Royal Botanical Gardens CANADA

Environmental Status of Berry Tract South Grassland Restoration Site

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Front cover photo: Scenic view of Berry Tract South - Dundas, Ontario. Photo by Mallory Peirce.

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Document Description

This report from the Natural Lands Department of Royal Botanical Gardens has been reviewed internally. Its contents have not yet been subject to an independent peer review. The report is the first edition of Environmental Status of RBG's Grassland Restoration Sites, with updated versions being produced as needed. It is authorized for release by Royal Botanical Gardens subject to acknowledgment that it is being provided for information purposes only, and that its contents may be subject to revision following independent review. References to other agencies, organizations, or officials do not constitute endorsement of this report by those or any other agency.

Executive Summary

Berry Tract Nature Sanctuary land was expanded in 2016 with the acquisition of a 17-hectare agricultural field property and ravine, almost doubling the size of the Berry Tract property area. The field was the focus of habitat restoration for grassland habitat and in support of the declining broader availability of this habitat type. The field also contains the headwaters of several creeks flowing to Cootes Paradise Marsh. In Ontario meadows/grasslands exist primarily as habitats in transition after disturbance. Disturbance events can range from abandoned agricultural practices, overgrown pastureland, to fires or large-scale windstorm events. Currently, nearly 99% of native grassland habitat across the continent has been destroyed. The lack of grassland habitat makes RBG's grassland restoration sites some of the most unique and important habitat in the Hamilton area for the Biodiversity Action Plan.

Starting in 2017 native grassland seed mix was installed into the field including 31 native grasslands species. In addition, three ponds were added to assist in general recovery of amphibian habitat lost to landscape drainage for agriculture. Early plant community restoration results were challenged by the extent of invasive weed species particularly common dandelion. Over time as the plant community has matured a shift to a plant community dominated by native grass and wildflowers has occurred and has brought about the presence of multiple grassland specific butterflies and birds.

As of 2025 plant monitoring results found 31 species just within the four monitoring plots. This included 7 species of grasses, and 24 species of wildflowers (forbs), with both Big Bluestem and Yellow Savannah Grass emerging as notable species although still uncommon. Early success with native rye grass, particularly Virginia Rye are subsiding with these grasses all part of the original seed mix. The most abundant species at about 30% of the plant cover is goldenrod, a native species not actively seeded in. Small grass species that couldn't be identified at the time of monitoring are also abundant, as is a typical small non-native weed Black Medick. Bare soil continues to exist in significant patches despite no agricultural activity since 2016 and non-native forbs are abundant indicating substantial plant succession has yet to occur with the historical effects of agricultural still affecting the site. Native species plant cover has increased from 39% in 2019 the first year of formal monitoring to 68% in 2025.

Bird and butterfly monitoring found a diversity of species including some grassland habitat specific species. 24 species of birds have been encountered during the June monitoring with most years averaging 17 species. The most common species are Red-winged Blackbirds, Tree Swallows, Bobolink and Song Sparrows, a dramatic change from the first year (2017) when European Starting's represented 45% of the birds encountered. The highlighted of the site is the early establishment of Bobolink (Threatened). This informed the choice to subsequently not allow public access to this area consistent with this species recovery strategy. This species population as well as overall bird numbers has since declined at the site consistent with general trends for grassland specialist birds. However unofficial visitor trails have also appeared within the site. Butterfly monitoring has found 19 species over time but has noted a declined to 12 species in the most recent monitoring. The species list and abundance has dramatically increased and included a transition to native species with the Common Wood Nymph as the most abundant. This also includes the appearance of Monarch Butterfly. Originally in 2017 non-native Cabbage White was most of the butterfly species encountered in monitoring.

Overall, when compared to the other grassland sites at Princess Pt and Rock Chapel, Berry Tract has similar although often slightly lower diversity and abundance of plants, birds and butterflies, but does include unique species. The site continues to have several environmental stewardship challenges. Invasive plant species continue to seed in, particularly Common Buckthorn, Queen Anne's Lace and non-native grass species and Black Locust has taken hold in one corner and will require dedicated management. Challenges also continue with the desire for public access and use, particularly as the field is a south facing slope hillside set into the Niagara Escarpment with spectacular view of Cootes Paradise.

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Introduction

Royal Botanical Gardens stewards approximately 50 hectares of grassland habitats across its nature sanctuaries, 45 of which are actively managed to ensure these meadows, prairies, and savannahs thrive. Historically, before North America was colonized by European settlers, grassland habitat spanned nearly 162 million hectares (Samson and Knopf 1994). Currently, nearly 99% of native grassland habitat across the continent has been destroyed. The lack of grassland habitat in North America makes RBG's grassland restoration sites some of the most unique and important habitat in the Hamilton area and a key supporting area to City of Hamilton's new 2024 Biodiversity Action Plan.

Berry Tract South is a 17-hectare meadow, part of RBGs Berry Tract property nestled between the Niagara Escarpment and Cootes Paradise and contributing to the restoration of grassland habitat. Several small springs and ephemeral creeks pass through/ originate in the site forming head waters of three creeks flowing to Cootes Paradise Marsh, including Mink Brook, Long Valley Brook, and Hickory Brook. A recently retired farm field, the site contains gentle rolling topography bordered by a network of residences and a neighbouring woodland split between Halton Conservation Authority's Cartwright Nature Sanctuary which is stewarded by both Halton Conservation Authority and Hamilton Naturalists' Club and RBG's Berry Tract.

The property was acquired to increase conservation lands within the Cootes to Escarpment EcoPark and build connectivity between the Niagara Escarpment and Cootes Paradise Nature Sanctuary. Agricultural practices ceased at the site at the end of 2016 the year after RBG acquired the property, with a grassland restoration project initiated in 2017. Extensive invasive species control and streambank restoration occurred in 2016, followed by generous native prairie seeding and cover cropping (oats) using machinery in 2017. This involved seeding the field with assistance of a local farmer/equipment and 200kg of seed purchased from St. Williams Nursery and Ecology Centre and included 31 species of native wildflowers (forbs) and grasses (see Appendix for species list), with funding from Hamilton Community Foundation Depressional wetlands were added in 2018 and 2020. Berry Tract South remains secluded from visitors, as no formal trail system runs through the site. This allows the restoration work to progress relatively undisturbed and protects ground-nesting birds and other cryptic wildlife species using the property.

Long before European contact, and still today, grasslands are a vital component of Indigenous Peoples' lives as these habitats provide both medicine and sustenance. In some cases, grasslands were intentionally managed by Indigenous Peoples using fire to maintain brush and increase browse for ungulates (Black et al.1999 and Turner 1999). Indigenous-led low-impact agriculture of native species in North America is one example as to how natural and human-induced disturbance have occurred at grassland sites across North America for thousands of years.

Native meadows exist primarily as temporary habitats in transition after disturbance. Disturbance events can range from abandoned agricultural practices, overgrown pastureland, to fires or large-scale windstorm blow down events. Meadows typically contain high levels of goldenrods and asters but can quickly transition once shrubs and trees begin establishing. Meadow maintenance is achieved through occasional mowing when woody species begin to overwhelm the ecosystem. Grass and wildflower ratios are completely opposite to tallgrass prairies in that 70% of the vegetation is comprised of wildflowers and 30% native grasses. With a higher percentage of wildflower presence in meadows, they are key habitats for nectar-loving wildlife, such as bees and butterflies.

Tallgrass prairie habitats, a unique subcategory of grasslands are primarily composed of deep-rooted native grass species and wildflowers that can withstand disturbance (i.e. grazing or fire) and generally unfavourable growing conditions (i.e. drought). Prairies are considered climax communities and therefore can remain established and robust for many years. Fire is a key component of prairies, controlling not only

woody and non-prairie plants, but also by stimulating growth and regeneration of prairie-adapted species. Conceptually, the primary difference between meadows and prairies is the ratio of grass to wildflowers. Prairies contain higher ratios of grass– typically 70% native grasses and 30% native wildflowers.

On the landscape level, grasslands are vital pieces in the ecological matrix and as a tool in combating climate change and dryer conditions. Densely and deeply rooted plants store nearly 90% of their carbon underground and assist with soil stabilization (Bai and Cotrufo, 2022). Overall, grasslands store approximately 34% of the world's terrestrial carbon stock, thus playing a vital role in carbon sequestration (Bai and Cotrufo, 2022) and making them superior carbon sinks in comparison to forests (Seastedt and Knapp, 1993). Through their roots, grassland species help to build a robust and healthy soils with diverse microbial communities, which assist in nutrient cycling. The dense plant community in grasslands is a vital asset in water management on the landscape primarily through reducing runoff during major melts and storms and increasing water infiltration. All in all, grasslands are an important habitat type and have climate-mitigating factors that can maintain and improve regional ecological integrity and biodiversity.

These habitats are currently threatened through the presence of invasive species, climate change, and succession to forest. To prevent succession, a key aspect of grassland habitat maintenance is introducing disturbance to the ecosystem through options such grazing, fire, drought, or flooding. RBG's preferred management techniques are controlled burns and mowing. These methods also reduce competition from non-native and invasive species, allowing native species to flourish.

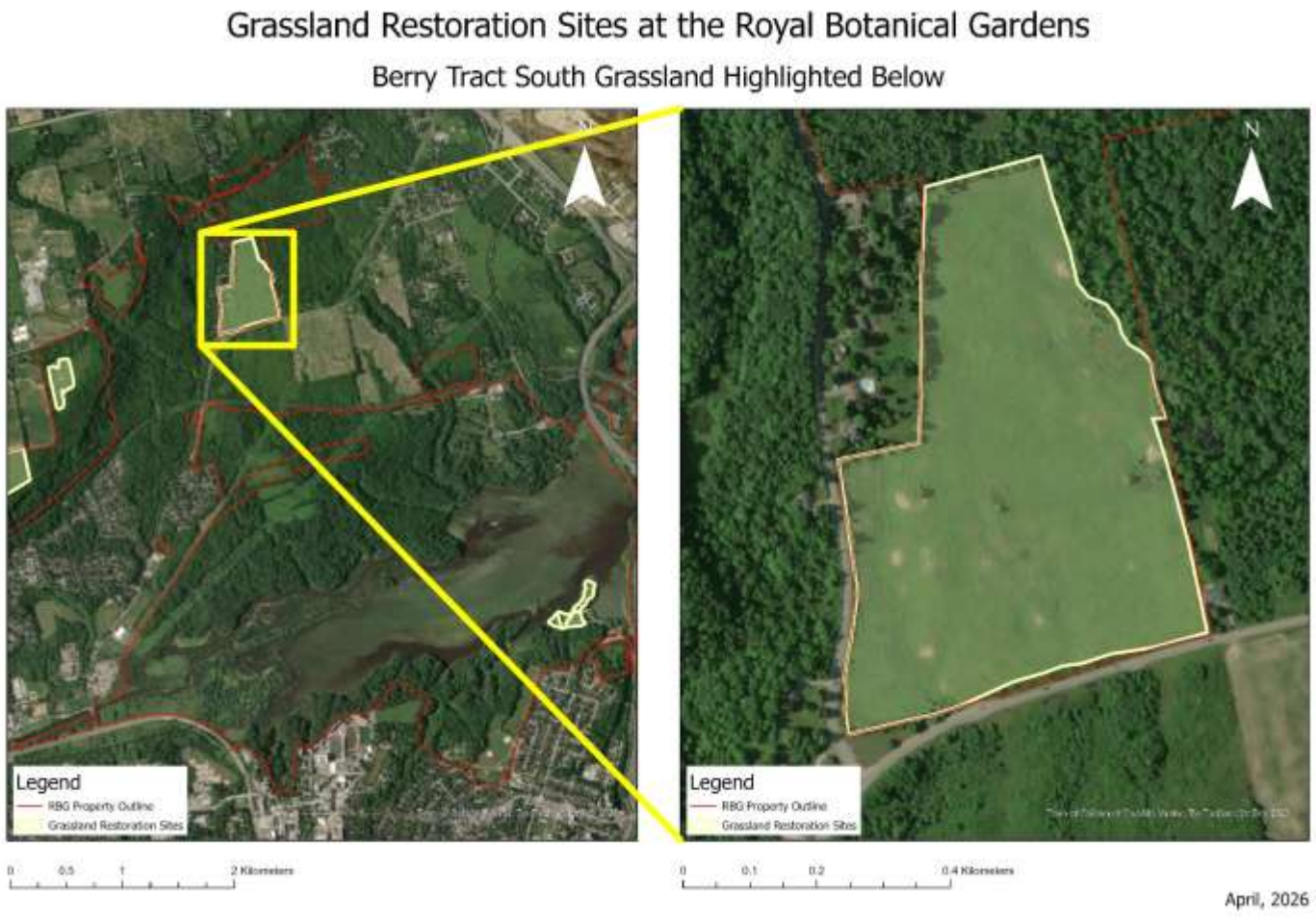
RBG stewards three areas of grassland habitat across its nature sanctuaries, all of which have specific ecological end goals. Each of three sites represent relatively recent restoration projects, converting sites from other land uses. The three areas include Princess Point at Cootes Paradise, Rock Chapel escarpment plateau lands, and Berry Tract along the south facing slope of the escarpment. This report focuses on the restoration outcomes at Berry Tract field following property acquisition in 2016, a site with the specific goal of being relatively undisturbed grassland habitat.

Methods

This report includes data collected through vegetation monitoring and bird monitoring index surveys, of which the methods for each are transcribed below. Four vegetation monitoring plots exist at Berry Tract South and have been monitored since 2019. Both bird and butterfly monitoring has occurred at Berry Tract South since 2017 with bird monitoring including a single grassland site, while butterfly monitoring is a transect through the meadow. The methodology for each monitoring program is outlined below.

Site Description

Berry Tract South is a 17-hectare meadow, part of RBGs Berry Tract property nestled between the Niagara Escarpment and Cootes Paradise and contributing to the restoration of grassland habitat. Several small springs and ephemeral creeks pass through/ originate in the site forming head waters of three creeks flowing to Cootes Paradise Marsh, including Mink Brook, Long Valley Brook, and Hickory Brook. A recently retired farm field, the site contains gentle rolling topography bordered by a network of residences and a neighbouring woodland split between Halton Conservation Authority's Cartwright Nature Sanctuary which is stewarded by both Halton Conservation Authority and Hamilton Naturalists' Club and RBG's Berry Tract property. The meadow is downslope from the escarpment talus and surface soils are principally clay and clay loam. Three ephemeral ponds were re-excavated into clay of the old field associated with the Long Valley Brook ephemeral creek. The southern edge is York Rd and heavily travel transportation route between the town of Dundas and Hwy6/Hwy 403



Vegetation Monitoring

Vegetation monitoring in RBG's grassland restoration sites occurs during the peak growing season on an annual basis. Princess Point is monitored annually, and Monarch Meadows and Berry Tract South are monitored biennially. Vegetation monitoring in Princess Point's prairie began in 2009, and plots in Princess Point's savannah have been monitored since 2003. Monitoring efforts began at Berry Tract South in 2019, and at the escarpments Monarch Meadows in 2022. Since that time, a robust monitoring regime has been implemented.

For the purposes of this report, four unique grassland locations will be discussed: Princess Point Prairie (seven monitoring plots), Princess Point Savannah (three plots), Berry Tract South (four plots), and Monarch Meadows (three plots). Restoration timelines vary amongst sites, resulting in datasets containing unequal amounts of data.

At each monitoring plot, four methods of data collection are conducted to ensure an accurate representation of the vegetation community is captured: quantitative photo monitoring, quadrat sampling, plot dominance, and transect monitoring.

Quantitative Photo Monitoring

Photo monitoring stations occur in each monitoring plot at both monitoring posts (labelled "a" and "b") set 10 metres apart. Incorporating a "density board" (placed at the opposite monitoring post), photographs are taken in both directions (i.e. from post "a" to post "b" and vice-versa). Photo-documentation is a vital tool to visually track changes in plant diversity, density, and height, and is usually the first data collected at a monitoring station to avoid inadvertently trampling vegetation in and around the posts. The following parameters are required to ensure consistency from year to year:

1. Density board dimensions measure 2.5m tall by 0.3m wide, with alternating black-and-white bands measuring 0.5m in height.
2. At each post, the camera or phone is held at 1.4m off the ground and must include as much land area as possible.
3. Density board must be centred in view finder, both left and right, and top to bottom.
4. The data collector records the estimated percentage of area in each band covered by vegetation while holding their head at 1.4m above ground.
5. The process is repeated at the opposite post.

Transect Data

Each monitoring station has a transect that runs between posts "a" and "b". The transect line is tied at both posts, 0.5m above ground. Species touching the transect line (moving from one post to the other) are recorded in order of occurrence. This data is usually collected second so that observers don't inadvertently trample vegetation as they move around the monitoring station.

Quadrat Sampling

Quadrat sampling occurs at both monitoring posts in each monitoring station.

1. A square 1m x 1m quadrat is placed at equidistance around each monitoring post, with the post in the centre of the quadrat. The side closest to the opposite post must be perpendicular to the hypothetical line between the two posts.
2. Each species with their stem growing within the plot is counted and their associated percent cover (how much physical space the species occupies) is estimated. If a plant is growing outside of the

plot, but leans over the three-dimensional space of the quadrat, then the percent cover is estimated only.

Plot Dominance Data

1. The top five (or maximum number in each layer) dominant species are recorded in each structural layer (canopy, shrub, and herbaceous) in the immediate area surrounding the plot.
2. The three structural layers exist within the boundary between plots “a” and “b” at each monitoring station, although some layers may be data deficient (i.e. lacking canopy cover).

Bird Monitoring Protocol

Monitoring Sites

Monitoring was initiated originally to correspond with forest monitoring plots which undergo additional vegetation assessments under RBG’s Long-term Forest Monitoring Program initiated in 2008. The same protocol was transferred to the Grasslands with a single monitoring site at Berry Tract South. The original program purpose was to assess the impact of Btk application to control Spongy Moth outbreaks, but surveys have since evolved to represent the status of terrestrial birds at RBG. Together, the monitoring plots are scattered amongst RBG’s nature sanctuaries. The bird monitoring plot at Berry Tract South has been monitored since 2018 with addition sites at other grassland locations.

Point Count Surveys

The 2025 sampling window ranged from June 6th- July 2nd and all plots were visited twice. Point count methodology was based on protocols set by the Ontario Breeding Bird Atlas (OBBA, 2001). The time of day during which a given plot was visited was intentionally varied during repeat visits to eliminate biases associated with time-of-day bird activity levels. A five-minute period of silence upon arrival at the site allowed for nearby birds to adjust to the disturbance caused by surveyors. This time was also used to record the appropriate site information on the monitoring sheet, including the date, time, study plot code, temperature (°C), percent cloud cover, wind strength (Beaufort scale), surveyors present, noise code (with “1” meaning very low noise level and “5” being extremely loud), and other relevant notes. A compass on a smartphone was used to orient the field data sheet towards magnetic north.

Following this time of silence was a ten-minute period where all species detected by song/call or visual observation within a 100-metre circular radius from the centre of the plot were recorded. Identification aids and other equipment were used at this time. In rare instances a smartphone could be used to make audio recording of the call of a rare and/or unknown bird.

On the data sheet, species were mapped out on a circle, where the centre represented the data recorder, and the edge of the circle represented the plot boundary. Species were placed in the circle based on their direction and approximated distance from the surveyors. If several individuals could be heard, surveyors assumed that multiple birds of the same species were calling only if they were consistently heard calling from distinctly different points (or at the same time). Any species which were visually confirmed were marked with a “v” on the data sheet. Notes were made on breeding behaviour of observed birds and if any nests were present. For more information on Methodology and associated data-collecting biases, please review the Data Collection section in Hamilton (2023).

Butterfly Monitoring Protocol

Since 2017, butterfly index monitoring has occurred at Berry Tract South during the month of July by a team of RBG staff and volunteers. A complete sweep of the site is done between the hours of 10:00am and 3:00pm, where every individual butterfly is counted. Essentially a long transect of about 1.5km.

Butterfly species that can be easily identified without handling are counted, but certain species are generally netted and identified in petri dishes with the aid of a field guide.

Results

Vegetation Monitoring

Species Richness and Abundance

Abundance

In 2020, the most abundant species during quadrat surveys was Common Dandelion which accounted for 27% of all observations, followed by Queen Anne's Lace (16%), Black Medick (14%), Frost Aster (12%), and American Willow-herb (11%) (Figure 1). All other species accounted for 20% of all observations. A notable amount of bare earth was present in 2020 continues to exist within the quadrates to 2025.

During the most recent sampling season, Tall/Canada Goldenrod was the most abundant species, accounting for 25% of all observations, followed by Black Medick (15%), Common Dandelion (11%), Cow Vetch (9%), and White Sweet Clover (5%) (Figure 1). All other observations accounted for 35% relative abundance. Tall/Canada Goldenrod was not among the species seeded into the field during restoration.

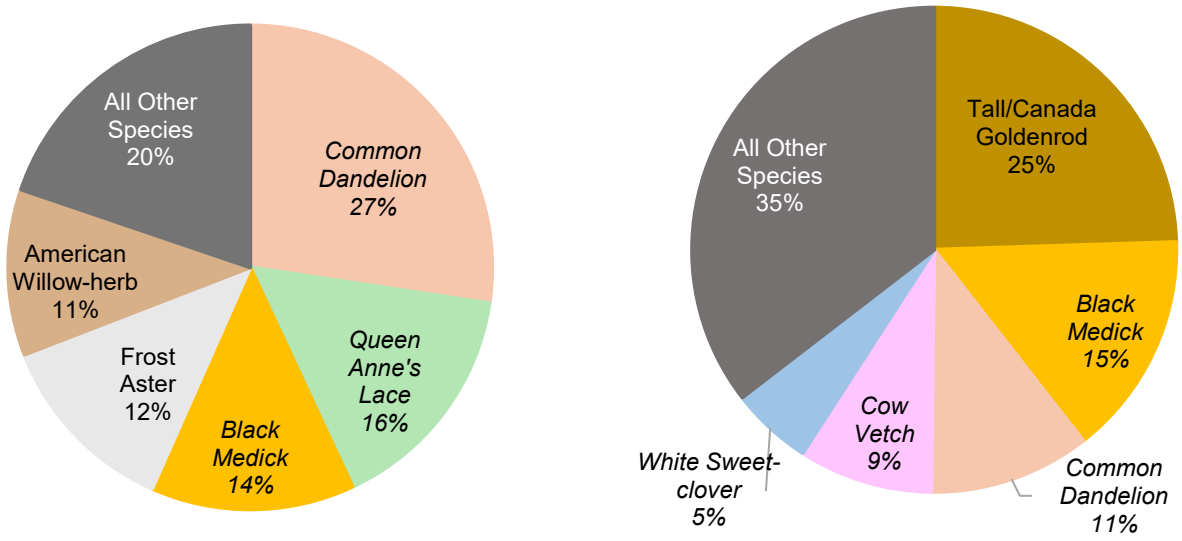


Figure 1. Relative abundance of the top five most abundant species (quadrat surveys) observed during vegetation monitoring at Berry Tract South in 2020 (left) and 2025 (right). Non-native species are italicized.

Relative Cover

In 2019, non-native Common Dandelion had the highest relative cover (22%) during quadrat surveys, followed by Virginia Wild Rye (10%), non-native Queen Anne's Lace (10%), American Willow-herb (9%), and non-native Redtop Grass (8%) rounding out the top five species with the highest relative cover (Figure 2). All other species accounted for the remaining 41% of vegetation cover.

A shift in the top five species with the greatest coverage occurred in 2025 when combined Unknown Non-native Grass species accounted for 35%, followed by Tall/Canada Goldenrod (29%), non-native Cow Vetch

(6%), non-native Common Dandelion (5%), and Lance-leaved Aster (3%) (Figure 2). All other species accounted for 22% of all observations.

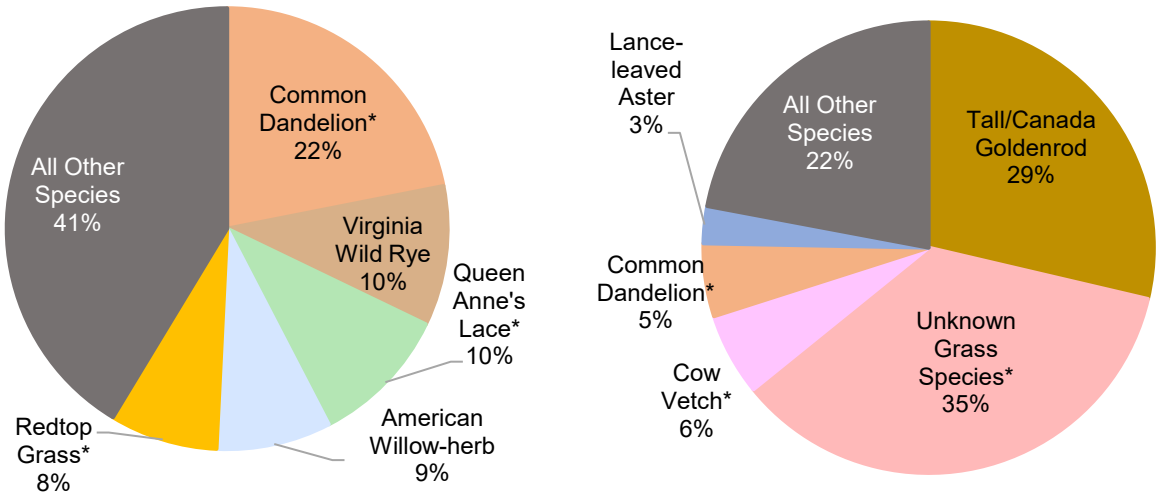


Figure 2. Relative cover of the top five species (quadrat surveys) in 2019 (left) and 2025 (right) at Berry Tract South. Non-native species indicated with an asterisk*.

Species Richness

Species richness at Berry Tract South can be examined using two different pools of data collected during vegetation monitoring. Both sets of data display relatively stable species richness, but the difference in total species observed varies (Figure 3). For instance, species richness collected during quadrat surveys has hovered between 26 species (2020) and 31 species (2025), whereas transect data has produced lower total values, ranging from 19 species (2020 and 2025) to 22 species (2021). The greatest difference in quadrat versus transect data occurred in 2025.

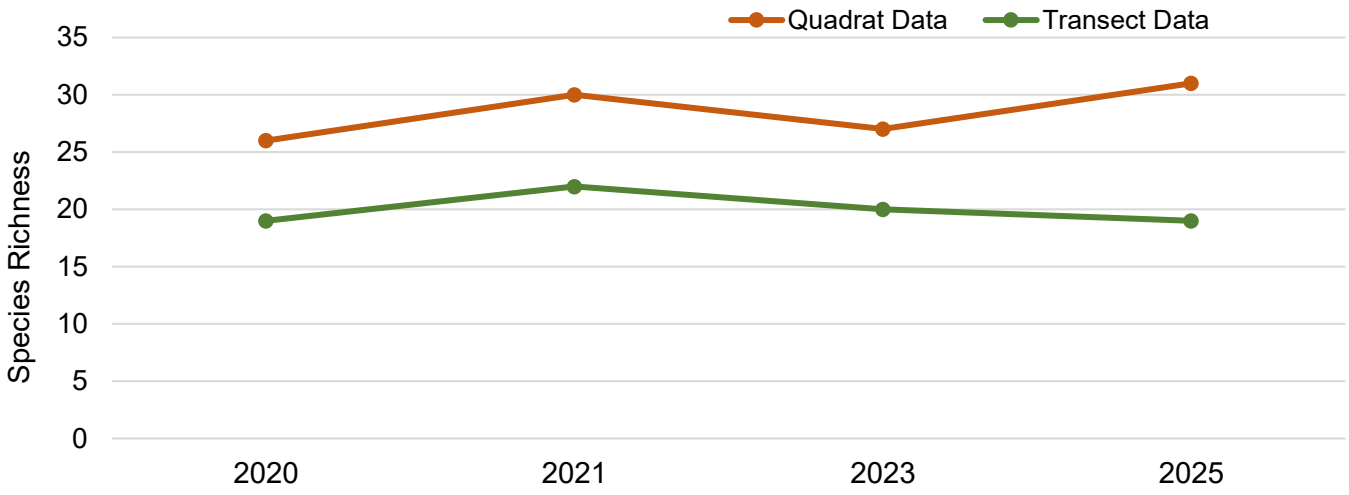


Figure 3. Species richness over time at Berry Tract South comparing data collected during quadrat surveys and transect surveys over time.

Grass Species

Abundance

Early to mid-successional native grasses, Canada Wild Rye and Virginia Wild Rye, are both well-established at Berry Tract South, with various rye grass species part of the original restoration seed mix.

Relative abundance of Virginia Wild Rye increased steadily from 2020 to 2023, with a decline of nearly 1% occurred in 2025 (Figure 4). Canada Wild Rye hovered from 0.7% relative abundance in 2020 and increased to 1.1% in 2021 but has since dropped back to 0.8% in 2025. Big Bluestem has increased rather steadily from 0.2% relative abundance in 2020 to 1% in 2025. Switchgrass was not detected in 2020 but has been recorded in each monitoring session since, but it has not yet crossed 1% relative abundance.

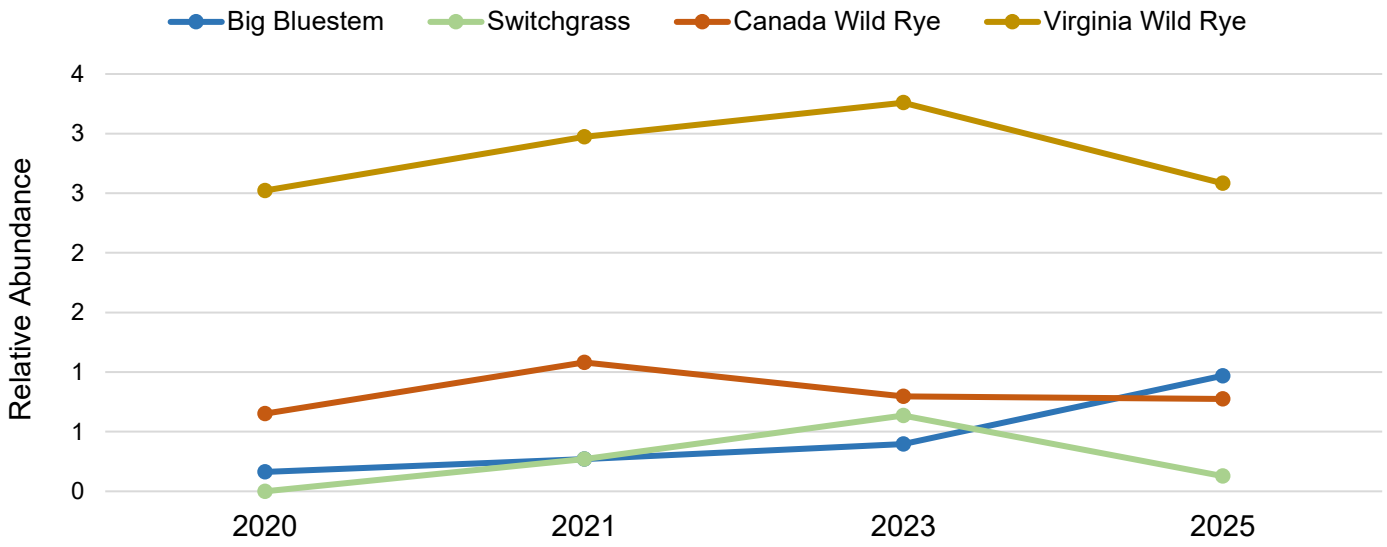


Figure 4. Relative abundance of native grass species in quadrat monitoring at Berry Tract South from 2020 to 2025.

Relative Cover

Seed in native tallgrass species have yet to prosper at Berry Tract South, and each species have only ever accounted for less than 2% relative cover during quadrat surveys (Figure 5). Both Big Bluestem and Switchgrass were first detected in 2020 and have increased in cover over time but have both experienced declines since cover peaked in 2023 and 2021, respectively. 2025 was the first monitoring season when Yellow Savannah Grass was detected, but at very low relative cover (0.3%).

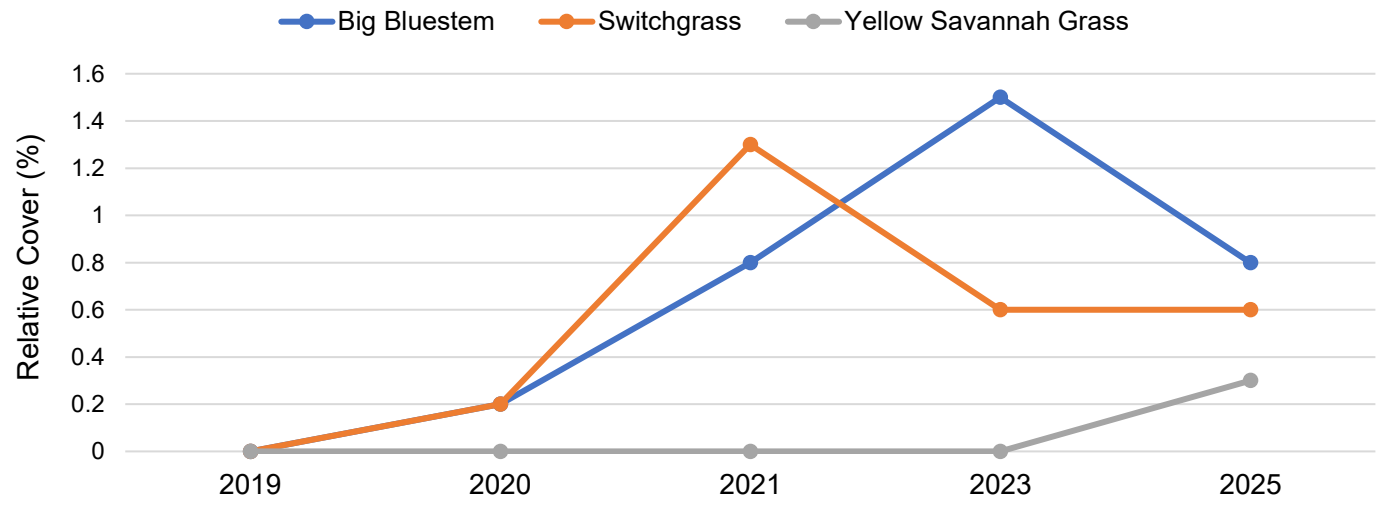


Figure 5. Native grass relative % cover (quadrat surveys) at Berry Tract South since monitoring began in 2019.

Forb Species

Abundance

In 2020, the most abundant forb species detected was Common Dandelion (29% of all forbs relative abundance), followed by Queen Anne's Lace (17%), Black Medick (14%), Frost Aster (13%), and American Willow-herb (12%) (Figure 6). All other forb species accounted for 15% of all observations.

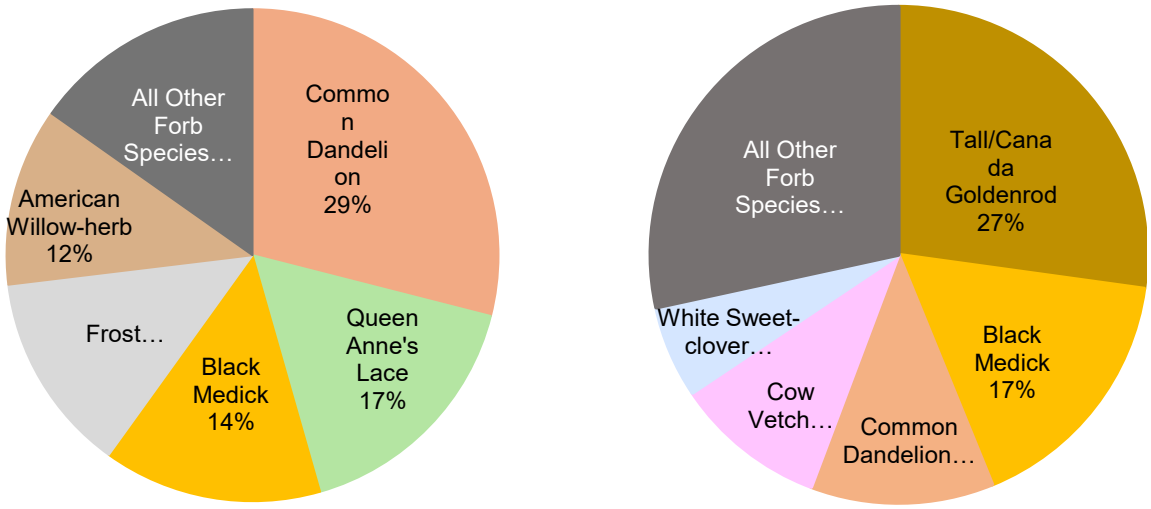


Figure 6. Relative abundance of top five most abundant forbs in quadrat surveys from 2020 (left) and 2025 (right).

Relative Cover

In terms of relative cover, Common Dandelion was the top species in 2020 at 23% relative cover, followed by Frost Aster (17%), Queen Anne's Lace (16%), Common Teasel (6%), Black Medick (4%), and all other species accounted for 34% of the remaining relative cover (Figure 7). In 2020, Tall/Canada Goldenrod accounted for 37% relative cover, followed by Cow Vetch (8%), Common Dandelion (7%), Lance-leaved Aster and Frost Aster (both at 3%). All other species accounted for 42% of the remaining relative cover.

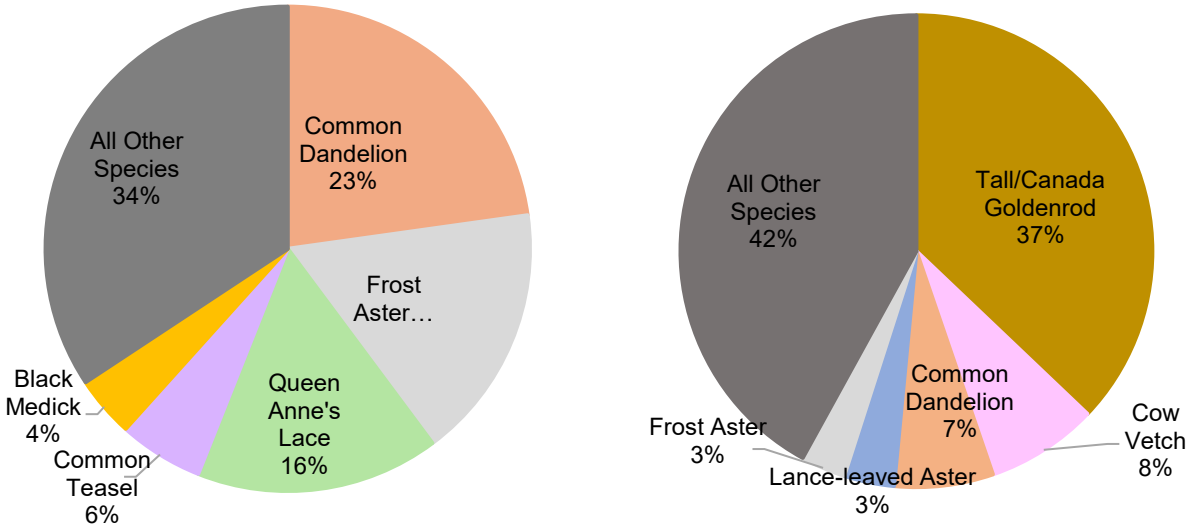


Figure 7. Relative cover of top five forb species observed at Berry Tract South in 2020 (left) and 2025 (right).

Non-native Plants

Relative Cover

Since vegetation monitoring began at Berry Tract South, non-native vegetation has drastically decreased. In 2019, non-native plant cover was about 62% (with native plant cover accounting for the remaining 38%), whereas in 2025, non-native plant cover has dropped to just under 32% and native plant cover has increased to just over 68% (Figure 8). The most dramatic increase in native plant cover occurred in 2021, where there was nearly a 20% increase in native plant cover when compared to 2020.

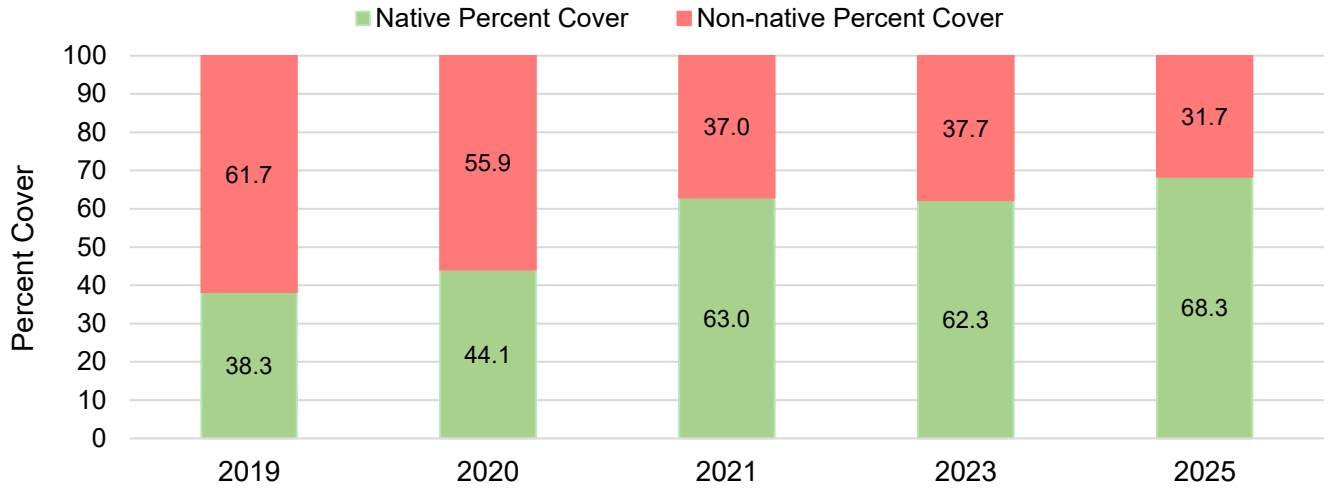


Figure 8. Native versus non-native plant cover of vegetation monitoring years (2019 - 2025) at Berry Tract South.

When examining specific non-native species' plant cover, there are three main species at Berry Tract South that have been a dominant non-native species since monitoring began: Common Dandelion, Cow Vetch, and Queen Anne's Lace (Figure 9). Of all non-native species, Common Dandelion accounted for over 40% relative cover, and remained so in 2020, but then decreased dramatically in 2021 and remain so in 2023. However, cover increased to nearly 30% in 2025.

Queen Anne's Lace follows a somewhat similar pattern as Common Dandelion, with its peak cover occurring in 2019 and 2020, and then falling dramatically in 2021 to under 5% cover and has remained relatively stable since that time. Oppositely, Cow Vetch has been increasing in cover since monitoring began in 2019, with its relative cover reaching a record high of just over 30% in 2025.

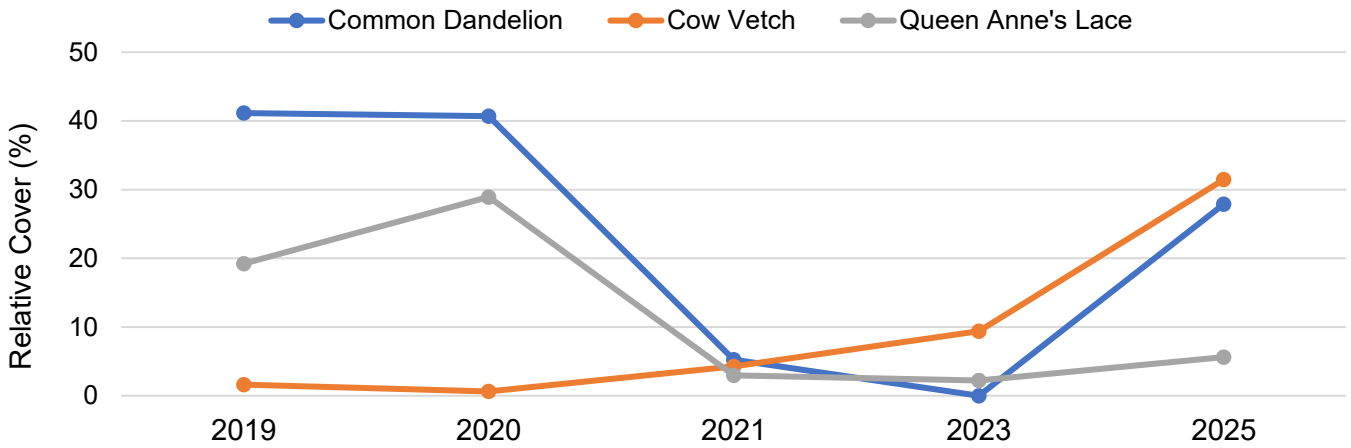


Figure 9. Top three most-abundant non-native species at Berry Tract South since monitoring began in 2019.

Species Form: Native versus Non-native Form

When looking at native and non-native vegetation, type or form should be examined to determine the cover of each type of plant in each category. At Berry Tract South in 2019, the majority of introduced species were herbaceous plants (84.5% cover of all introduced plants) (**Error! Reference source not found.**). Non-native graminoids made up most of the remaining cover, accounting for 14.8%. Non-native shrubs (0.1%) and non-native vines (0.6%) were observed but accounted for very little relative cover. The composition of non-native species' plant forms has changed slightly since then. In 2025, non-native herbaceous species accounted for 95.1% relative cover, followed by non-native vines (3.1%), non-native graminoids (1.3%), and non-native shrubs (0.4%) (**Error! Reference source not found.**).

Native plant types remain quite steady in their abundance, except for native graminoids, which have decreased from 32.1% relative cover in 2019 to 5.8% cover in 2025. Native herbaceous plant cover, however, has greatly increased since 2019, changing from 67.7% in 2019 to 93.8% of all native plant cover in 2025. Native shrubs have yet to be detected in-plot at Berry Tract South, and only trace amounts of native vines (native grape species).

	2019	2020	2021	2023	2025
Eurasian					
Graminoid	14.8%	2.9%	0.0%	0.0%	1.3%
Forb	84.5%	96.1%	97.3%	100.0%	95.1%
Shrub	0.1%	0.1%	0.2%	0.0%	0.4%
Vine	0.6%	0.8%	2.5%	0.0%	3.1%
Native					
Graminoid	32.1%	32.9%	18.3%	17.4%	5.8%
Forb	67.7%	66.7%	81.0%	81.6%	93.8%
Shrub	0.0%	0.0%	0.0%	0.6%	0.0%
Vine	0.2%	0.4%	0.7%	0.3%	0.4%

Table 1. Native versus non-native species based on form type at Berry Tract South between 2019 and 2025 observed during quadrat monitoring. Only plants identified to species level are displayed in this table; non-native unidentified grasses are excluded.

Transect Data

Since 2019, species richness through transect monitoring has remained rather stable, but peaking in 2021 when 22 species were observed (Figure 10). Generally, between 18 and 22 species have been observed through transect monitoring at Berry Tract South.

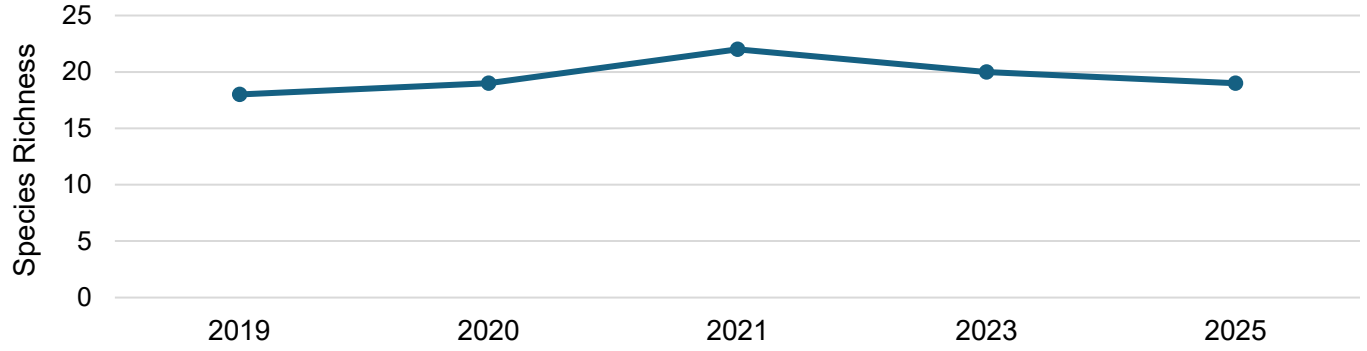


Figure 10. Species richness trends during transect monitoring at Berry Tract South.

Relative abundance is quite variable over time since monitoring began, and many species do not depict any notable trends, but some species have increased or decreased in abundance. Tall/Canada Goldenrod has increased steadily from 9.6% relative abundance in 2019 to 57.9% in 2025 (Figure 11). Oppositely, Virginia Wild Rye has slowly declined in relative abundance from 31.9% relative abundance in 2019 to 2.4% in 2025. Other species have experienced more moderate trends, such as Frost Aster, which was not detected in 2019, but then reached 16.5% relative abundance in 2021. Since that time, its relative abundance has declined to 1.9% in 2025. Until 2025, Big Bluestem was generally increasing during transect monitoring and peaked in abundance in 2023 (23.7%), but a notable drop in abundance was observed in 2025 (7.7%).

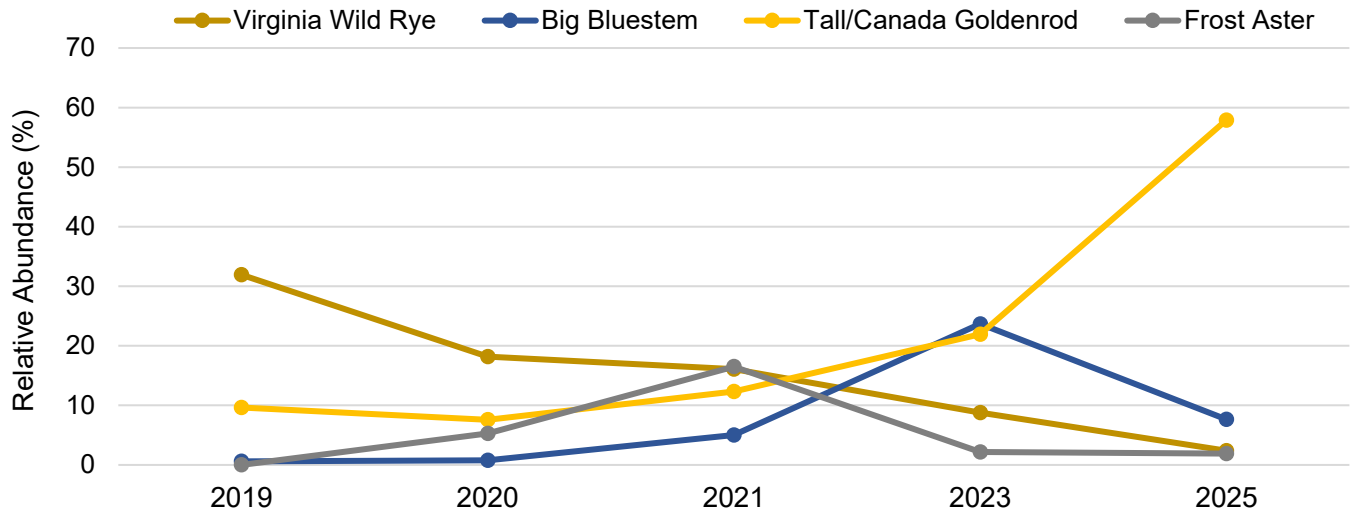


Figure 11. Relative abundance of prominent native species at Berry Tract South during transect monitoring.

Non-native species' abundance at Berry Tract South has fluctuated over time, with both variation in abundance noted during transect monitoring. For example, Redtop Grass was observed at 7.2% in 2019, then increasing to 12.1% in 2020, but has not since been noted in transect monitoring at the site (Figure 12). Oppositely, Cow Vetch has increased from less than 1% relative abundance in both 2019 and 2020, to over 9.1% in the most recent sampling window. White Sweet Clover has experienced both increases and decreases since 2019; with a peak of 14.9% relative abundance observed in 2023. The species was not detected during the 2025 monitoring period.

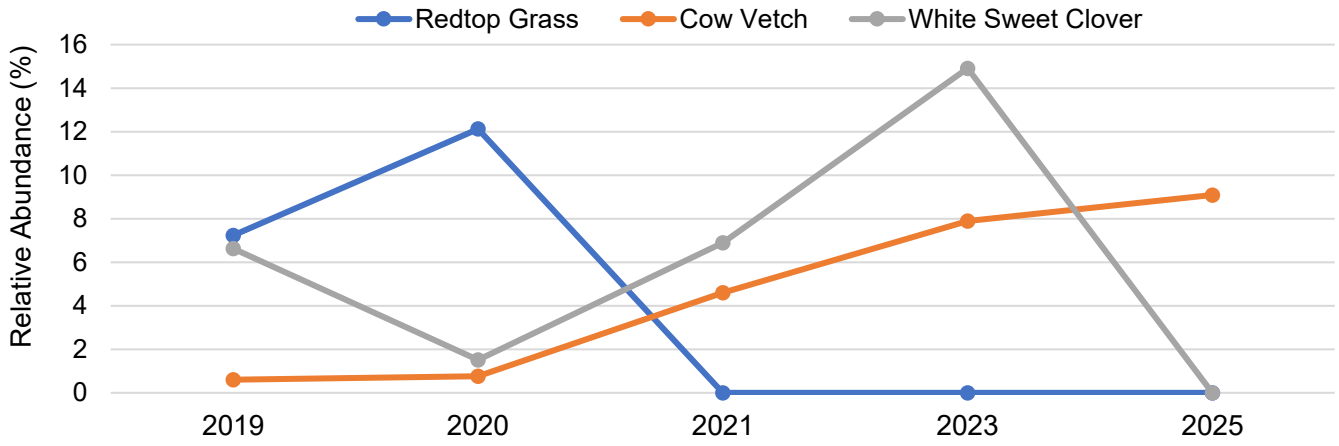


Figure 12. Relative abundance of three most prominent non-native species observed at Berry Tract South during transect monitoring.

Photo Monitoring

The results from photo monitoring at Berry Tract South suggest qualitative increases in vegetation density since monitoring began in 2019 (**Error! Reference source not found.**). Vegetation height was struggling to meet the 1.0-1.5 metre height in 2019 across many plots, but since 2021, vegetation height and relative density has continued to increase.

	2019	2020	2021	2023	2025
2.0-2.5m					
1.5-2.0m					
1.0-1.5m					
0.5-1.0m					
0.0-0.5m					

Figure 13. Photo monitoring results from five monitoring sessions at Berry Tract South. Dark colouration represents denser vegetation growth in comparison to light colouration.

Bird Monitoring

Species Richness

Bird species richness at Berry Tract peaked the first year of monitoring in 2017 with 24 species and since then has remained relatively stable with an average of 17 from 2018-2025 (Figure 14).

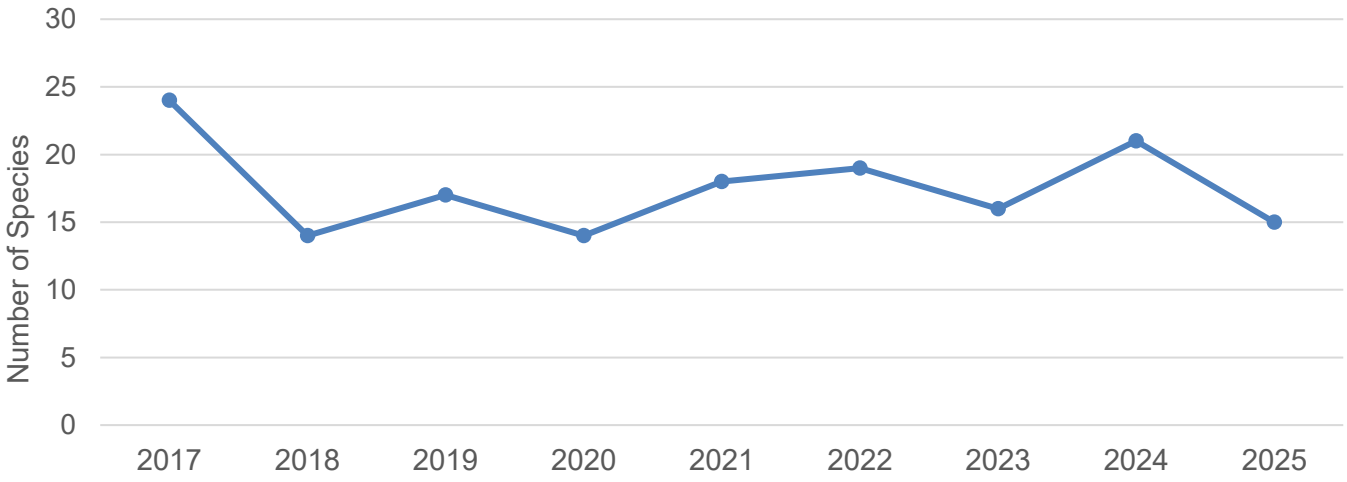


Figure 14. Bird species richness at Berry Tract South, 2017-2025.

Relative Abundance

In 2025, the top five most abundant species detected at Berry Tract were: Red-winged Blackbird (29%), followed by the Tree Swallow (22%) and Bobolink in third at 13%. The fourth most abundant was the Song Sparrow at 9% and then a three-way tie for fifth place between Eastern Kingbird, Northern Yellow Warbler and Savannah Sparrow accounting for 4% each (Figure 15). All other species detections accounts for 15%. When comparing to 2017, the most abundant bird was the European Starling accounting for 45% of all observations. The second most abundant was the Song Sparrow (9%), followed by a tie for third with Red-winged Blackbird and Savannah Sparrow at 7%. The fourth most abundant was a three-way tie with

American Crow, Northern Cardinal and Northern Yellow Warbler at 4% each. All other species accounts for 20%.

Detections

Bird detections at Berry Tract shows strong variability over the past five years as seen in Figure 16. The period of 2018-2021 was relatively stable with an average of 33 detections each year, and there was a

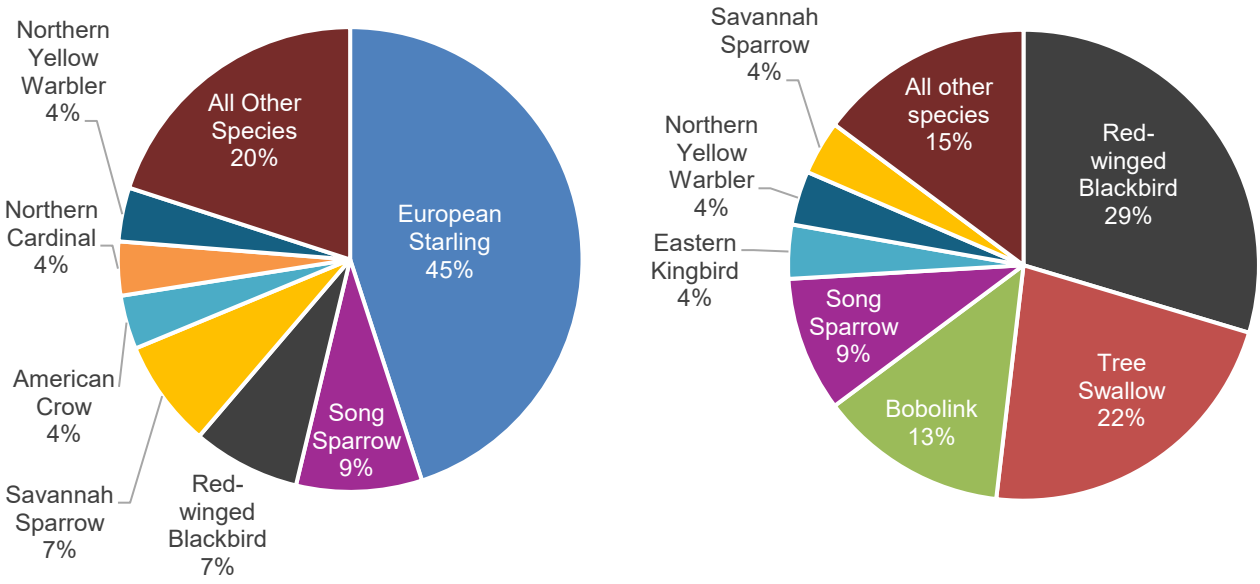


Figure 15. Relative bird abundance at Berry Tract South 2017 (left) and 2025 (right).

peak in 2022 of 56. There is a significant drop in 2023 and again in 2025, with just 27 detections, the lowest since monitoring began on the site. Although, when comparing to Rock Chapel and Princess Point, it still has the highest amount that year.

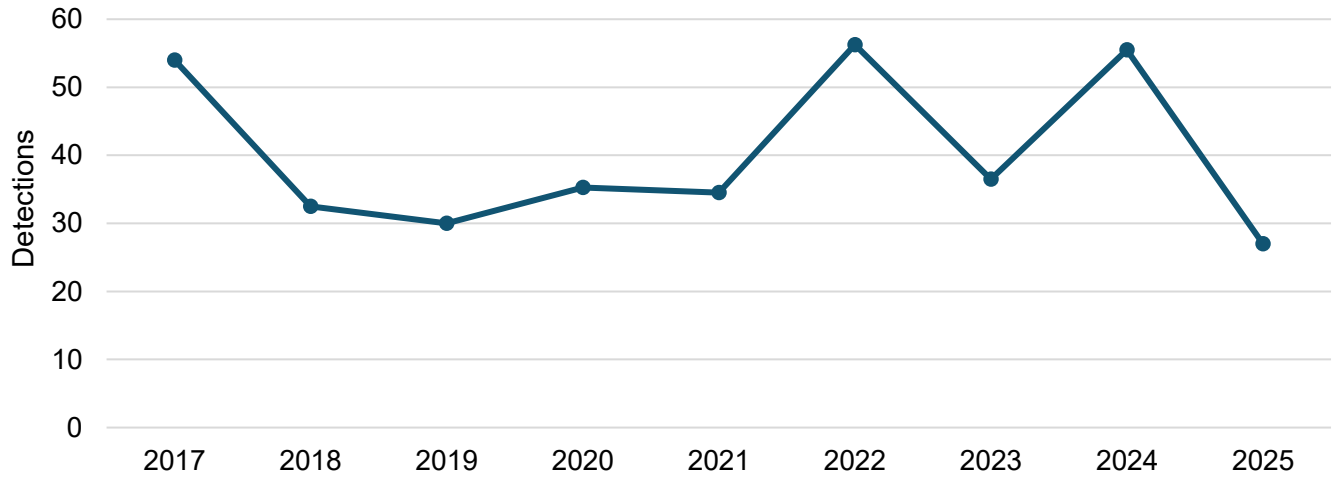


Figure 16. Bird detections at Berry Tract South from 2017 to 2025.

Species-at-Risk

Savannah Sparrow, a common grassland songbird listed as Special Concern by the IUCN, has been steadily decreasing on Berry Tract over the past five years, as seen in Figure 17. The years 2019 and 2020 saw a peak of 14 individuals each in one sitting, while in 2025 only 1 was seen.

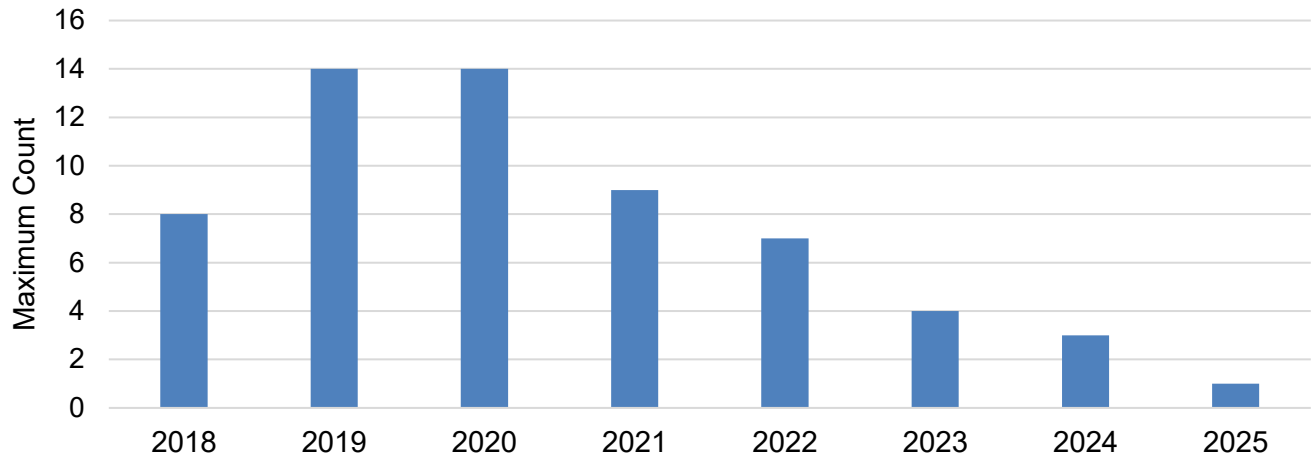


Figure 17. Savannah Sparrow maximum count at Berry Tract from 2018 – 2025.

Bobolink detections have slightly increased since bird surveys began although this year saw its lowest count since 2021 with just four individuals seen (Figure 18). The graph below also includes the maximum count of Red-winged Blackbirds which are known to be a very aggressive and territorial species that share the same habitat here as the Bobolink. Due to this, we speculate they might be controlling or suppressing the Bobolink population, as seen in the graph when there was a large increase of Red-winged Blackbirds in 2023, the number of Bobolinks went down. We will continue monitoring this in the future.

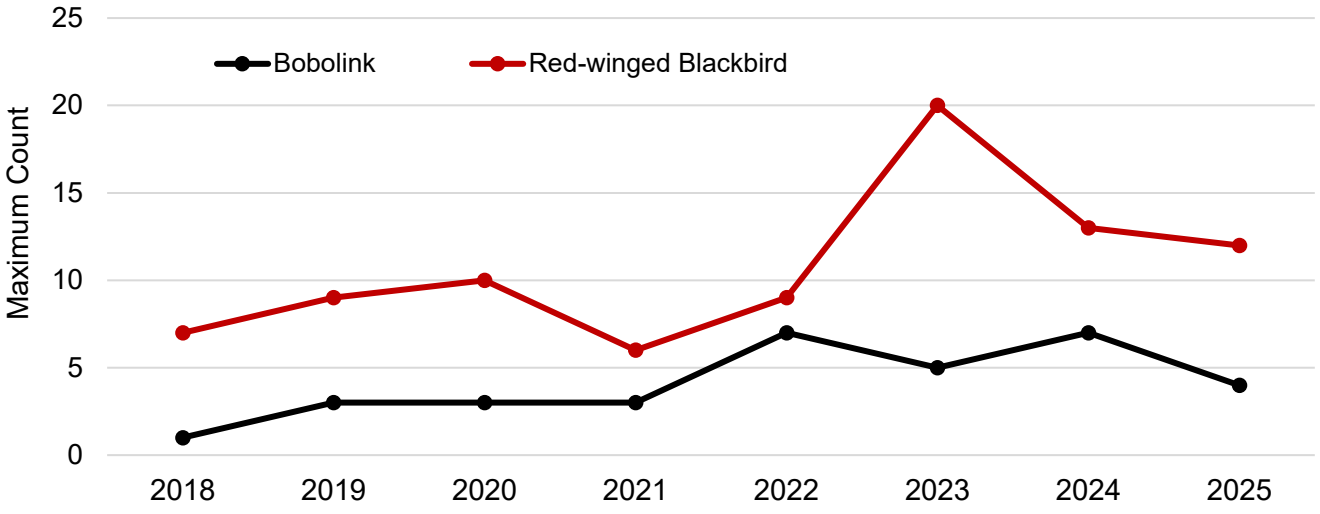


Figure 18. Bobolink and Red-winged Blackbird maximum count at Berry Tract from 2018 to 2025.

Butterfly Monitoring

Species Richness

Butterfly species richness at Berry Tract has ranged from a low of 7 species in 2017 to a high of 19 species in 2021 (Figure 19). This past season 12 species were detected.

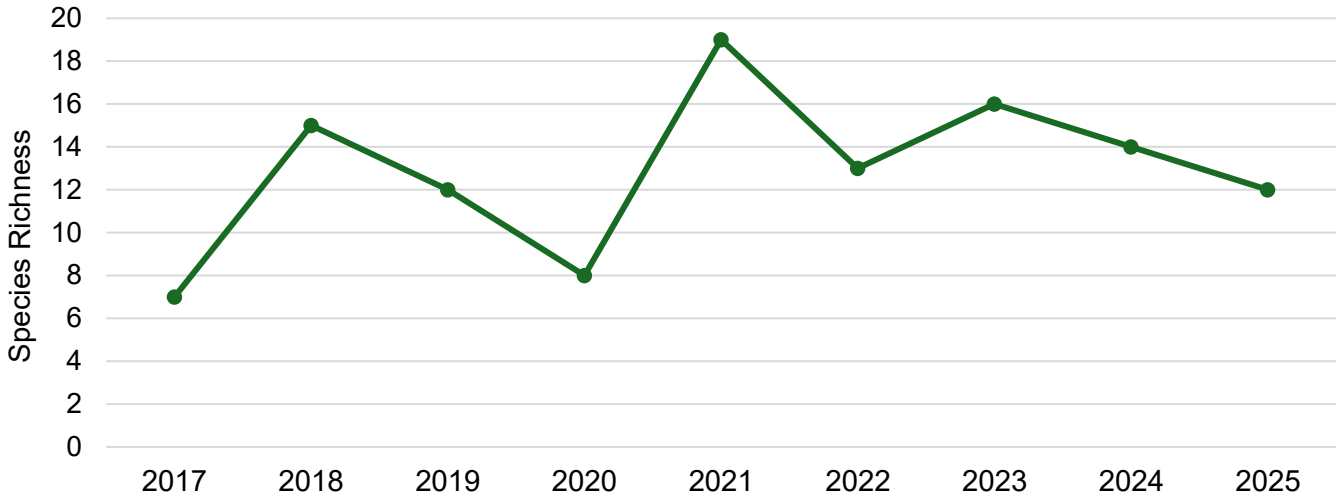


Figure 19. Butterfly species richness at Berry Tract South from 2017 to 2025.

Relative Abundance

In 2025, the top five most abundant species were: Common Wood Nymph (39%), Cabbage White (18%), followed by unknown Cresent species in third at 14%. The fourth most abundant was the Clouded Sulphur (12%) and the Monarch in fifth at 9%, all other species account for 8%. Comparing this to 2017, the Cabbage white was the most abundant, being 60% of all observations, followed by the Monarch in second at 24% (Figure 20). The third most abundant was Black swallowtail (7%), and a tie for fourth with Clouded Sulphur and Giant swallowtail at 3% each. All other species account for just 3%, as this was the year of lowest total detections.

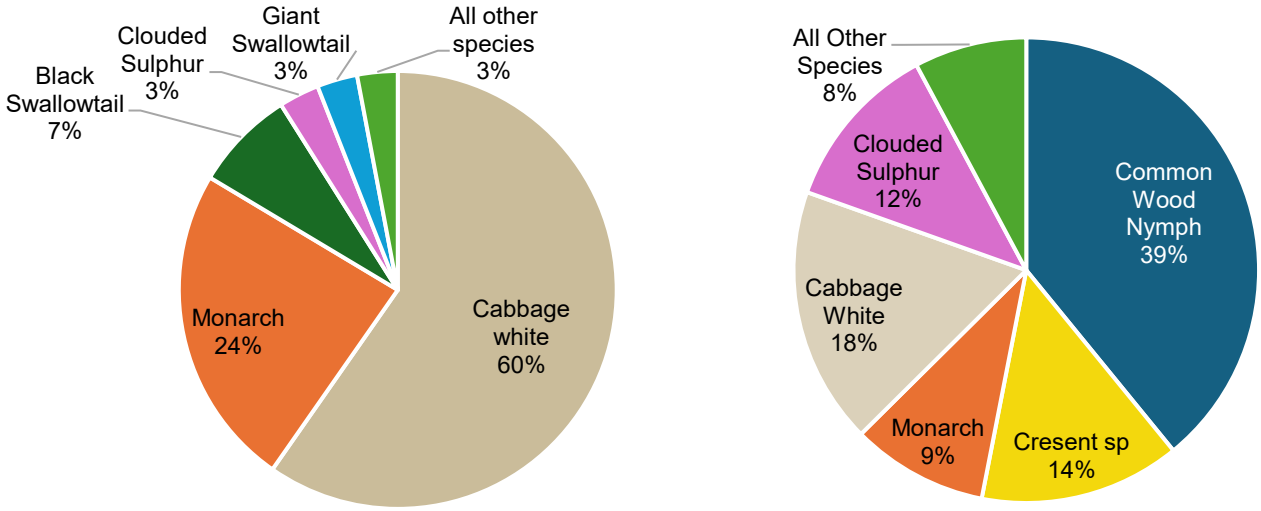


Figure 20. Relative butterfly abundance at Berry Tract South in 2017 (left) and 2025 (right).

Detections

Butterfly detections at Berry Tract experienced its lowest year in 2017 with 67 observations. The years of 2021-2023 were very strong with over 200 observations and a peak in 2022 with 310 (Figure 21). This past year saw 179 observations, which is the fourth highest across the nine years of monitoring. When comparing to Monarch Meadows and Princess Point, Berry Tract typically receives the highest number of detections.

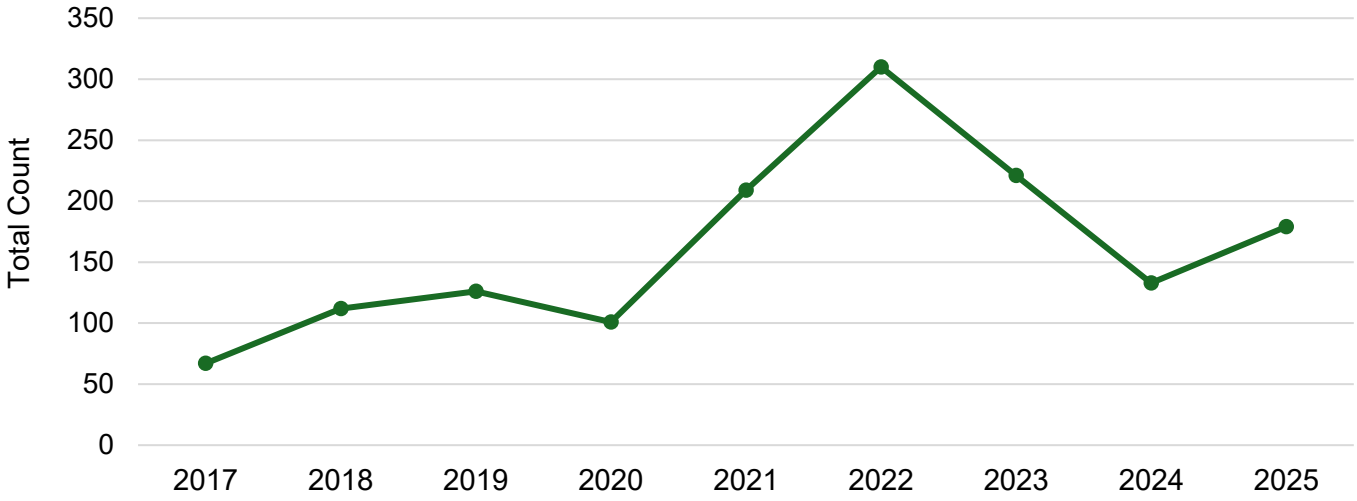


Figure 21. Butterfly detections at Berry Tract South from 2017 to 2025.

Monarch Butterfly

Monarch butterfly detections at Berry Tract were lowest in 2018 with just one detection and increased up until 2021 with a record of 30 (Figure 22). Since then, observations have dropped to an average of 19 each year from 2022-2025.

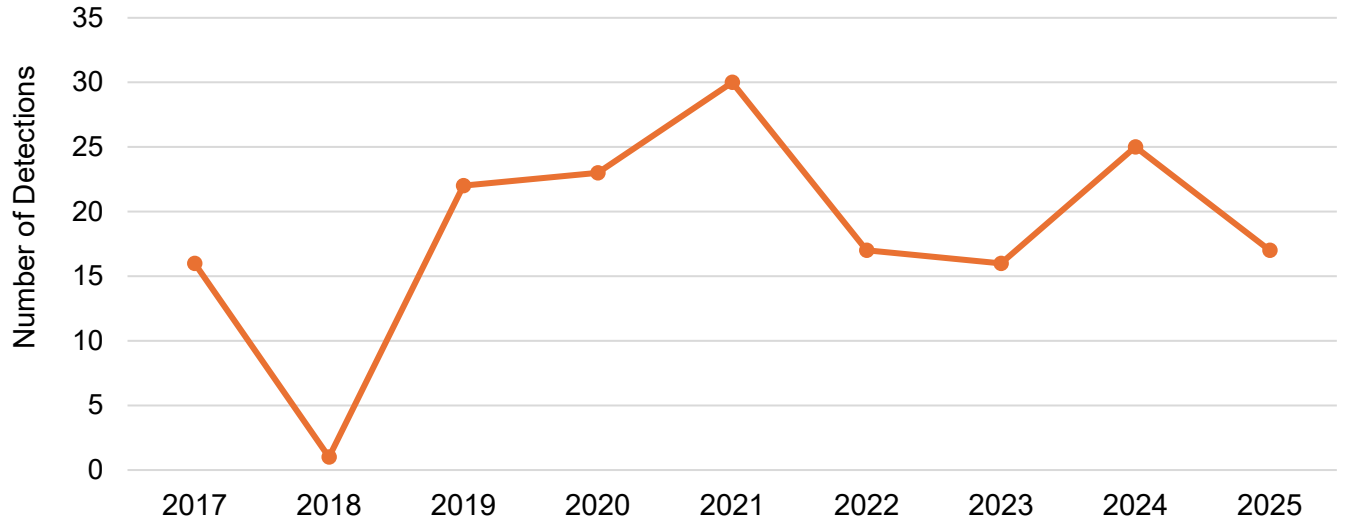


Figure 22. Monarch butterfly detections at Berry Tract, 2017-2025

Comparison Across RBG's Grassland Sites

Vegetation Monitoring Comparison

Figure 23 shows species richness trends across three sites – Monarch Meadows, Princess Point, and Berry Tract South – from 2021 to 2025. Berry Tract south shows slightly lower diversity than the other grassland sites. Princess Point maintains consistently high species richness throughout the monitoring period, fluctuating only slightly between 34 and 35 species, indicating a relatively stable and well-established community. In contrast, Monarch Meadows shows a steady upward trend, increasing from 25 species in 2022 to 34 species by 2024, suggesting successful habitat development or restoration efforts contributing to increased plant biodiversity.

Berry Tract South's plant community species richness exhibits more variability over time. Species richness remains stable at 30 species from 2021 to 2023, followed by a noticeable decline to 27 species in 2024, before rebounding to 32 species in 2025. This fluctuation may indicate sensitivity to environmental conditions. Overall, Princess Point remains the most stable site, which makes sense due to the on-going management and controlled burns that happen at the site, Monarch Meadows demonstrates consistent growth, and Berry Tract highlights the importance of continued monitoring to understand and address year-to-year changes in species diversity.

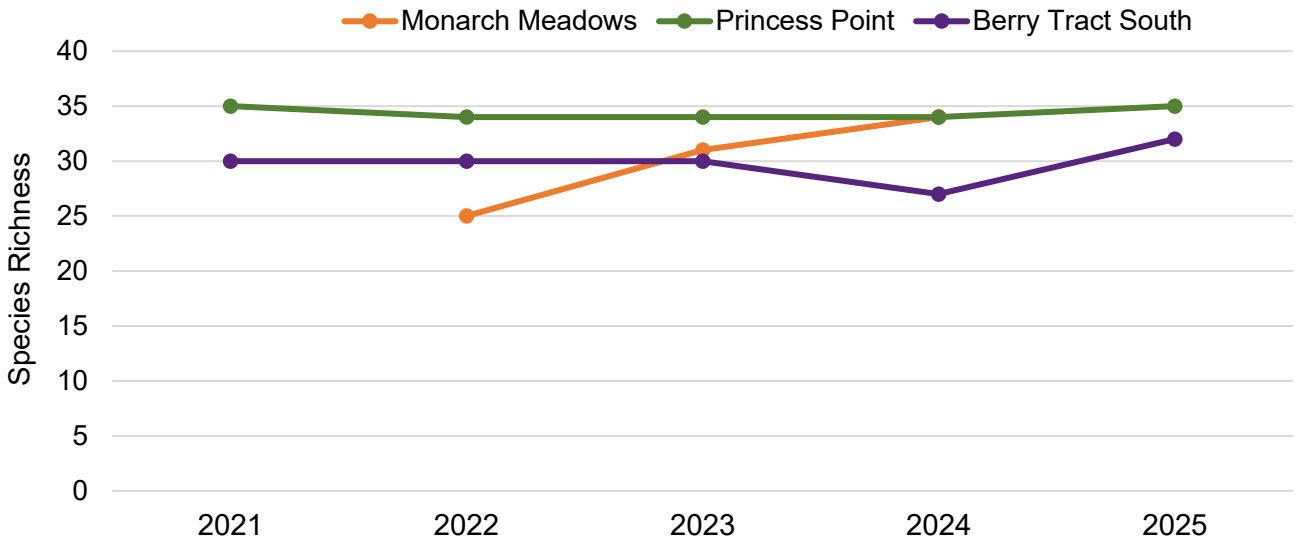


Figure 23. Plant species richness trends across all three grassland restoration sites from 2021 - 2025.

Bird Monitoring Comparison

Berry Tract south has similar numbers of birds to Rock Chape and follows a similar trend, but less than Princess Pt at Cootes Paradise Marsh. Princess Point almost exclusively has the greatest number of bird detections per visit, except for 2020 when a large flock of gulls flew over the monitoring plot thus inflating the average number of detections per visit. Since then, Princess Point has the greatest number of bird detections in the grassland site. Bird detections at Berry Tract South have been slightly declining, ranging from 30 detections per visit in 2020 to around 20 detections in 2025.

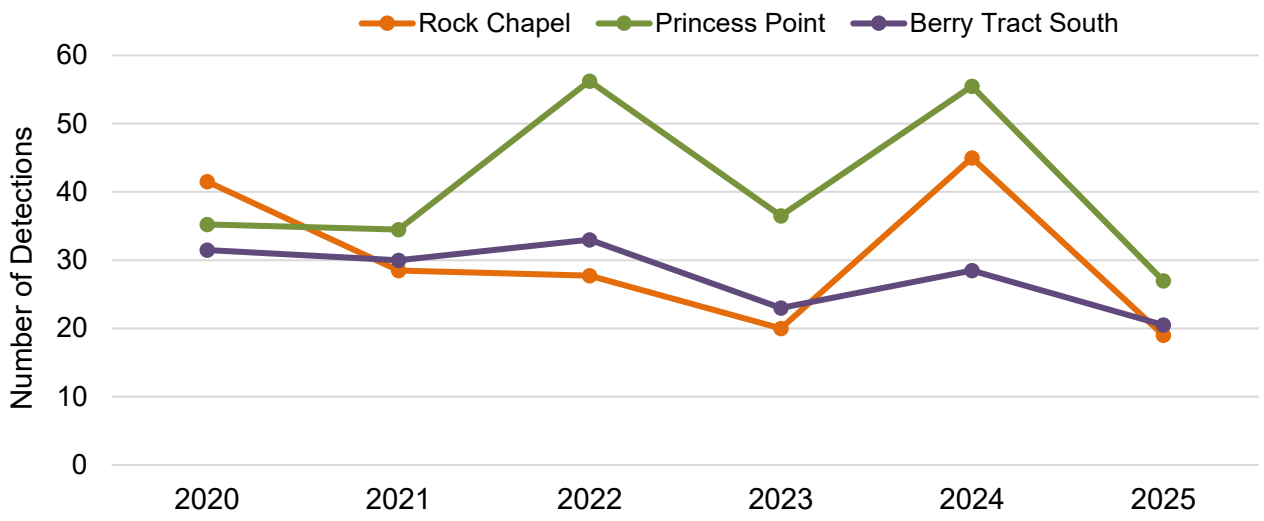


Figure 24. Bird detections trends for bird monitoring plot across all three grassland restoration sites 2020 - 2025.

Overall grassland species richness has declined at all three monitoring sites over time. Princess Point consistently has the highest number of detections, and also generally supports the greatest species richness (Figure 25). However, species richness at Princess Point has been declining since 2021 also, and in 2024, Berry Tract South recorded the highest number of observed species. At Rock Chapel, species richness has not yet returned to its 2021 peak of 21 species. Ongoing monitoring of species richness is important to monitor if this downward trend persists.

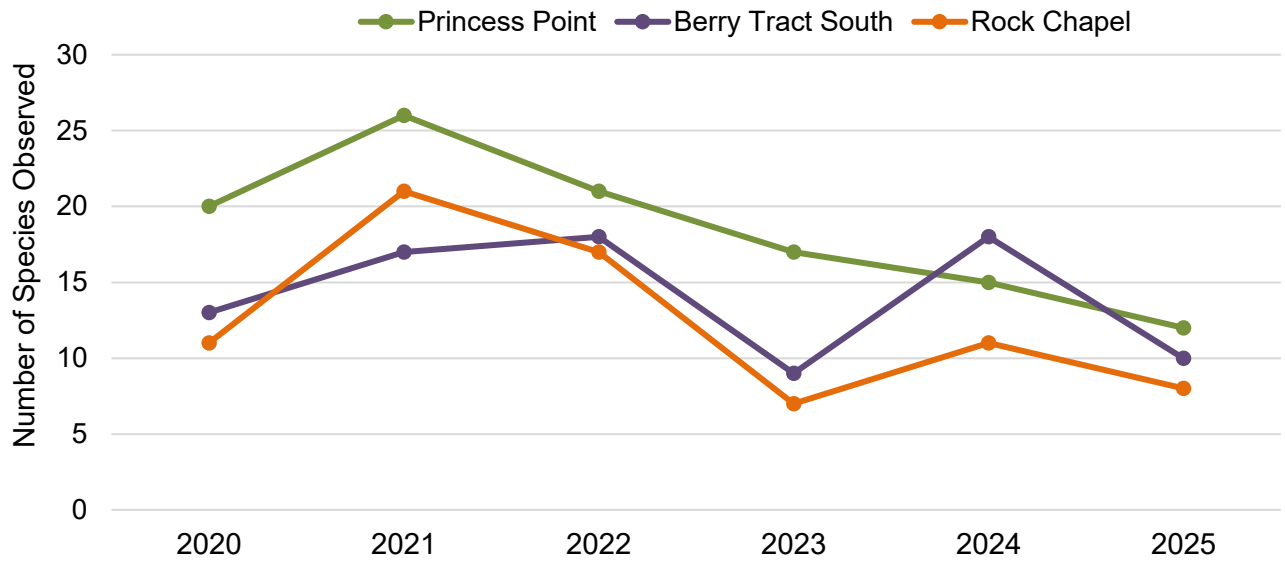


Figure 25. Bird species richness from 2020 - 2025 at three grassland monitoring sites at RBG.

Butterfly Monitoring Comparison

Distinct temporal trends in species richness have occurred over the past three monitoring years at Princess Point, Rock Chapel, and Berry Tract South (Figure 26). At Princess Point, species richness increases steadily from 2021 to 2024, rising from a relatively low starting point to a peak, before then stabilizing at a similarly high value in 2025. Rock Chapel follows a different pattern, with a slight dip in 2022 followed by a sharp increase to its highest value in 2024. A notable decline occurred at Rock Chapel

in 2025. In contrast, Berry Tract South begins with the highest species richness in 2021 but experiences a consistent decline over time, with only a brief stabilization between 2022 and 2023 before continuing the downward trend through 2025. Overall, while Princess Point and Rock Chapel display gains in species richness in 2023 and 2024 before stabilizing or declining. Berry Tract South exhibits a clear downward trend, highlighting shifting patterns in biodiversity across the site over the five-year window.

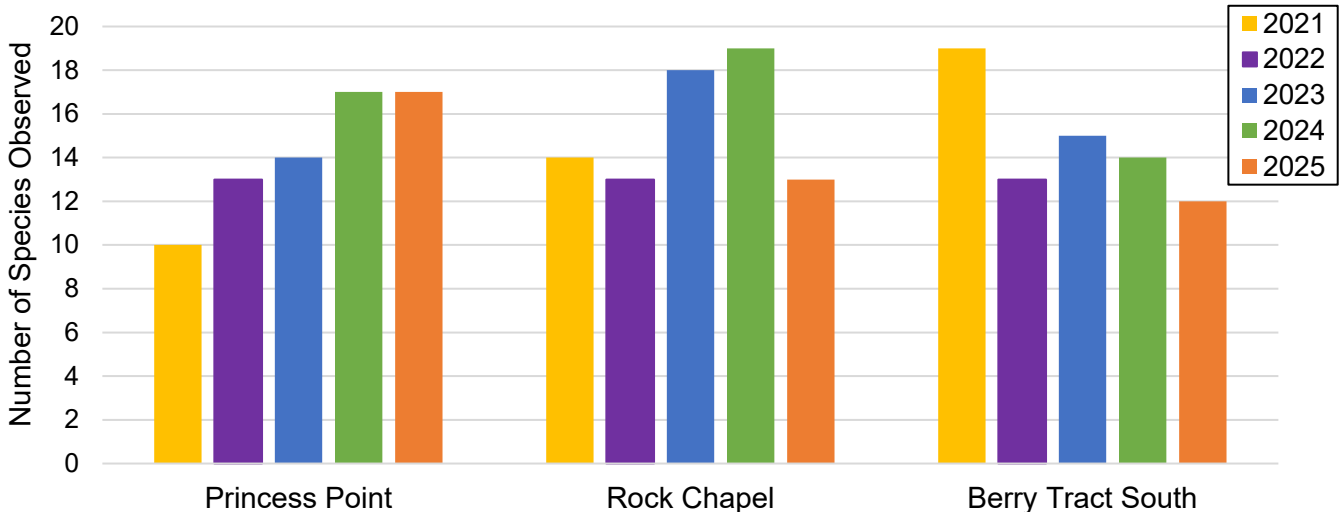


Figure 26.Butterfly species richness trends at Princess Point, Rock Chapel, and Berry Tract South from 2021 to 2025.

A clear difference can be observed in butterfly detections across Princess Point, Rock Chapel, and Berry Tract South from 2021 to 2025, with each site exhibiting distinct trends. Berry Tract South recorded the highest detections overall, peaking sharply in 2022 at just over 300 observations before declining substantially to its lowest point in 20254, followed by a rebound in detections in 2025. Rock Chapel showed a steady increase from 2021 to a peak in 2023, where it had the highest detections among all sites that year, before declining in the subsequent years. In contrast, Princess Point consistently had the lowest number of detections, with a gradual increase reaching a peak in 2023, followed by a decline through 2025. Overall, 2023 appears to be a significant year, marking the peak detections more two of the three sites over the last five monitoring years, followed by a general decreasing trend in detections. This suggests possible broader landscape environmental or ecological factors influencing butterfly presence across the sites.

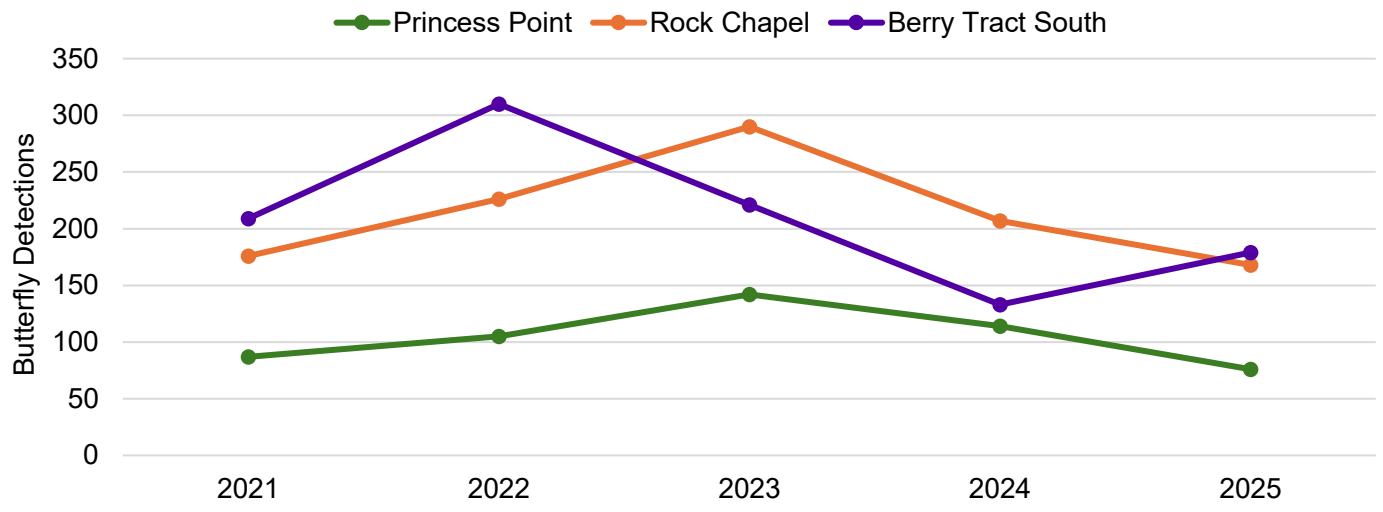


Figure 27. Butterfly detections across Princess Point, Rock Chapel, and Berry Tract South from 2021 - 2025.

Discussion

Since agricultural use ceased in 2016, Berry Tract South has undergone a substantial ecological transformation from a largely exposed and disturbed field to a structurally complex grassland system by 2025. Vegetation monitoring indicates clear progress toward restoration objectives, with native plant cover increasing approximately 38% in 2019 to over 68% in 2025. Species richness has remained relatively stable over time (approximately 26-31 species in quadrat surveys), suggesting that while overall diversity has been maintained, the site is undergoing shifts in composition rater than simple increases in species count. These changes are evident in the transition from early dominance associated non-native forbs such as Common Dandelion and Queen Anne's Lace to more structurally dominant species such as Tall/Canada Goldenrod. Overall, the vegetation data reflect a trajectory consistent with early to mid successional meadow development, with movement toward a more native dominated system and with bare soil still to be colonized by plants in the field. When compared to the Princess Pt and Rock Chapel grassland sites, Berry Tract has similar although often slightly lower diversity and abundance of plants, birds and butterflies, but does include unique species to the site.

Bird communities have shown rapid and sustained use of the site, with species richness stabilizing at an average of approximately 17 species annually since 2018. The composition of the bird community has shifted over time, from early dominance by generalist or non-native species such as European Starling to more characteristic open-habitat species including Red-winged Blackbird, Tree Swallow, and Bobolink. However, overall bird detections have declined in recent years, and species at risk such as Savannah Sparrow have shown marked decreases, reflecting broader regional declines in grassland bird populations despite local habitat improvements. Butterfly monitoring similarly demonstrates strong habitat uptake, with peak detections exceeding 300 individuals and relatively high species richness compared to other sites.

Taken together, these results indicate that restoration efforts at Berry Tract South have successfully transitioned the site from an agricultural field to a functional grassland ecosystem.

Plant Community

When grassland monitoring began at Berry Tract South in 2019, the three species with highest abundance were all non-native (Dandelion, Queen Anne's Lace, and Black Medick). This is unsurprising given its long history as a row crop agricultural field, as typically non-native weedy species colonize the site in the initial stages of restoration, later giving way to early colonizing native species. The seeded native species require several years to mature. Dandelion and Black Medick continue to be two of the three top species in 2025; however, Tall/Canada Goldenrod has increased to be the most abundant species observed during surveys. None of the seeded in forbs dominate within the monitoring sites, although they occur in abundance in localized patches.

When looking at vegetation coverage, however, Dandelion remained the species with the greatest coverage during the first year of surveys, followed by Virginia Wild Rye. Virginia Wild Rye has since decreased in cover, as has Dandelion. Tall/Canada Goldenrod has begun to colonize the site, as well as unidentifiable non-native grass species. The non-native grass species should be closely watched to ensure that their coverage does not continue to increase, in which case, management practices should be implemented.

Species richness has generally remained steady over time, with a slight increase in 2025 to 31 species observed in the quadrat data. An increase in native species richness would be an ideal outcome for meadow restoration, so if the stall in species richness continues, restoration efforts to increase native

species richness should be pursued. Although, it should be noted that native plant cover has almost doubled since monitoring began in 2019, increasing from 38.3% to 68.3%. This suggests that native meadow species are successfully established at the site. However, if this number begins to decline, then management efforts will be required.

Despite the end goal of restoration at Berry Tract South being meadow habitat, native tallgrass species are an important part of the ecosystem complex. Within vegetation monitoring plots, native tallgrass species have yet to prosper. However, anecdotally, outside of the monitoring plots, there are swaths of Yellow Savannah Grass and patches of native rye species. Within plots though, Big Bluestem and Switchgrass have increased in cover, but only by approximately 1% each. Yellow Savannah Grass was detected in plot for the first time in 2025, but significant patches of this species exist within the meadow matrix. If future restoration management is planned, increasing native tallgrass species at the site would be a priority.

Non-native Cow Vetch has increased dramatically in abundance since 2019. This plant has recently become troublesomely abundant in isolated patches at RBG's other grassland restoration sites. It is a weedy plant, but can form massive clumps that suppress native vegetation, as observed at Princess Point. The abundance of this plant should be closely monitored, and management should be taken to reduce the presence of this plant within RBG's grassland restoration sites.

Non-native plant cover is typically made up of forbs, as they account for 95% of all non-native species' relative abundance. Similarly, forbs account for most of the native species' relative abundance, native graminoids account for just under 6%. Ideally, in a native meadow consists of around 30% native grasses. Therefore, efforts to increase native grass abundance at Berry Tract South should be undertaken.

Photo monitoring provides subjective quantitative results in a qualitative depiction. Darker colour represents denser vegetation within a given height range. This monitoring suggests that plant cover at Berry Tract South is becoming denser and slightly taller. Percent coverage is estimated by RBG staff and therefore emits substantial amounts of subjectivity in the data due to researcher bias. As technology progresses, and as budget allows, RBG should inquire about utilizing technology to receive more accurate vegetation density measurements. More research should be done to conclude whether vertical habitat strata density can be calculated, in comparison to canopy top view over extended areas.

Wildlife Community

Breeding Bird Surveys

Overall, 15 different species of birds were detected with an average of 27 detections for each visit. This is lower than 2024, which had 21 species and 56 detections. This past season had the lowest detections since monitoring began in 2018. This trend is consistent across all three of grassland sites at RBG. A key Findings of the State of Canada's Bird Populations (2024 Context) highlights that Grassland species have suffered the steepest declines of all groups of bird species, declining 67% since 1970 (Birds Canada and Environment and Climate Change Canada 2024). Given the broader state of grassland bird species, it's important to note that declines in detections of certain bird species should not be interpreted as evidence that restoration efforts aren't working. While habitat restoration at Berry Tract can improve breeding or stopover conditions on site, bird populations are influenced by many factors across their full annual cycle. Mortality during migration—such as collisions with windows and buildings, exposure to poor air quality, and other environmental stresses—can reduce the number of birds that reach these restored sites. In addition, worsening conditions on their overwintering grounds, including habitat loss or food scarcity, may also affect survival and population size.

As a result, even when restoration is improving local habitat quality, broader pressures occurring during migration or on wintering grounds can still lead to declines in detections. This highlights the importance of considering the entire migratory lifecycle when interpreting the monitoring data. The following is focus on some of the species considered as most impacted by grassland habitat loss more broadly

Bobolink

The Bobolink is a Threatened Species-at-risk grassland bird species found in tallgrass prairies, meadows, and hayfields across the United States and southern Canada, with a wintering range that includes parts of Bolivia, Brazil, Paraguay, and Argentina (Government of Canada, 2010). Bobolink are native to Ontario and have been present since at least the mid 1700's. The species became more widespread in the 19th century due to wide-scale deforestation providing grassland habitat in the form of hayfields and pastures (COSEWIC, 2022). The 2025 State of the Birds report classifies the species as an Orange Alert Tipping Point species, indicating it has lost more than 50% of its population over the past 50 years, with accelerated declines in the last decade. Data from the North American Breeding Bird Survey estimate an average annual decline of 1.7% between 1966 and 2023, amounting to a cumulative loss of 63%. Major threats include habitat loss and degradation from agricultural expansion and intensification, as well as early hayfield cutting, which can destroy up to 90% of ground nests (COSSARO, 2022). Bobolink are an area-sensitive bird, meaning they require large open spaces to breed successfully. While individual territories are relatively small, they generally don't occupy habitats unless they meet minimum size thresholds of approximately 20-30 acres (McCracken et al., 2014). While only 4 were seen during our bird surveys in June, it's worth mentioning that 17 were seen during butterfly monitoring in July. This increase could be attributed to the fledgelings having left the nest by that point, and the parents no longer hiding amidst the ground vegetation.

Savannah Sparrow

Savannah Sparrow is a common grassland songbird classified as a species of Least Concern but has shown to be notably declining at Berry Tract. It has a broad breeding range across much of North America, from Alaska and northern Canada south through the United States, occupying open habitats such as grasslands, meadows, agricultural fields, and coastal areas. During the winter season, many populations migrate to the southern United States, Mexico, and Central America. The Savannah sparrow is not considered area sensitive, so it will occupy smaller patches of grasslands than Bobolink of Eastern Meadowlark, and it therefore more widespread (McCracken et al., 2014). Despite its overall status, the Canadian population has experienced a substantial decline since 1970, with an estimated decrease of 45% based on data from the North American Breeding Bird Survey. Earlier and more frequent harvesting of agricultural grasslands in recent decades has been identified as a major driver of declines in Savannah Sparrows and other grassland songbirds, as it can destroy nests and reduce habitat suitability. Observations at Berry Tract have had similar findings, showing a decline over the past six years. Savannah Sparrow will continue to be closely monitored in the coming years.

Lack of Eastern Meadowlark

It has always been pondered by RBG ecologists as to why Eastern Meadowlark has yet to be detected at Berry Tract South. Substantial research suggests that habitat requirements of Bobolink and Eastern Meadowlark are similar, so much so that the Ontario government has incorporated both species into a single recovery strategy due to their similar life history (McCracken et al. 2013). The question remains – why aren't Eastern Meadowlark utilizing Berry Tract South for reproduction?

Eastern Meadowlark are interspecifically territorial, but not interspecifically territorial, and tolerate the presence of other ground-nesting species such as Bobolink (Jaster et al. 2022). However, meadowlarks

are extremely sensitive to disturbance and even the presence of biologists conducting research have been shown to increase nest abandonment in females (Jaster et al. 2022). The breeding season for Eastern Meadowlark typically occurs between late March and Augusts, depending on the latitude of the breeding site – and in Wisconsin, pairs are usually determined in early April (Jaster et al. 2022). RBG staff do not enter Berry Tract South until June for bird inventory surveys. However, as mentioned previously, neighbouring property owners to Berry Tract South have continually mowed an unsanctioned trail through the northwest corner of the site. Therefore, it cannot be confidently stated that there is zero human presence at the site when Eastern Meadowlarks are breeding. Since RBG staff have yet to detect Eastern Meadowlark during their bird surveys in June, it could be hypothesized that neighbours using unsanctioned trails could be flushing Eastern Meadowlark from Berry Tract South before RBG ecologists could detect them.

Potential for Grasshopper Sparrow

Grasshopper Sparrow is currently listed as Special Concern both provincially and federally and can often be found in the same habitat as Savannah Sparrow (Vickery 2020). Since Savannah Sparrow occurs at Berry Tract South, RBG ecologists have pondered the potential of Grasshopper Sparrow to inhabit the site. Berry Tract South is near perfect habitat for the species; prefers moderately open grasslands and prairies with sparser vegetation and patches of open bare ground in the East and Midwest (Wiens 1973). However, this may not be possible strictly due to size.

Berry Tract South is approximately 16 hectares, whereas Grasshopper Sparrows require a minimum habitat size of approximately 30 hectares (Herkert 1994). Therefore, despite matching Grasshopper Sparrow vegetation requirements, the size of Berry Tract South will restrict Grasshopper Sparrow establishment at the site. Potential future property acquisition of land larger than 30 hectares could be considered and if acquired, restoration efforts should focus on attracting Grasshopper Sparrow to the site.

Butterfly Surveys

It total, there were 19 different species seen at Berry Tract South during butterfly monitoring in 2025 and 423 detections. These are the lowest numbers seen over the past 5 years, with the previous year, 2024, having 28 different species and 454 detections.

As with birds, factors such as pesticide exposure, weather, and limited connectivity between suitable habitats can affect survival and movement. In addition, the availability of host plants needed for larval development in surrounding areas may influence whether butterflies establish or persist at restored sites. Similar to birds, butterflies also migrate annually into the southern U.S and Mexico where deforestation and increasing heat and drought conditions are threatening their populations. As a result, detections may decline even when local habitat quality is improving, highlighting the importance of considering landscape-level factors when interpreting these monitoring results.

Considering Berry Tract South was formerly open row crop agricultural land with no native plant diversity and few suitable resources for nesting or larval development, the site has undergone substantial ecological improvement. Restoration efforts have supported the return of a diversity of species, an important context when interpreting years with lower observations such as this past one. Despite natural fluctuations, the site continues to provide valuable habitat, and ongoing efforts aim to support a wide range of species. In the face of broader global stressors, we hope species of all kinds find Berry Tract South as a refuge where they can find suitable habitat and resources.

Environmental Stewardship Recommendations

Invasive Plant Species Priorities

Invasive species pose the largest threat to the ecological integrity of Berry Tract South. A strategic site management plan would be greatly beneficial to combating invasive species at the site. Below are highlighted invasive species that pose a threat to Berry Tract South.

Poa spp.

Management of *Poa spp.* is required to maintain the ecological integrity and desired species composition of Berry Tract South. *Poa spp.* is most effectively managed through regular prescribed burns. This promotes native warm-season grasses and forbs while limiting the establishment of cool-season species. Mechanical and chemical control methods are generally not practical or effective management options for *Poa spp.* within these habitats.

To date, Berry Tract South has yet to be burned. It is recommended to implement an appropriate burn regime for the site to support long-term grassland health and structure.

Dog-strangling Vine

Vincetoxicum spp., commonly referred to as Dog-strangling Vine, is a perennial herbaceous vine introduced to Canada to 1899 that has since become widespread throughout southern Ontario. The species poses a significant threat to grassland and old field restoration initiatives due its prolific seed production, and ability to function as a habitat generalist. Dog-strangling Vine has the capacity to establish rapidly and form dense monocultures, thereby displacing native vegetation and undoing restoration progress. At Berry Tract South, Dog-strangling Vine exists in small patches throughout the site. The likelihood of successful eradication is still high but will continue to decline as the patches are allowed to spread.

Management of Dog-strangling Vine should follow the operational procedures outlined in the RBG Dog-strangling Vine management plan. Manual removal is recommended for small, localized infestations within grassland habitats. For larger, or more established patches, targeted herbicide application is required to achieve effective control. Prescribed burns are not sufficient for eradication; however, they may be incorporated as one component of an integrated management strategy.

Early detection and rapid response are critical to limiting establishment and spread. Inspections for Dog-strangling Vine should therefore be integrated into routine field activities to enable timely treatment of emerging populations.

Reed Canary Grass

Invasive reed canary grass (*Phalaris arundinacea subsp. arundinacea*) is significantly established within Berry Tract South. This species exhibits substantially greater growth and competitive ability than traditional, native grassland species. This can be seen at Berry Tract South as it has formed dense monocultures along the east and west edges of the site.

The use of regular prescribed burns can be an effective management strategy for Reed Canary Grass. The burns must be implemented during appropriate seasonal windows (August, or September) to optimize efficacy while minimizing impacts to native species. It is encouraged to use chemical control in combination with prescribed burns to improve management outcomes. Conducting a prescribed burn prior to herbicide application can thin the density of reed canary grass, improving herbicide contact and coverage. Prior herbicide treatment of Reed Canary Grass has occurred at Berry Tract South. The results

of this herbicide treatment were effective with noticeable die back occurring. Treatment should continue until the Reed Canary Grass is eradicated; failure to achieve eradication will result in re-invasion.

As with Dog-strangling Vine, early detection and rapid response are essential to preventing the establishment and spread of Reed Canary Grass. Inspections should be incorporated into routine field activities to facilitate management of emerging populations.

Common Reed

Common Reed (*Phragmites australis*) has been recognized as one of Canada's worst invasive species by Agriculture and Agri-Food Canada. It currently occurs within Berry Tract South and neighboring properties. Within Berry Tract South, it is found throughout the middle of the property tracking along the wetter gullies on the landscape; a few stems can be found in the Southeast corner as well. On the opposite side of York Rd along the southern edge of Berry Tract is a large stand of Common Reed – likely the source population. This site is on Hamilton Conservation Authority and collaboration to treat should be considered.

Prescribed burns can be used to help slow the spread of Common Reed but is not adequate for complete eradication. As eradication is the goal for Berry Tract South, it is recommended to treat any stems with glyphosate. This treatment can occur during treatment of other invasive species at Berry Tract South if the glyphosate is mixed at a 5% solution.

Invasive Shrub Management

Continuing management of invasive woody species is critical to maintaining the ecological classification and native species composition of Berry Tract South. Common Buckthorn and Common Lilac occur along site boundaries, exerting seed pressure and continued encroachment into grassland habitat. Past management of Common Buckthorn has occurred along these site boundaries. It is recommended that this management continues while incorporating the control of Common Lilac shrubs.

For shrubs that exist within the grasslands, it has been found that the dry, clay soil of Berry Tract South makes mechanical removal not feasible. Mowing has been used to control the growth of these species and prevent them from producing seed. This can be an effective solution to slow the spread but is ineffective for eradication – the primary goal for Berry Tract South. Invasive shrubs found within the grassland habitat can be controlled via foliar herbicide treatment. This application can occur during treatment of other invasive species if using a 5% glyphosate mix.

Black Locust is spreading into the southwest corner of Berry Tract South. A mature Black Locust exists directly opposite this corner on the other side of Valley Rd. This tree is likely the source and should be considered for removal if permission from the landowner can be obtained. The Black Locust sprouts within Berry Tract South must be controlled as they can form dense monocultures.

Ecosystem Management and Restoration

Controlled Burns Option

Controlled burns have been an effective restoration tool to assist with grassland establishment at RBG's first grassland restoration site, Princess Point. A controlled burn has yet to occur at Berry Tract South as mowing has been the preferred disturbance activity of choice. However, there are certain benefits to fire disturbance that mowing does not support, such as restoring nutrients to the soil. There are two major factors to consider: the proximity to neighbouring houses and the presence of Bobolink.

Neighbouring houses is a concern for controlled burns at Berry Tract South; however, many other environmental organizations have done this in the past using proper burn breaks. McMaster University undertook a controlled burn at their McMaster Forest Site in 2024, which has neighbouring houses that

abut the property. Communication with neighbours, proper burn breaks, and emergency plans will provide a controlled environment to allow the burn to occur.

The second concern is the nesting Bobolink at Berry Tract South. Controlled burns typically occur in early spring or late fall, when favourable conditions exist. There have been many studies that look at Bobolink behavioural response to controlled burns. Grant et al. (2010) examined grassland bird species' response to controlled burns in a North Dakota mixed-grass prairie. The study found that grassland passerines are well-adapted to periodic fires, with pairs of Savannah Sparrow and Bobolink having the lowest number of detections during the first growing season post-burn but showing an increase and stabilization within two to three postfire growing seasons (Grant et al. 2010). Multiple other studies have supported favourable Bobolink response to controlled burning outside of the nesting season (Bollinger and Gavin, 1992; Herkert 1994; Madden et al. 2000). Therefore, if controlled burns are necessary at Berry Tract South for habitat maintenance and management, there is no concern for negatively impacting grassland bird species.

Land Acquisition and Grassland Restoration

Land acquisition remains as a principal priority of the Cootes to Escarpment EcoPark partners within this area. Property acquisition plays a critical role in grassland restoration by securing key parcels of land that can be protected, managed, and therefore, ecologically reconnected over time. By strategically acquiring properties in areas adjacent to existing grassland restoration sites, ecological integrity of each system is increased. This is important in terms of restoring large patches of grassland habitat across the broader landscape. The interconnected or closely-spaced patches enhance habitat connectivity, allow for species movement (if wildlife-supporting infrastructure exists, such as wildlife culverts), and increase genetic diversity – all increasing ecosystem resilience. A landscape network of interconnected grassland ecosystems also helps buffer against disturbances like Climate Change and invasive species, making restoration efforts more sustainable and impactful at a regional scale.

Ephemeral Ponds

In 2018 and 2020 low-lying areas were sculpted to create four ponds to support amphibian life at Berry Tract South. The low-lying areas already hold water, but the landscape was sculpted to ensure water was held during the entire amphibian breeding season. To date, many of these ponds still hold water and support both aquatic plant life and avian species. Formal amphibian monitoring has yet to be conducted but should be considered in the future.

In 2020, cattail seed was spread around the pond edges. Cattails emerged the following season and have continued to spread around and into the ponds. Cattails are useful plants in soil stabilization and have been shown to reduce salinity in rice fields (Marsh 1962). Their spread should be monitored going forward, as research has shown that cattails can quickly dominate a shallow pond creating dense monocultures resulting in the elimination of open water habitat and water levels (Apfelbaum 1985). Therefore, cattail management may be required to maintain open water habitat in the ponds.

Emerging Threats

Grassland Pests, Climate Change, and Diseases

Native grasslands are generally less affected by large-scale disease and pest outbreaks than forests ecosystems, which may make them more resilient under future climate conditions. Forest ecosystems are often composed of a smaller number of dominant tree species, making them more vulnerable to species-specific pests and pathogens—many of which are expanding their ranges and increasing in severity as temperatures rise. In contrast, grasslands support a high diversity of plant species, reducing the likelihood that any single pest or disease would cause widespread damage. Grassland species are also generally

shorter-lived and more adaptable, allowing them to recover quickly from disturbance compared to forests, which often respond more slowly to environmental change (Zhu et al., 2024). However, it is also important to note that the apparent lower incidence of pests and diseases in grasslands may reflect a lack of research and monitoring compared to forests, whereas such impacts are extensively studied.

In the context of Berry Tract South, these characteristics suggest that maintaining and restoring native grassland habitat may provide a more stable and resilient ecosystem under future climate conditions (Zhu et al., 2024). As pest pressures, heat, and drought continue to intensify, grasslands are likely to remain less susceptible to large-scale biological disturbances. Berry Tract south is a warm and dry location due to its south facing slope angle against the escarpment.

Climate change is expected to drastically impact and potentially change the species composition of natural ecosystems. Although these future outcomes cannot be truly determined, hypotheses can be made based on climate modeling scenarios. Climate change modeling scenarios are used to see how different levels of greenhouse gas emissions could affect species and habitats in the future using comprehensive climactic data and forecasting calculations. Natural Resources Canada's "Plant Hardiness Zone Maps" is valuable for ecologists to determine which species currently present in the ecosystem can persist through climate change and which may be better suited to new areas.

A low-emissions scenario (e.g., SSP1-2.6) assumes strong action to reduce emissions, which would limit warming and help many species maintain their current habitats. A middle scenario (e.g., SSP2-4.5) reflects moderate changes, where some species may shift their ranges or face new challenges. A high-emissions scenario (e.g., SSP5-8.5) assumes emissions continue to rise, leading to greater warming, more extreme weather, and higher risks for wildlife, including habitat loss and population declines. These calculations predict shifts in "core" and "range" habitats for plant species. Core habitat is defined as the central and most critical area within a species range that are essential for its long-term survival. Range habitat is the total area in which a species lives and moves and is on a broader scale than core, including areas of lower use. Looking at these helps conservationists plan restoration projects that can better support species under a range of possible future conditions.

To help predict the future of species composition at Berry Tract South, we used the forecasted models under the moderate scenario, SSP2, reflecting at 2°C increase. Looking at native plant and bird species on each site, we can see if RBG properties will continue to be in species core habitat or if a forecasted range shift is possible in the future.

Table 2. Plant species currently present in Berry Tract South monitoring plots 2025, and their current and forecasted core habitat presence on site, based on climate modelling scenarios (scenario 245, 2071-2100).

Species Name	Current Range	Presence at RBG in Forecasted Climate Change Induced Range Shift
American Willow-herb (*Epilobium ciliatum*)	✓	✓
Big Bluestem (*Andropogon gerardii*)	✓	✓
Black-eyed Susan (*Rudbeckia hirta*)	✓	✓
Calico Aster (*Symphyotrichum lateriflorum*)	✓	✓
Canada Wild Rye (*Elymus canadensis*)	✓	✓
Common Evening-primrose (*Oenothera biennis*)	✓	✓
Common Milkweed (*Asclepias syriaca*)	✓	✓
Common Ragweed (*Ambrosia artemisifolia*)	✓	✓
Cut-leaved Coneflower (*Rudbeckia laciniata*)	✓	✓
Daisy Fleabane (*Erigeron annuus*)	✓	✓
False Sunflower (*Heliopsis helianthoides*)	✓	✓
Foxglove Beardtongue (*Penstemon digitalis*)	✓	✓
Frost Aster (*Solidago pilosum*)	✓	✓
Grass-leaved Goldenrod (*Euthamia gramifolia*)	✓	✓
Gray Dogwood (*Cornus racemosa*)	✓	×
Heal-all (*Prunella vulgaris*)	✓	✓
Heath Aster (*Symphyotrichum ericoides*)	✓	✓
Lance-leaved Aster (*Symphyotrichum laceolatum*)	✓	✓
New-England Aster (*Symphyotrichum novae-angliae*)	✓	✓
Riverbank Grape (*Vitis riparia*)	✓	×
Summer Grape (*Vitis aestivalis*)	✓	×
Switch Grass (*Panicum virgatum*)	✓	✓
Tall Coreopsis (*Coreopsis tripteris*)	✓	✓
Tall/Canada Goldenrod (*Solidago altissima/canadensis*)	✓	✓
Virginia Wild Rye (*Elymus virginicus*)	✓	✓
Yellow Savannah Grass (*Sorghastrum nutans*)	✓	✓

As shown in Table 2, the majority of grassland plant species are projected to retain their core habitat at Berry Tract South in a 2°C increase climate scenario, with the exception of Gray Dogwood, Riverbank Grape, and Summer Grape. This pattern highlights the relative resilience of grasslands to increasing temperatures compared to tree species found in a forest ecosystem, as seen in the 2024 Rock Chapel Forest Status Report. These findings suggest that maintaining and restoring grassland habitats at Berry Tract South may support greater ecological stability under future climate conditions.

Table 3. Bird species present in Berry Tract South monitoring 2025, and their current and forecasted range using climate modeling scenario (+ 2°C by 2050). Check mark represents present/forecasted to be present and "x" indicates loss of suitable habitat.

Species Name	Present in Current Range	Climate Change Range Shift by 2050 (+ 2 °C)
Red-winged Blackbird *(Agelaius phoeniceus)*	✓	✓
Tree Swallow (*Tachycineta bicolor*)	✓	×
Bobolink (*Dolichonyx oryzivorus*)	✓	×
Song Sparrow (*Melospiza melodia*)	✓	×
Eastern Kingbird (*Tyrannus tyrannus*)	✓	✓
Northern Yellow Warbler (*Setophaga aestiva*)	✓	×
Savannah Sparrow (*Passerculus sandwhichensis*)	✓	×
American Robin (*Turdus migratorius*)	✓	✓
Baltimore Oriole (*Icterus galbula*)	✓	✓
Black-capped Chickadee (*Poecile atricapillus*)	✓	×
Blue Jay (*Cyanocitta cristata*)	✓	✓
Brown-headed Cowbird (*Molothrus ater*)	✓	✓
Common Yellowthroat (*Geothlypis trichas*)	✓	✓
Field Sparrow (*Spizella pusilla*)	✓	✓
Orchard Oriole (*Icterus spurius*)	✓	✓

Grassland bird species that will be most affected by a 2°C increase and will lose this area as a suitable habitat are Tree Swallow, Bobolink, Song Sparrow, Savannah Sparrow, Northern Yellow Warbler, and Black-capped Chickadee (Table 3). In total that is six out of fifteen species, which is 40% of the diversity typically observed at Berry Tract South. These temperature changes lead to more extreme weather events such as droughts or flooding and previous research suggests that grassland birds are sensitive to temperature warming and increased variability in precipitation (Nelson et al., 2024).

While plant diversity appears relatively stable under future conditions, it will be interesting to see how wildlife species that inhabit Berry Tract South and their composition will change over time.

Extreme Weather Events

Heat & Drought

Climate change threatens ecosystems worldwide through alterations in temperature and precipitation and increases the frequency and intensity of climate extremes like drought and heat waves (Hoover et al., 2014). Grasslands are well suited to tolerate increasing drought and heat, making them especially important as climate change intensifies these conditions. One of the reasons for this being that native grasses have deep roots that can access moisture stored well below the surface, allowing them to survive long dry periods. Grassland species are also naturally adapted to variable climates and can tolerate periods of stress by going dormant and recovering quickly when conditions improve. Studies in grasslands have shown that if one plant species is not resistant to climate change, the gaps can be quickly filled in by another species compensating for this loss (Hoover et al., 2014). This can happen much quicker is grasslands ecosystems with fast-growing herbaceous species, compared to a forest of slower growing tree species. In addition, the continuous ground cover characteristic of grasslands helps reduce soil moisture loss and protect against extreme temperatures. Together, these traits make grasslands more resistant to drought and heat than many other land cover types, supporting their value in climate-resilient restoration.

Flood Mitigation

Grasslands deliver many ecosystem services including water management to alleviate flood risk reduction (Marley et al., 2024). They play an important role in reducing flood risk by naturally absorbing and slowing the movement of water across the landscape. Although, it's important to note that they are more resilient to soil loss and flooding if degradation like compaction is avoided (Marley et al., 2024), highlighting the importance of trail users staying on the marked path. Their deep, dense root systems improve soil structure and create spaces that allow water to soak into the ground—known as Infiltration. This reduces the amount of surface runoff that can quickly overwhelm streams and drainage systems during heavy rain. They temporarily store water and release it more slowly over time, which helps lower peak flood levels.

Wildfires

Across many of the bird species richness and detection graphs there was a noticeable drop in 2023 and 2025. Air quality indexes have shown these years to be the worst for wildfire smoke in Ontario and Canada in recent decades. Looking back at our records from those years, there were at least 16 days where we recorded wildfire smoke creating hazy conditions and poor air quality during the survey. This was far more than any other previous monitoring year. Research has shown that birds can be negatively impacted by this, having similar health affects to those seen in humans. Following the 2023 wildfires a recent study looked at the vocal activity of grassland birds in New York in response to wildfire smoke. They found a negative effect of smoke levels on bird vocal activity, and the most significant declines were observed in grassland species such as Bobolink, Eastern Meadowlark, Field Sparrow and Savannah Sparrow (Simamora et al., 2026). Bird vocalizations are important during the breeding season as it plays a role in mate attraction, territory defense and parent-offspring interactions, and a loss of this may reduce overall bird species fitness (Simamora et al., 2026). This indicates another additive stressor for grassland birds. While it is still a very understudied topic, it's important to consider when analyzing the above graphs. Further research is needed as wildfires are predicted to increase as global temperatures rise.

Increased Anthropogenic Pressures

Neighbour Behaviour

Unsanctioned Trail Use

Historically, adjacent property owners have mowed sections of RBG's grassland restoration areas to create unauthorized access points from their backyards. While this issue has occurred at multiple locations across RBG's nature sanctuaries, it has been particularly persistent at Berry Tract South. The problem has continued since RBG assumed land management of the site and persists despite on-going communication with neighbouring residents. The mowed areas are also visible in aerial imagery, through Google Earth.

This problematic behaviour has several implications the most significant of which is wildlife/birds pushed out of the area. It also encourages increased human use of the property, including travel along unsanctioned trails, which is currently prohibited at this site. Increased foot traffic and repeated passage compact soils, reduces soil pore space, limits water infiltration, and can ultimately inhibit native plant establishment and growth. Soil compaction can also favour the establishment of invasive species, further diminishing restoration efforts. Additionally, increased human presences and noise can disturb sensitive and elusive wildlife species, particularly birds, that rely on grassland habitat for nesting and foraging, which can potentially lead to nest abandonment or reduced reproductive success. For instance, mowing during the Bobolink breeding season can directly cause mortality from equipment that destroys nests, eggs, and nestlings, however if nests survive the interaction, then nestlings are at increased risk of predation due to lack of overstory (tall vegetation) protection (Perlut et al. 2006). The unsanctioned trails may not simply be

utilized by people but could also be utilized by off-leash pets, specifically dogs, which can also impact low-nesting or ground-nesting bird species, such as Savannah Sparrow.

The negative ecological consequences of these activities include damage to property – such as undermining RBG's restoration efforts – further unauthorized use of the site, and a heightened risk of invasive species introduction due to disturbance and removal of native plant communities. These impacts compromise the long-term ecological integrity and success of the grassland community.

High Traffic and Road Networks

Busy roads adjacent to Berry Tract South pose a significant threat to ecosystem function and wildlife safety. High volume traffic can lead to direct mortality for small mammals, birds, and insects attempting to cross the road between fragmented habitats thereby limiting movement between sites and acting as strong physical and ecological barriers. Barriers like roads can further impact wildlife due to mortality and potentially resulting in local population decline and isolating wildlife populations from one another thereby resulting in reduced gene flow (inbreeding).

Both auditory and visual pollution from high traffic roads is concerning for wildlife at Berry Tract South, specifically for sensitive species. Constant noise disturbance may disrupt breeding behaviour, specifically in birds, thereby reducing habitat suitability. In addition, artificial lighting from roads can further disrupt natural activity patterns – especially for nocturnal species. In addition to auditory and visual overstimulation and disruption, runoff from roads and vehicle emissions introduce pollutants such as salts into neighbouring soils and vegetation. Thereby potentially altering the plant community and reducing food quality for herbivores and insects. Roadsides also typically accumulate litter, thus increasing threats to nearby nature sanctuaries.

Together, these cumulative impacts can significantly decrease the ecological integrity and long-term ecological success of nearby nature sanctuaries. However, these devastating ecological outcomes can be avoided with proper mediating measures at the local and broader landscape level. The most vital action is installing safe wildlife crossings or culverts to promote safe movement across fragmented habitats, particularly for smaller mammals and amphibian species. Improved efficacy of such crossings can be improved through the installation of wildlife fencing to guide animals toward safe crossing points, therefore reducing road mortality.

To reduce noise and light pollution, two suggestions exist to minimize, but not eliminate these threats. Firstly, noise pollution can be reduced through the establishment of a vegetative buffer surrounding the site. Well-established buffer zones can help reduce noise and create transitional habitats that can soften current harsh edge effects. A partial native vegetative buffer at Berry Tract South exists, however, enhancement and growth of the buffer is needed to create a well-established system. Secondly, light pollution can be reduced through installation of motion-activated lighting systems along municipally maintained roads that would reduce disruption to nocturnal species.

Opportunities for Future Research

Pollinator Inventory Study

Despite long-term butterfly monitoring, a comprehensive pollinator inventory has not yet been conducted at Berry Tract South. Establishing this baseline is essential for understanding, and therefore protecting, the ecological relationships within the grassland community. Such a study would help identify trends, emerging threats, and opportunities for conservation over time. Thus, supporting broader environmental stewardship efforts and ensuring that critical pollination services continue to sustain plant communities, wildlife, and overall ecosystem resilience.

In addition, a broader insect inventory would improve understanding of the food web that supports local bird populations. Many bird species rely heavily on insects as a primary food source, particularly during the breeding season when demand for protein is high. Collecting this information would provide valuable insight into local food web dynamics and help inform future land management decisions aimed at maintaining healthy pollinator populations and supporting ecological interactions that sustain the ecosystem overall.

Plant-Pollinator Interaction Study

Future research could focus on identifying which plant species are most important for supporting diverse and resilient pollinator communities throughout the growing season. An example of information to be collected includes examining flowering phenology and how well plant community resources are distributed over time to support pollinator needs from early spring through to late fall. Identifying gaps in nectar and pollen availability can significantly impact pollinator survival. Understanding these temporal dynamics is critical for effective habitat management.

An additional study could also investigate the degree of specialization within the ecosystem, determining whether certain pollinator species rely heavily on plant species or if more generalist interactions are dominant. The importance of this information is critical in restoration efforts and has important implications for ecosystem stability – specialized pollinator-plant relationships could be more vulnerable to disturbance or species loss. Examining how invasive species can alter these interactions would be a vital part of this study, due to the competitive and aggressive nature of invasive species.

Another direction of study would be assessing pollination effectiveness – measuring not just rates of visitation but how successfully different pollinators contribute to plant reproduction. These results would suggest which pollinator species are most functionally important to the grassland plant community. Together, these three suggested studies provide deeper understanding of pollinator and plant communities are intertwined, helping guide more effective restoration efforts, species selection for planting and seeding, and long-term management strategies supporting both biodiversity and successful ecological function.

Savannah Sparrow Decline Study

Despite being a widespread and common species in grassland habitats, Savannah Sparrow detections have continually declined at Berry Tract South since bird monitoring began in 2017. Declines typically occur due to poor land management practices, such as poorly timed mowing regimes that reduce nesting success. However, this is not the case at Berry Tract South. Therefore, a study into the reasoning for their decline at Berry Tract South would be extremely useful to help guide future land management practices.

One possibility is changing vegetation structure impacting breeding success, as this influence on breeding success remains unclear (Winter et al. 2005). Further investigation into this topic would be beneficial to land managers to develop successful mowing regimes to support Savannah Sparrow reproduction. Similarly, human disturbance can influence nesting success as females are known to abandon the nest at any stage of reproduction (Wheelwright and Rising, 2020). Therefore, unsanctioned unofficial trails support unauthorized use of the site by neighbours which could disturb Savannah Sparrow nesting success, and therefore overall presence at Berry Tract South.

It would be ideal to have the pollinator and insect study conducted prior to the Savannah Sparrow study, as diet potentially could play a role in their decline at Berry Tract South. One study suggests that beetles comprised of approximately 33% (by volume) of all food consumed in May and June (Judd 1901b, Martin et al. 1951). Having an overall insect inventory at Berry Tract South would assist in determining if their decline is related to lack of prey at the site.

Bobolink Breeding and Population Study

As bird inventory data suggests, Bobolink are well-established at Berry Tract South, however an exact population study has not been completed, nor has the nesting success of Bobolink at the site been examined. A population study of Bobolink at Berry Tract South would provide valuable insight into the status and potential habitat needs of this iconic, threated grassland bird species within the study area. Bobolink are known for sensitivity to changes in their grassland ecosystems and land use.

The study would aim to assess population size over time, distribution at the site, and breeding success, while also taking key environmental factors into account such as vegetation composition, habitat structure, and insect availability. Greater understanding of these factors and their influence on Bobolink presence and reproductive success will help identify conditions that support stable or increasing population growth. The outcome of this study would inform management strategies to maintain suitable breeding habitat and contribute to broader conservation efforts for sustainable grassland bird communities.

Conclusion

When comparing the vegetation community at Berry Tract South from ten years ago until now, the ecological change is remarkable. Starting from an ecologically unproductive farm field to a native meadow that supports a variety of bird and butterfly species. The most abundant plant species during the most recent sampling window was Tall/Canada Goldenrod, which has changed since 2020 when Common Dandelion was the most abundant species. Unknown non-native grass species had the largest vegetation coverage in 2025. Native and non-native plant cover has switched since monitoring began, with most recent surveys indicating nearly 70% native plant cover and the majority of plant species seeded in are found within the monitoring plots.

Bobolink continue to use Berry Tract South for breeding grounds; however, Savannah Sparrow has declined sharply at the site. Further research into their disappearance should be conducted and land management practices should be adjusted to support their use of the site. Butterfly detections and species richness have declined since 2023, with a slight increase in detections in 2025. However, wildfire smoke could be the cause of this decline. A refined site management plan, including invasive species management, should be developed to prioritize restoration practices going forward as part of the RBGs Terrestrial Habitats Management Projects Plan.

Overall, when compared to the Princess Pt and Rock Chapel grassland sites, Berry Tract has similar although often slightly lower diversity and abundance of plants, birds and butterflies, but does include unique species to the site. To the passer by the field is a striking site to those travelling adjacent York Road or Valley Road. The site continues to have several environmental stewardship challenges. Invasive plant species continue to seed into the bare soil areas, particularly Common Buckthorn, Black Medic, Queen Anne's Lace and non-native grass species. In addition, Black Locust has taken hold in one corner and will require dedicated management to resolve. Challenges also continue with the desire for public access and use, particularly as the field is a south facing slop hillside set into the Niagara Escarpment with spectacular view of Cootes Paradise.

In Ontario meadows/grasslands exist primarily as temporary habitats in transition after disturbance. Disturbance events can range from abandoned agricultural practices, overgrown pastureland, to fires or large-scale windstorm blow down events. Currently, nearly 99% of native grassland habitat across the continent has been destroyed. The lack of grassland habitat makes RBG's grassland restoration sites some of the most unique and important habitat in the Hamilton area and key site into the future in support of Hamilton's Biodiversity Action Plan (2025).

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Appendix 1

Table 4. Plant species found at Berry Tract South that were seeded in 2017 or naturally occurred at the site.

Common Name	Latin Name	In Seed Mix	In mix Not found	Naturally Occurring
American Willow-herb	Epilobium ciliatum			ü
Avens species	Geum sp.			ü
Bentgrass species	Agrostis sp.			ü
Bergamot	Monarda fistulosa	ü		
Big Bluestem	Andropogon gerardii	ü		
Bindweed species	Convolvulus sp.			ü
Black Medick	Medicago lupulina			ü
Black-eyed Susan	Rudbeckia hirta	ü		
Butter-and-eggs	Linaria vulgaris			ü
Calico Aster	Symphyotrichum lateriflorum			ü
Canada Blue Grass	Poa compressa			ü
Canada Horseweed	Conyza canadensis			ü
Canada Thistle	Cirsium arvense			ü
Canada Wild Rye	Elymus canadensis	ü		
Cinquefoil species	Potentilla sp.			ü
Clover species	Trifolium sp.			ü
Common Buckthorn	Rhamnus cathartica			ü
Common Dandelion	Taraxacum officinale			ü
Common Evening-primrose	Oenothera biennis	ü		
Common Milkweed	Asclepias syriaca	ü		
Common Plantain	Plantago major			ü
Common Ragweed	Ambrosia artemisiifolia			ü
Common Speedwell	Veronica officinalis			ü
Common St. Johnswort	Hypericum perforatum			ü
Common Teasel	Dipsacus fullonum ssp. sylvestris			ü
Cow Vetch	Vicia cracca			ü
Creeping Jenny	Lysimachia nummularia			ü
Cut-leaved Coneflower	Rudbeckia laciniata	ü		
Daisy Fleabane	Erigeron annuus			ü
False sunflower	Heliopsis helianthoides	ü		
Field Bindweed	Convolvulus arvensis			ü
Flat Topped Aster	Doelingeria umbellata		ü	
Foxglove beardtongue	Penstoman digitalis	ü		
Frost Aster	Symphyotrichum pilosum			ü
Tall Sunflower	Helianthus giganteus		ü	
Grass-leaved Goldenrod	Euthamia graminifolia			ü
Gray dogwood	Cornus racemosa			ü
Hawkweed Oxtongue	Picris hieracioides ssp. hieracioides			ü
Heal-all	Prunella vulgaris ssp. lanceolata			ü
Heath Aster	Symphyotrichum ericoides	ü		ü
Lance-leaved Aster	Symphyotrichum lanceolatum			ü
New-England Aster	Symphyotrichum novae-angliae	ü		
Orchard Grass	Dactylis glomerata			ü
Pale Swallow-wort	Cyncnchum rossicum			ü
Quack Grass	Elymus repens			ü
Red Clover	Trifolium pratense			ü
Redtop Grass	Agrostis gigantea			ü
Riverbank Grape	Vitis riparia			ü
Rough Leved Goldenrod	Solidago patula		ü	
Riverbank Rye	Elymus riparius		ü	
Rush species	Juncus sp.			ü
Sedge species	Carex sp.	ü		
Self-heal	Prunella vulgaris			ü
Showy Tick-Trefoil	Desmodium canadense		ü	
Summer Grape	Vitis aestivalis			ü
Switch Grass	Panicum virgatum	ü		
Tall coreopsis	Coreopsis tripteris	ü		
Tall/Canada Goldenrod	Solidago altissima/canadensis			ü
Virginia Mountain Mint	Pycnanthemum virginianum	ü		
Virginia Wild Rye	Elymus virginicus	ü		
White Clover	Trifolium repens			ü
White Sweet-clover	Melilotus alba			ü
Wild Carrot	Daucus carota			ü
Yellow Hyssop	Agastache nepetoides		ü	
Yellow Savannah Grass	Sorghastrum nutans	ü		

Table 5. List of plant species observed at Berry Tract South quadrat surveys in 2019, 2020, 2021, 2023, and 2025.

Introduced Species	**2019**	**2020**	**2021**	**2023**	**2025**
Black Medick (*Medicago lupulina*)	x	x	x	x	x
Butter-and-eggs (*Linaria vulgaris*)		x	x		x
Canada Blue Grass (*Poa compressa*)		x			
Canada Thistle (*Cirsium arvense*)	x	x	x		x
Common Buckthorn (*Rhamnus cathartica*)	x	x	x		x
Common Dandelion (*Taraxacum officinale*)	x	x	x		x
Common Plantain (*Plantago major*)	x		x		
Common Speedwell (*Veronica officinalis*)	x				x
Common St.Johnswort (*Hypericum perforatum*)				x	
Common Teasel (*Dipsacus fullonum ssp. sylvestris*)	x	x	x		x
Cow Vetch (Vicia cracca)	x	x	x	x	x
Creeping Jenny (*Lysimachia nummularia*)				x	
Field Bindweed (*Convolvulus arvensis*)	x	x	x		x
Hawkweed Oxtongue (*Picris hieraciodes ssp. hieracoides*)		x	x	x	x
Orchard Grass (*Dactylis glomerata*)					x
Pale Swallow-wort (*Cyncnchum rossicum*)	x				
Quack Grass (*Elymus repens*)		x			
Red Clover (*Trifolium pratense*)	x	x	x	x	x
Redtop Grass (*Agrostis gigantea*)	x	x			
White Clover (*Trifolium repens*)	x				x
White Sweet-clover (*Melilotus alba*)	x	x	x	x	x
Wild Carrot (*Daucus carota*)	x	x	x	x	x
Native Species					
American Willow-herb (*Epilobium cilatum ssp. ciliatum*)	x	x	x		
Big Bluestem (*Andropogon gerardii*)		x	x	x	x
Black-eyed Susan (*Rudbeckia hirta*)	x	x		x	x
Calico Aster (*Symphyotrichum lateriflorum*)				x	
Canada Horseweed (*Conyza canadensis*)				x	
Canada Wild Rye (*Elymus canadensis*)	x	x	x	x	x
Common Evening-primrose (*Oenothera biennis*)			x		
Common Milkweed (*Asclepias syrica*)	x	x	x	x	x
Common Ragweed (*Ambrosia artemisiifolia*)	x				
Cut-leaved Coneflower (*Rudbeckia laciniata*)	x				
Daisy Fleabane (*Erigeron annus*)	x	x	x		x
False Sunflower (*Heliopsis helianthoides*)	x	x	x	x	x
Foxglove Beardtongue (*Penstemon digitalis*)					x
Native Species	**2019**	**2020**	**2021**	**2023**	**2025**
Frost Aster (*Symphyotrichum pilosum*)		x	x	x	x
Grass-leaved Goldenrod (*Euthamia graminifolia*)	x	x	x	x	x
Gray Dogwood (*Cornus racemosa*)				x	
Heal-all (*Prunella vulgaris ssp. lanceolata*)			x		
Heath Aster (*Symphyotrichum lanceolatum ssp. lanceolatum*)	x		x	x	
Lance-leaved Aster (*Symphyotrichum ericoides*)	x	x	x	x	x
New-England Aster (*Symphyotrichum novae-angliae*)	x	x	x	x	x
Riverbank Grape (*Vitis riparia*)	x	x		x	x
Self-heal (*Prunella vulgaris*)				x	
Summer Grape (*Vitis aestivalis*)			x		
Switch Grass (*Panicum virgatum*)		x	x	x	x
Tall coreopsis (*Coreopsis tripteris*)				x	x
Tall/Canada Goldenrod (*Solidago altissima/canadensis*)	x	x	x	x	x
Virginia Wild Rye (*Elymus virginicus var. virginicus*)	x	x	x	x	x
Yellow Savannah Grass (*Sorghastrum nutans*)					x

Table 6. Bird species of Berry Tract South 2017-2025. Note: a protocol change after 2022 from 4 to 2 visits at each site

Species Name	2017	2018	2019	2020	2021	2022	2023	2024	2025
American Crow (*Corvus brachyrhynchos*)	x	x		x		x	x	x	
American Goldfinch (*Spinus tritis*)		x	x	x	x	x	x		
American Robin (*Turdus migratorius*)	x	x	x		x				x
Baltimore Oriole *(Icterus galbula*)	x	x	x					x	x
Barn Swallow (*Hirundo rustica*)			x	x	x	x		x	
Black-capped Chickadee (*Poecile atricapillus*)					x		x		x
Blue Jay (*Cyanocitta cristata*)	x			x	x	x	x	x	x
Bobolink (*Dolichonyx oryzivorus*)		x		x	x	x	x	x	x
Brown Thrasher (*Toxostoma rufum*)				x	x				
Brown-headed Cowbird (*Molothrus ater*)	x					x			x
Canada Goose (*Branta canadensis*)	x							x	
Carolina Wren (*Thyothorus ludovicianus*)	x		x						
Cedar Waxwing (*Bombycilla cedrorum*)	x	x		x		x			
Chimney Swift (*Chaetura pelagica*)	x								
Chipping Sparrow (*Spizella passerina*)	x	x							
Common Grackle (*Quiscalus quiscula*)					x	x		x	
Common Yellowthroat (*Geothypis trichas*)	x				x			x	x
Eastern Bluebird (*Sialia sialis*)			x						
Eastern Kingbird (*Tyrannus tyrannus*)	x		x		x	x		x	x
Eastern Towhee (*Pipilo erythrophthalmus*)		x	x	x					
European Starling (*Sturnus vulgaris*)	x			x	x	x	x	x	
Field Sparrow (*Spizella pusilla*)	x	x	x	x	x	x		x	x
Gray Catbird (*Dumetella carolinensis*)	x	x							
Great Blue Heron (*Ardea Herodias*)	x	x	x		x			x	
Great Crested Flycatcher (*Myiarchus crinitus*)	x				x			x	
Indigo Bunting (*Passerina cyanea*)	x			x	x			x	
Killdeer (*Charadrius vociferus*)	x					x	x		
Mallard (*Anas platyrhynchos*)			x			x		x	
Mourning Dove (*Zenaida macroura*)	x		x						
Northern Cardinal (*Cardinalis cardinalis*)	x		x		x	x		x	
Northern Flicker (C*olaptes auratus*)						x	x		
Northern House Wren (*Troglodytes aedon*)	x	x	x	x	x	x	x		
Northern Yellow Warbler (*Setophaga aestiva*)	x	x	x	x	x	x	x	x	x
Orchard Oriole (*Icterus spurius*)						x			x
Osprey (*Pandion haliaetus*)					x				
Red-bellied Woodpecker (*Melanerpes carolinus*)	x				x				
Red-tailed Hawk (*Buteo jamaicensis*)		x	x						
Red-winged Blackbird (*Agelaius phoeniceus*)	x	x	x	x	x	x	x	x	x
Ring-billed Gull (*Larus delawarensis*)	x		x			x	x		
Rock Pigeon (*Columbia livia*)	x		x			x			
Rose-breasted Grosbeak (*Pheucticus ludovicianus*)	x	x							
Savannah Sparrow (*Passerculus sandwhichensis*)	x	x	x	x	x	x	x	x	x
Song Sparrow (*Melospiza melodia*)	x	x	x	x	x	x	x	x	x
Tree Swallow (*Tachycineta bicolor*)	x		x	x	x	x	x	x	x
Turkey Vulture (*Cathartes aura*)	x	x		x		x	x		
Unknown Gull species	x		x	x	x	x			
White-breasted Nuthatch (*Sitta carolinensis*)	x								
Wild Turkey (*Meleagris gallopavo*)	x								
Willow Flycatcher (*Empidonax trailii*)	x		x		x				
Wood Duck (*Aix sponsa*)			x	x					
Wood Thrush (*Hylocichla mustelina*)	x								
Species Richness	**37**	**19**	**25**	**20**	**26**	**26**	**16**	**21**	**15**

Table 7. Butterfly species seen at Berry Tract South from 2017-2025

Species Common Name	Scientific Name	2017	2018	2019	2020	2021	2022	2023	2024	2025
American Painted Lady	*Vanessa virginiensis*								x	
Banded Hairstreak	*Satyrium calanus*			x		x				
Black Swallowtail	*Papilio polyxenes*	x	x	x	x	x	x	x	x	x
Cabbage White	*Pieris rapae*	x	x	x	x	x	x	x	x	x
Canada x Eastern Swallowtail hybrid						x				
Clouded Sulphur	*Colias philodice*	x	x	x	x	x	x	x	x	x
Swallowtail spp. (black)	*Papilio or Battus sp.*							x		
Common Wood Nymph	*Cercyonis pegala*		x	x		x	x	x	x	x
Crescent sp.						x	x	x	x	x
Delaware Skipper	*Atrytone logan*									
Dun Skipper	*Euphyes vestris*			x		x		x	x	x
Columbine Dusky Wing	*Erynnis lucilius*		x							
Eastern-tailed Blue	*Everes comyntas*			x		x		x		
European Skipper	*Thymelicus lineola*			x		x		x		x
Fritillary sp.							x		x	x
Giant Swallowtail	*Papilio cresphontes*	x			x				x	
Great Spangled Fritillary	*Speyeria cybele*			x		x		x	x	x
Juvenal's Duskywing	*Erynnis juvenalis*								x	
Least Skipper	*Ancyloxypha numitor*							x		x
Little Glassy Wing	*Pompeius verna*					x			x	
Little Wood Satyr	*Megisto cymela*			x		x	x			x
Monarch	*Danaus plexippus*	x	x	x	x	x	x		x	x
Mourning Cloak	*Nymphalis antiopa*					x	x			
Hairstreak spp.						x				
Northern Broken Dash	*Wallengrenia egeremet*		x							
Northern Cloudy Wing	*Thorybes pylades*									
Northern Crescent	Phyciodes morpheus					x				
Northern Pearly Eye	Enodia anthedon		x				x			
Orange Sulphur	*Colias eurytheme*		x		x	x	x	x	x	
Painted Lady /American Painted Lady	*Vanessa sp.*		x						x	
Pearl Crescent	*Phyciodes tharos*					x	x	x	x	x
Question Mark or Comma sp.									x	
Question Mark	*Polygonia interrogationis*									
Red Admiral	*Vanessa atalanta*			x				x	x	
Red Spotted Purple	*Speyeria cybele*	x								
Silver Spotted Skipper	*Epargyreus clarus*					x	x	x		
Skipper sp.			x		x	x	x	x	x	x
Sulphur sp			x				x	x		
Summer Azure	*Celastrina neglecta*									x
Tiger Swallowtail sp.	*Papilio sp.*	x			x	x	x	x	x	
Virginia Ctenucha (moth)	*Ctenucha virginica*							x		
Wild Indigo Duskywing	*Erynnis baptisae*						x			
Total Detections		**67**	**79**	**126**	**101**	**209**	**310**	**221**	**133**	**179**
Species Richness		**7**	**12**	**12**	**8**	**19**	**13**	**16**	**14**	**12**