green Warbler	BTNW	x																	
18	Blackburnian Warbler	BLWA	x																	
19	Blackpoll warbler	BPWA	x																	
20	Blue grosbeak	BLGR	x																	
21	Blue Jay	BLJA	x	4	4	7	5	6	2	1	3	3	5	2	8	3	7	3	3	4.1
22	Blue-gray Gnatcatcher	BGGN	x	5	5	1	5	6	1	3	6	4	2	2	4	3	4	3	6	3.8
23	Blue-headed vireo	BHVI	x						1											0.1
24	Blue-winged warbler	BWWA								1	1									0.1
25	Bobolink	BOBO	x																	
26	Broad-winged hawk	BWHA	x																	
27	Brown thrasher	BRTH	x			1				1	5	1	1						3	0.8
28	Brown-headed Cowbird	BHCO	x	29	10	11	6	11	11	8	14	14	13	7	17	18		10	18	12.3
29	Canada goose	CAGO	x											1					1	0.1
30	Cape May warbler	CMWA	x																	
31	Carolina wren	CAWR	x																	
32	Cedar Waxwing	CEWA	x	4	13	19	10	5	15	10	6	7	7	12	13	3	3	8	7	8.9
33	Chestnut-sided Warbler	CSWA	x																	
34	Chimney swift	CHSW	x				5	3	1	1	2	2	1				4	3	5	1.7
35	Chipping Sparrow	CHSP	x	7	2	2	4	5	5	5	1	2	5	1	2	2	1	3	6	3.3
36	Clay-colored Sparrow	CCSP	x	4	5	2	3	7	5	6	4	6	3	2	2	5	4	1	1	3.8
37	Cliff swallow	CLSW					3													0.2
38	Common Grackle	COGR															3			0.2
39	Common nighthawk	CONI	x																	
40	Common Yellowthroat	COYE	x	1	9	13	10	9	9	10	9	9	11	1	10	7	7	7	8	8.1
41	Cooper's hawk	COHA	x				1					2					1	1		0.3
42	Dark-eyed junco	DEJU	x																	
43	Dickcissel	DICK									2	4			1					0.5
44	Double-crested cormorant	DCCO	x												1					0.1
45	Downy Woodpecker	DOWO	x	1	1	3	1		2	1	3				2	2	3	3	1	1.4
46	Eastern bluebird	EABL	x	4	1	4	4	2	3	3	3	1	1		1	1		4	3	2.2
47	Eastern Kingbird	EAKI	x	1	2	2	2	1			1	2	1		2		2		2	1.2
48	Eastern meadowlark	EAME	x	2				2		1					1		1			0.5
49	Eastern Phoebe	EAPH	x	6	1	2	1			1	1	1								0.9

	Common name	Code	May Bird hikes	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2021	2022	2023	2024	2025	Annual Avg
50	**Eastern Towhee**	**EATO**	**x**	**3**	**3**	**3**	**7**	**5**	**4**	**4**	**6**	**3**	**6**	**4**	**7**	**6**	**7**	**9**	**2**	4.9
51	Eastern wood pewee	EAWP	x	6	4	3	9	5	4	4	4	5	5	4	8	4	8	7	8	5.5
52	European Starling	EUST	x	1		1														0.1
53	**Field Sparrow**	**FISP**	**x**	**7**	**4**	**7**	**10**	**4**	**7**	**10**	**7**	**5**	**7**	**3**	**7**	**7**	**7**	**10**	**4**	6.6
54	**Golden-winged warbler**	**GWWA**	**x**																	
55	**Grasshopper sparrrow**	**GRSP**	**x**																	
56	Gray Catbird	GRCA	x	7	8	4	10	7	6	6	8	12	13	1	11	9	10	12	15	8.7
57	Great Blue Heron	GBHE	x		4		1			1								1		0.5
58	Great Egret	GREG	x	1	20					2		4								1.9
59	Great-crested Flycatcher	GCFL	x	6	3	6	5	6	2		2	2		1	4	2	6	2	9	3.5
60	Hairy woodpecker	HAWO	x	1	1		1		1	1	1	1	3	1		3	2	4	2	1.4
61	Harris sparrow		x																	
62	House Finch	HOFI	x	2							1	1		1		1	3		13	1.5
63	House Wren	HOWR	x	14	12	8	14	15	6	13	15	12	13	13	12	12	13	14		12.4
64	Indigo Bunting	INBU	x	7	6	8	7	5	7	6	7	5	7	5	5	5	8	7	13	6.8
65	Killdeer	KILL	x					1		1		1	2			1	1		1	0.5
66	**Lark Sparrow**	**LASP**	**x**																	
67	Least Flycatcher	LEFL	x							2		1							2	0.3
68	Magnolia warbler	MAWA	x																	
69	Mallard	MALL	x							1									1	0.1
70	Marsh wren	MAWR			4	5		2				2	2			2	2	1	2	1.4
71	Mourning Dove	MODO	x	1		3	1	1		1	1	1	1		1	1				0.9
72	Mourning Warbler	MOWA	x							1										0.1
73	Nashville Warbler	NAWA	x																	
74	Northern cardinal	NOCA	x	7	7	4	6	3	2	3	11	4	4	3	5	5	7	5	1	4.8
75	Northern Flicker	YSFL	x	1	1	2	2		1	1	2	1	1						1	0.9
76	**Northern harrier**	**NOHA**																		
77	Northern parula	NOPA	x																	
78	**Northern Rough-winged Swallow**	**NRWS**	**x**	**1**	**1**	**1**		**2**	**1**		**1**	**6**		**2**	**23**	**2**	**4**	**7**		3.4
79	**Olive-sided flycatcher**	**OSFL**	**x**																	
80	Orange-crowned warbler	OCWA	x																	
81	Orchard oriole	OROR	x		1	2	1	3			3		1				1	1	1	0.9
82	Osprey	OSPR	x																	
83	Ovenbird	OVEN	x	5	1	4	2	3		1	1		2			1	2	1	1	1.5
84	Palm Warbler	PAWA	x																	
85	Pileated Woodpecker	PIWO	x	1			1		1					1	1	1		1	2	0.6
86	Red-bellied woodpecker	RBWO	x			3	1	1	1	1			3	2	3	1	3	1	2	1.4
87	Red-breasted nuthatch	RBNU	x																	
88	Red-eyed Vireo	REVI	x	3	3	3	6	4	2	3	4	3	2		2	5	1	1	5	2.9
89	**Red-headed woodpecker**	**RHWO**	**x**																	
90	Red-tailed Hawk	RTHA	x			1	2				1	1			1			1		0.5
91	Red-winged Blackbird	RWBL	x	3	3	7	4	3	7	13	2	6	2	1	18	8	9	14	8	6.8
92	Ring-billed Gull	RBGU	x																	
93	Ring-necked pheasant	RNPH	x																	
94	Rock pidgeon	ROPI	x																	
95	Rose-breasted Grosbeak	RBGR	x	8	6	3	1	5	4	3	5	5	3	4	5	4	5	3	5	4.3
96	Ruby-crowned kinglet	RCKI	x																	
97	Ruby-throated Hummingbird	RTHU	x	2				2		1	1	1			3		1		2	0.9
98	Sandhill crane	SACR	x										2			2				0.3
99	Savannah Sparrow	SAVS	x																	
100	Scarlet tanager	SCTA	x		1		1	1	1	1					1	1				0.5
101	**Sedge wren**	**SEWR**	**x**		**1**															0.1
102	Sharp-shinned Hawk	SSHA	x	1		1														0.1
103	Song Sparrow	SOSP	x	14	12	6	8	10	10	13	11	13	10	12	10	11	11	8	7	10.4
104	Sora	SORA																1		1.0
105	Swainson's Thrush	SWTH	x																	
106	Swamp Sparrow	SWSP			1	2	1	1	1	1		1	1	1						0.7
107	Tennessee Warbler	TEWA	x																	
108	Tree Swallow	TRES	x	5	3	2	27	1	1	2	1	3	4	3		9	4	4	8	4.8
109	**Trumpeter swan**	**TRUS**																**2**		2.0
110	Turkey vulture	TUVU	x															3		0.2
111	Warbling vireo	WAVI	x	1	2	2	1	2				1			4	1	3	1	1	1.2

	Common name	Code	May Bird hikes	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2021	2022	2023	2024	2025	Annual Avg
112	Western Meadowlark	WEME	x																	
113	White-breasted Nuthatch	WBNU	x		4	2	2	2	1		2	2	2	1	2		3	2		1.7
114	White-crowned sparrow	WCSP	x																	
115	White-throated sparrow	WTSP	x																	
116	Wild Turkey	WITU	x	3					3	2	4	3	2		8		3	2	1	1.9
117	Willow flycatcher	WIFL								1										0.1
118	Wilson's Warbler	WIWA	x																	
119	Wood duck	WODU			6		27	1							6	21	1			4.4
120	Wood thrush	WOTH	x	1			1								4	1				0.5
121	Yellow Warbler	YWAR	x	5	6	4	6	5	8	8	5	10	8	8	18	19	15	13	10	9.3
122	Yellow-bellied Sapsucker	YBSA	x						1		1	1	1	1		1		1	1	0.5
123	Yellow-billed cuckoo	YBCU				1					3	1								0.4
124	Yellow-headed blackbird	YHBL	x												1	2	2	1	1	0.4
125	Yellow-rumped Warbler	MYWA	x																	
126	Yellow-throated vireo	YTVI	x		1		1	4	2	1	2	1	1	4	1	4	3	2	2	1.8
	No. Birds			234	223	209	270	203	170	192	222	220	198	153	289	240	247	236	254	223
	No. Species		111	47	46	48	50	45	42	50	49	52	45	36	49	46	48	49	51	47
	No. new species				3	6	2	2	1	4	1		1	1	2		1	2		
	No. SGCN			6	4	6	4	5	4	5	7	6	4	3	9	5	6	6	5	5

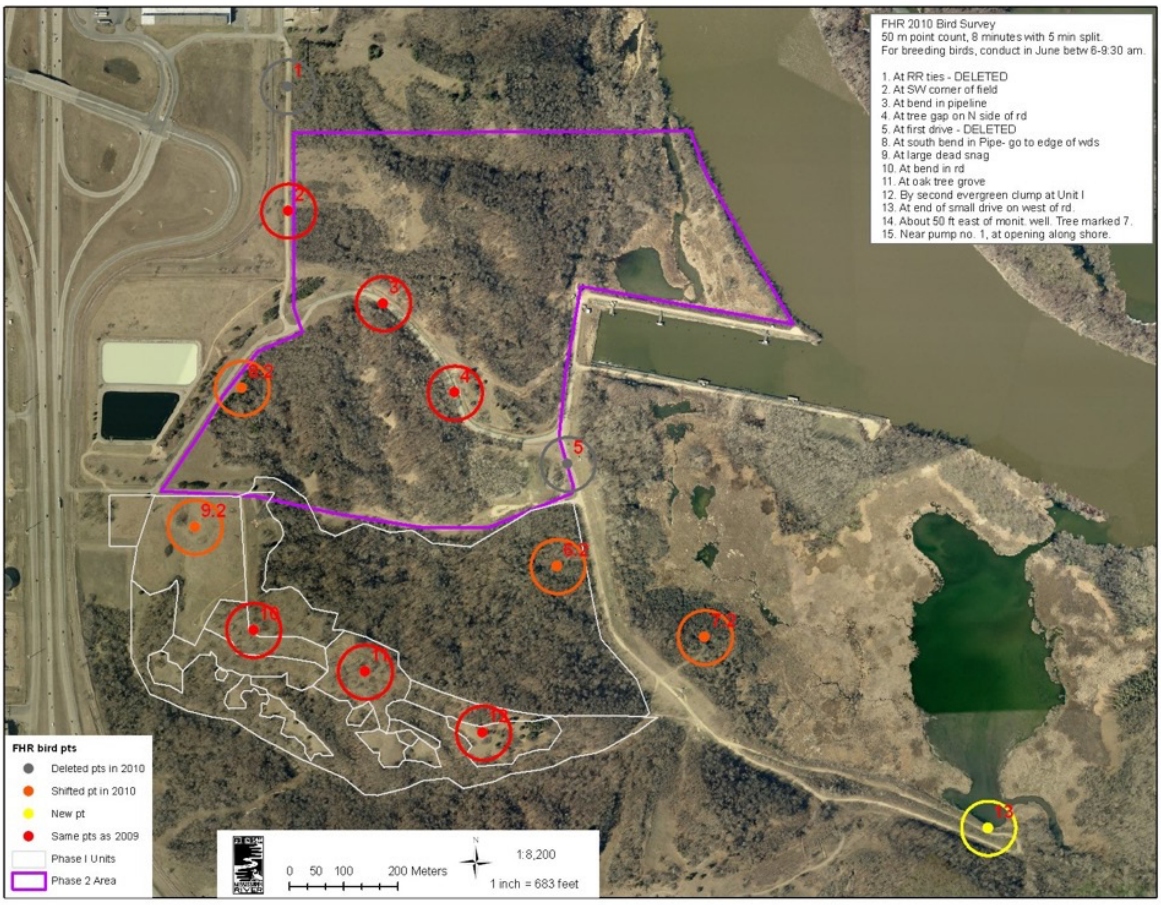


Figure C1. Locations of bird survey points since 2009.

APPENDIX D. POLLINATOR DATA

Table D1. *Bumble bee survey data, Flint Hills Resources Pine Bend Bluffs Property, 2025*

unit_name	unit_type	date	bee_genus_species	Bee abundance	floral_association
Rem1	Remnant	6/4/25	Bombus_auricomus	1	Lithospermum canescens
Rem1	Remnant	6/4/25	Bombus_bimaculatus	1	Penstemon grandiflorus
Rem1	Remnant	6/4/25	Bombus_griseocollis	1	Penstemon grandiflorus
Rem1	Remnant	6/4/25	Bombus_griseocollis	1	
Rem1	Remnant	6/4/25	Bombus_impatiens	1	Penstemon grandiflorus
Rem1	Remnant	7/29/25	Bombus_affinis	2	Monarda fistulosa
Rem1	Remnant	7/29/25	Bombus_auricomus	2	Monarda fistulosa
Rem1	Remnant	7/29/25	Bombus_bimaculatus	7	Monarda fistulosa
Rem1	Remnant	7/29/25	Bombus_citrinus	1	Monarda fistulosa
Rem1	Remnant	7/29/25	Bombus_impatiens	6	Monarda fistulosa
Rem1	Remnant	7/29/25	Bombus_impatiens	1	Teucrium canadense
Rem1	Remnant	8/14/25	Bombus_perplexus	2	Monarda fistulosa
Rem1	Remnant	8/14/25	Bombus_vagans	1	Monarda fistulosa
Rem1	Remnant	9/3/25	Bombus_impatiens	2	Liatris punctata
Rem1	Remnant	9/3/25	Bombus_impatiens	1	Solidago canadensis
Rem2	Remnant	9/3/25	Bombus_impatiens	1	Solidago canadensis
Rem2	Remnant	9/3/25	Bombus_impatiens	1	Ageratina altissima
Rem2	Remnant	9/3/25	Bombus_vagans	1	Solidago canadensis
Rem3	Remnant	7/29/25	Bombus_bimaculatus	2	Monarda fistulosa
Rem3	Remnant	8/20/25	Bombus_citrinus	1	Liatris punctata
Rem3	Remnant	8/20/25	Bombus_griseocollis	3	Liatris punctata
Rem3	Remnant	8/20/25	Bombus_impatiens	3	Solidago canadensis
Rem3	Remnant	9/3/25	Bombus_citrinus	1	Solidago canadensis
Rem3	Remnant	9/3/25	Bombus_fervidus	1	Liatris punctata
Resto1	Restoration	6/4/25	Bombus_flavidus	1	Scrophularia lanceolata
Resto1	Restoration	6/4/25	Bombus_griseocollis	6	Scrophularia lanceolata
Resto1	Restoration	6/4/25	Bombus_impatiens	6	Scrophularia lanceolata
Resto1	Restoration	6/4/25	Bombus_impatiens	1	Thlaspi arvense
Resto1	Restoration	6/4/25	Bombus_impatiens	1	Zizia aurea
Resto1	Restoration	7/28/25	Bombus_auricomus	11	Monarda fistulosa
Resto1	Restoration	7/28/25	Bombus_citrinus	2	Monarda fistulosa
Resto1	Restoration	7/28/25	Bombus_griseocollis	6	Monarda fistulosa
Resto1	Restoration	7/28/25	Bombus_impatiens	23	Monarda fistulosa

Resto1	Restoration	7/28/25	Bombus_vagans	1	Monarda fistulosa
Resto1	Restoration	8/20/25	Bombus_auricomus	23	Monarda fistulosa
Resto1	Restoration	8/20/25	Bombus_auricomus	1	Ratibida pinnata
Resto1	Restoration	8/20/25	Bombus_auricomus	3	Cirsium discolor
Resto1	Restoration	8/20/25	Bombus_bimaculatus	2	Monarda fistulosa
Resto1	Restoration	8/20/25	Bombus_borealis	7	Cirsium discolor
Resto1	Restoration	8/20/25	Bombus_citrinus	3	Cirsium discolor
Resto1	Restoration	8/20/25	Bombus_griseocollis	6	Monarda fistulosa
Resto1	Restoration	8/20/25	Bombus_griseocollis	2	Ratibida pinnata
Resto1	Restoration	8/20/25	Bombus_griseocollis	2	Cirsium discolor
Resto1	Restoration	8/20/25	Bombus_impatiens	19	Monarda fistulosa
Resto1	Restoration	8/20/25	Bombus_impatiens	3	Silphium integrifolium
Resto1	Restoration	8/20/25	Bombus_impatiens	3	Cirsium discolor
Resto1	Restoration	8/20/25	Bombus_vagans	4	Cirsium discolor
Resto1	Restoration	9/3/25	Bombus_auricomus	1	Cirsium discolor
Resto1	Restoration	9/3/25	Bombus_griseocollis	3	Monarda fistulosa
Resto1	Restoration	9/3/25	Bombus_griseocollis	3	Cirsium discolor
Resto1	Restoration	9/3/25	Bombus_impatiens	7	Solidago canadensis
Resto1	Restoration	9/3/25	Bombus_impatiens	3	Solidago rigida
Resto1	Restoration	9/3/25	Bombus_impatiens	1	Monarda fistulosa
Resto1	Restoration	9/3/25	Bombus_impatiens	1	Cirsium discolor
Resto2	Restoration	6/5/25	Bombus_griseocollis	4	Scrophularia lanceolata
Resto2	Restoration	6/5/25	Bombus_griseocollis	1	Rubus idaeus
Resto2	Restoration	6/5/25	Bombus_impatiens	1	Rubus idaeus
Resto2	Restoration	6/5/25	Bombus_impatiens	8	Scrophularia lanceolata
Resto2	Restoration	6/5/25	Bombus_impatiens	1	Glechoma hederacea
Resto2	Restoration	7/28/25	Bombus_auricomus	3	Monarda fistulosa
Resto2	Restoration	7/28/25	Bombus_bimaculatus	1	Monarda fistulosa
Resto2	Restoration	7/28/25	Bombus_griseocollis	4	Monarda fistulosa
Resto2	Restoration	7/28/25	Bombus_impatiens	30	Monarda fistulosa
Resto2	Restoration	8/14/25	Bombus_auricomus	1	Solidago canadensis
Resto2	Restoration	8/14/25	Bombus_griseocollis	1	Monarda fistulosa
Resto2	Restoration	8/14/25	Bombus_impatiens	1	Cirsium discolor
Resto2	Restoration	8/14/25	Bombus_impatiens	9	Monarda fistulosa
Resto2	Restoration	8/14/25	Bombus_impatiens	2	Chamaecrista fasciculata
Resto2	Restoration	8/14/25	Bombus_pensylvanicus	1	Monarda fistulosa
Resto2	Restoration	9/3/25	Bombus_impatiens	7	Solidago canadensis

Table D2. *Butterfly survey data, Flint Hills Resources Pine Bend Bluffs Property, 2025*

unit_name	date	survey_type	butterfly_genus_species	butterfly abundance
Rem 1	2025-06-04	Transect	Coenonymph tullia	1
Rem 1	2025-08-14	Off-transect	Colias eurytheme	1
Rem 1	2025-08-20	Transect	Colias eurytheme	1
Rem 1	2025-08-20	Transect	Colias eurytheme	1
Rem 1	2025-08-20	Transect	Colias philodice	3
Rem 1	2025-07-28	Off-transect	Cupido comyntas	1
Rem 3	2025-08-20	Off-transect	Cupido comyntas	3
Rem 3	2025-08-20	Off-transect	Cupido comyntas	1
Rem 3	2025-08-20	Transect	Cupido comyntas	2
Rem 3	2025-08-20	Transect	Cupido comyntas	1
Rem 3	2025-06-04	Off-transect	Danaus plexippus	1
Rem 3	2025-07-28	Off-transect	Danaus plexippus	1
Rem 3	2025-07-28	Off-transect	Danaus plexippus	1
Rem 3	2025-07-28	Transect	Danaus plexippus	1
Rem 3	2025-07-28	Transect	Danaus plexippus	1
Rem 3	2025-07-28	Transect	Danaus plexippus	1
Rem 3	2025-07-28	Transect	Danaus plexippus	1
Rem 3	2025-07-29	Off-transect	Danaus plexippus	1
Rem 3	2025-07-29	Transect	Danaus plexippus	1
Rem 3	2025-07-29	Transect	Danaus plexippus	1
Rem 3	2025-07-29	Transect	Danaus plexippus	1
Rem 3	2025-07-29	Transect	Danaus plexippus	2
Rem 3	2025-08-14	Off-transect	Danaus plexippus	1
Rem 3	2025-08-20	Off-transect	Danaus plexippus	4
Rem 3	2025-08-20	Transect	Danaus plexippus	1
Rem 3	2025-08-20	Transect	Danaus plexippus	1
Rem 3	2025-08-20	Transect	Danaus plexippus	1
Resto 1	2025-08-20	Transect	Danaus plexippus	1
Resto 1	2025-08-20	Transect	Danaus plexippus	1
Resto 1	2025-09-03	Off-transect	Danaus plexippus	1
Resto 1	2025-09-03	Off-transect	Danaus plexippus	1
Resto 1	2025-09-03	Off-transect	Danaus plexippus	2
Resto 1	2025-09-03	Off-transect	Danaus plexippus	2
Resto 1	2025-09-03	Off-transect	Danaus plexippus	1
Resto 1	2025-09-03	Transect	Danaus plexippus	1
Resto 1	2025-09-03	Transect	Danaus plexippus	3
Resto 1	2025-09-03	Transect	Danaus plexippus	1
Resto 1	2025-07-29	Off-transect	Epargyreus clarus	1

Resto 1	2025-07-28	Off-transect	Papilio cresphontes	1
Resto 1	2025-06-04	Off-transect	Papilio glaucus	1
Resto 1	2025-07-28	Off-transect	Papilio glaucus	1
Resto 1	2025-08-20	Off-transect	Phyciodes tharos	1
Resto 1	2025-08-20	Transect	Phyciodes tharos	1
Resto 1	2025-09-03	Transect	Phyciodes tharos	1
Resto 1	2025-07-28	Off-transect	Pieris rapae	3
Resto 1	2025-07-28	Transect	Pieris rapae	1
Resto 1	2025-07-28	Transect	Pieris rapae	2
Resto 1	2025-07-28	Transect	Pieris rapae	3
Resto 1	2025-07-29	Off-transect	Pieris rapae	1
Resto 1	2025-07-29	Off-transect	Pieris rapae	2
Resto 1	2025-07-29	Off-transect	Pieris rapae	1
Resto 1	2025-07-29	Transect	Pieris rapae	1
Resto 1	2025-08-20	Off-transect	Pieris rapae	1
Resto 1	2025-08-20	Transect	Pieris rapae	1
Resto 1	2025-08-20	Transect	Pieris rapae	1
Resto 2	2025-08-20	Transect	Pieris rapae	1
Resto 2	2025-09-03	Off-transect	Pieris rapae	1
Resto 2	2025-09-03	Off-transect	Pieris rapae	1
Resto 2	2025-09-03	Off-transect	Pieris rapae	3
Resto 2	2025-09-03	Transect	Pieris rapae	1
Resto 2	2025-09-03	Transect	Pieris rapae	1
Resto 2	2025-07-28	Off-transect	Speyeria cybele	1
Resto 2	2025-08-14	Off-transect	Speyeria cybele	1
Resto 2	2025-08-20	Off-transect	Speyeria cybele	2
Resto 2	2025-08-20	Transect	Speyeria cybele	2
Resto 2	2025-06-04	Off-transect	Unknown skipper species	1
Resto 2	2025-06-04	Off-transect	Unknown vanessa species	1