Royal Botanical Gardens CANADA

Princess Point Tallgrass Prairie Environmental Status 2025

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Grassland vegetation data collection was completed by Mallory Peirce, William Jack, Reilly Smith, Naida Cavallin, and Julia Minaji. Bird data collection has been primarily collected by Lindsay Barr and Mallory Peirce, as well as former interns and assistants since monitoring began. Butterfly data has been continually collected by Lindsay Barr with the support of Mallory Peirce and previous interns and assistants, as well as volunteers.

Front cover photo: Yellow Savannah Grass (*Sorghastrum nutans*) at Princess Point. 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 been subject to an independent peer review. The report is the first edition of all Environmental Status of RBG's Grassland Restoration Sites and includes three reports covering Berry Tract, Rock Chapel and Princess Point, with updated versions being produced as needed. For Princess Pt a previous 20217 report is also available. 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

Since mowing the overall area ceased in 2003 and browsing Canada Geese have substantially reduced by shoreline plantings, Princess Point has undergone an extensive ecological transformation from a largely exposed damaged turf area and woodland to a structurally complex grassland system in 2025. Since the last report in 2017, Vegetation monitoring indicates clear progress toward restoration objectives, with native plant cover increasing approximately from 23% in 2009 to 65% in 2017 and 77% in 2025. Native prairie grass including both Big Bluestem (*Andropogon gerarrdii*) and Yellow Savanah Grass (*Sorghastrum nutans*) have both become noteworthy plant species at the site although not at a level reflecting a tallgrass prairie environment. Canada/Tall Goldenrod dominate the site and represent 66% of the cover in 2025 - an ideal species for migratory butterflies during late summer and fall.

Plant species richness has slowly increased over time to over 30 species within the monitoring sites in 2025, with the site continuing to undergo shifts in composition. Results also vary greatly year to year, but a general trend of increased species richness during years when a controlled burn occurred: 2009, 2010, 2013, 2017, 2021, 2023, and 2025. These changes are evident in the transition from early dominance associated non-native forbs such as Common Plantain and Canada Thistle to more structurally dominant species such as Tall/Canada Goldenrod. Overall, the vegetation data reflect a trajectory consistent with mid successional meadow development, with and ongoing movement toward a more native grass dominated system. When compared to the Berry Tract and Rock Chapel grassland sites, Princess Pt is more diverse and includes a slightly different collection of species and a more diverse mix of plants, butterflies and birds

Bird communities at Princess Point have shown a gradual decline in both numbers and diversity, with 19 species found in 2025, but of the grassland sites at RBG is the most diverse. The composition of the bird community is strongly influence by both the adjacent marsh and woodland habitats. Also, the high degree of visitors through the site and the general size and fragmentation of the landscape does not necessarily favour grassland birds. The bird community has shifted over time from an early dominance by Red winged Blackbirds (2009) to a more balanced community of mixed species including American Robin, Baltimore Oriole, Common Grackle and Yellow Warbler in 2025. The species with the most striking decline is Tree Swallow, formerly common with none encountered in 2025, although notable numbers continue to present at Cootes Paradise. Butterfly monitoring demonstrates strong habitat uptake and increases in diversity with richness climbing to 16 species in 2025, with overall butterfly numbers relatively consistent over time. A striking feature of 2025 monitoring was that only a single Monarch Butterfly encountered at the site in July unlike previous years.

Taken together, these results indicate that restoration efforts at Princess Point are continuing to successfully transition the site from a mowed turf area to a functional grassland ecosystem, and inspiring visitor experience, but with fire dependence to transition the plant community towards tallgrass prairie. The site's biodiversity is at the same time also notably impacted by the degree of visitation to the site with trampling tied to the desire to capture the experience in pictures. Ongoing management challenges focus both on visitor management as well as the continue elimination of invasive plant species remaining in pockets around the perimeter as well as ongoing controlled burns to facilitate tallgrass prairie species.

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 and in particular tallgrass prairie, 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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Introduction

Situated in Hamilton, Princess Point lies on the southern shore of Cootes Paradise as low promontory into the marsh. Princess Point's peninsula has been a natural gathering place for people dating back to retreat of the last ice age (Haines et al., 2011). Many archaeological excavations on the peninsula have revealed detailed accounts of life during the Middle to Late Woodland period in northeastern North America (Bursey 2003). The archaeological discoveries for this period noted the transition to early maize-based agriculture and an increasingly sedentary way of life (Bursey 2003; Crawford and Smith, 1996) in what is now Ontario as the climate warmed.

This historical plant community at Princess Point was shaped by First Nations use as well as the sandy soils and can be found in remnant tallgrass prairies and oak savannah ecosystems. The remnant fragments have guided restoration efforts of the peninsula since 2007, with the end goal of fully restoring 2.5 hectares to tallgrass prairie and 0.5 hectares to oak savannah. For over a half a century prior the area was largely a mowed park providing water access and activity space for recreation at Royal Botanical Gardens. The site includes extensive marsh infill to provide public access as well as some site fill on the grassland area to level the formerly subtly rolling landscape. A 1km long nature trail follows the shoreline around the site and includes several viewing platforms to gathering in the enthusiastic visitors as well as manage slope/shoreline erosion. Prior to this the area was grazed as pasture lands but appears to lack active crop farming through review of the site's history. To help restore the plant community extensive planting and seeding has occurred over the years as well as regular controlled burns.

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. All of these sites are restoration projects initiated between 2009 and 2020. 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 important and unique habitat in the Hamilton area and supports an under valued category of the Hamilton Biodiversity Action Plan.

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, there is evidence that 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.

Tallgrass prairie habitats are among the rarest remaining types of grasslands. They 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 in dryer

areas 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 than wildflowers – typically 70% native grasses and 30% native wildflowers.

Native meadows exist primarily as temporary habitats in transition after disturbance. Disturbance events can range from abandoned agricultural practices, overgrown pastureland, or roadsides. Meadows in Ontario 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 upwards of 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.

On the landscape level, grasslands are vital pieces in the ecological matrix and as a tool in combating climate change. 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, either through 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 to grassland habitat. 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 ongoing restoration outcomes at Princess Point updated last in 2017 (Raddasao 2017). The ecosystem stewardship goal of Princess Point is to be a Tallgrass Prairie and Oak Savanah based plant community, supporting migratory bird and butterfly species, with public access and education. To this end regular controlled burns have occurred in April at Princess Point beginning in 2008, eight to date including April 2025.

Methods

This report includes data collected through vegetation monitoring and bird monitoring index surveys, and a butterfly transect of which the methods for each are summarize below. There are currently 13 grassland vegetation monitoring plots across RBG's nature sanctuaries. Seven plots at Princess Point Prairie, four plots at Berry Tract South, and three plots in the Monarch Meadows of Rock Chapel. At Princess Pt monitoring has occurred since 2009. Other "archived" monitoring plots exist, but have not been consistently or continually monitored in recent years. A long-term bird monitoring plot at Princess Point (CP-SS-6) monitored since 2010 is summarized in this report. Butterfly monitoring in the form of an annual, single day count has occurred at the site since 2011.

Site Description

Princess Point is a 3-hectare site including both tallgrass prairie and oak savannah habitats, in the southeast corner of RBG's Cootes Paradise Nature Sanctuary. The site is a low sand peninsula sitting about 3-5m above the waters of Cootes Paradise Marsh and is the primary public access area for the South side of Cootes Paradise. Following European settlement, the lands were principally used as pasture lands, as well as water access for recreation. Acquired by RBG in 1942, the site became a public access and recreation focal area with extensive mowed turf. The access area is infill of the marsh to accommodate the extensive visitation and is linked to the waterfront trail. Ongoing grassland restoration efforts at the site are critical to increasing biodiversity have been ongoing since 2007. Adjacent to site is Westdale neighbourhood to the south, and Highway 403 to the east, a significant noise pollution element in this scenic landscape. Ongoing controlled burns have occurred to maintain tallgrass prairie habitat, the last controlled burn completed in April 2025.

Vegetation Monitoring

Vegetation monitoring in RBG's grassland restoration sites occurs during the peak growing season on an annual basis. In 2003, RBG's controlled burn vegetation monitoring began at various sites including York Boulevard Prairie, Sassafras Point and a portion of Princess Point's Oak Savannah and slight methodology adjustments and additions were made up until 2009. Vegetation monitoring in Princess Point's prairie began in 2009. Since that time, a robust monitoring regime has been established including photo monitoring, transects and plots. Monitoring has transitioned away from Sassafras Point and York Blvd Prairies to focus on newly restored habitat at Berry Tract and Rock Chapel. Princess Point is monitored annually, and Monarch Meadows and Berry Tract South are monitored biennially. Monitoring efforts began at Berry Tract South in 2019, and at Monarch Meadows in 2022.

For the purposes of this report, four unique grassland locations will be compared: Princess Point Prairie (seven monitoring 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 detailed below.

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 sites were initially chosen to correspond with forest monitoring plots which undergo additional vegetation assessments under RBG’s Long-term Forest Monitoring Program. The original purpose was to assess the impact of Btk application to control Spongy Moth outbreaks that were dramatically affecting the oak forest, but surveys have since evolved to represent the health of terrestrial birds at RBG. These sites focus on terrestrial habitats, including grassland restoration sites. Together, the monitoring plots are scattered amongst RBG’s nature sanctuaries with the Princess Pt site ongoing since 2011 at a single grassland plot.

Point Count Surveys

The 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 2011, butterfly index monitoring has occurred at Princess Point during the month of July by a team of RBG staff and volunteers. A complete sweep of the trail system is done between the hours of 10:00am and 3:00pm, where every individual butterfly is identified and counted. Essentially, a long transect of about 1km is surveyed. Butterfly species that can easily be 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

Plots Species Richness and Abundance

Abundance

In both 2009 and 2025, Tall/Canada Goldenrod was the most abundant species observed during vegetation monitoring (Figure 1). In 2009, Tall/Canada Goldenrod accounted for 41% of all species, followed by Path Rush (16%), Black Medick (15%), Upright Yellow Wood-sorrel (7%), and Red Clover (5%). All other species accounted for 16% of all observations. In 2025, Tall/Canada Goldenrod was the most abundant species accounting for 66% of all observations, followed by Wild Bergamot (8%), Cow Vetch (5%), Black Medick (4%), Common Ragweed (3%), and all other species accounted for 14% of all observations (Figure 1).

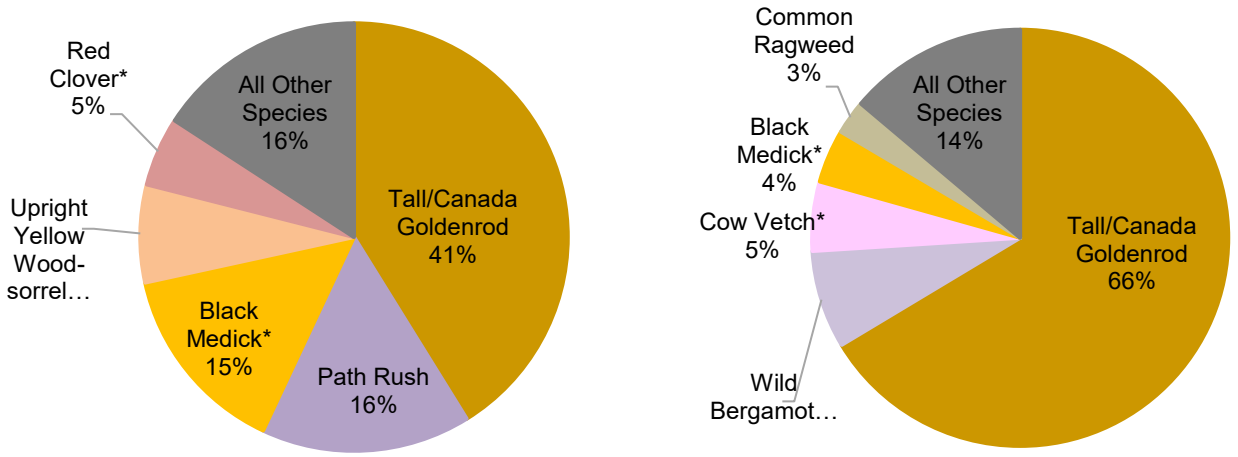

Figure 1. Relative abundance of all plant species in 2009 (left) and 2025 (right) during quadrat monitoring-avg/plot.

Relative Cover

In 2009, non-native Ribgrass accounted for 53% of all vegetation cover in quadrat monitoring plots (Figure 2), followed by Tall/Canada Goldenrod (17%), non-native Kentucky Blue Grass (12%), Wood Blue Grass (7%), Black Medick (2%), and all other species combined accounted for 9% of all vegetation cover. In 2025, Tall/Canada Goldenrod was the species with the greatest relative cover, accounting for 58% of all plant coverage (Figure 2). followed by Wood Blue Grass (11%), Unknown Non-native Graminoid species (8%), Wild Bergamot (7%) and Bent Grass species (3%). All other species accounted for 13% of total vegetation.

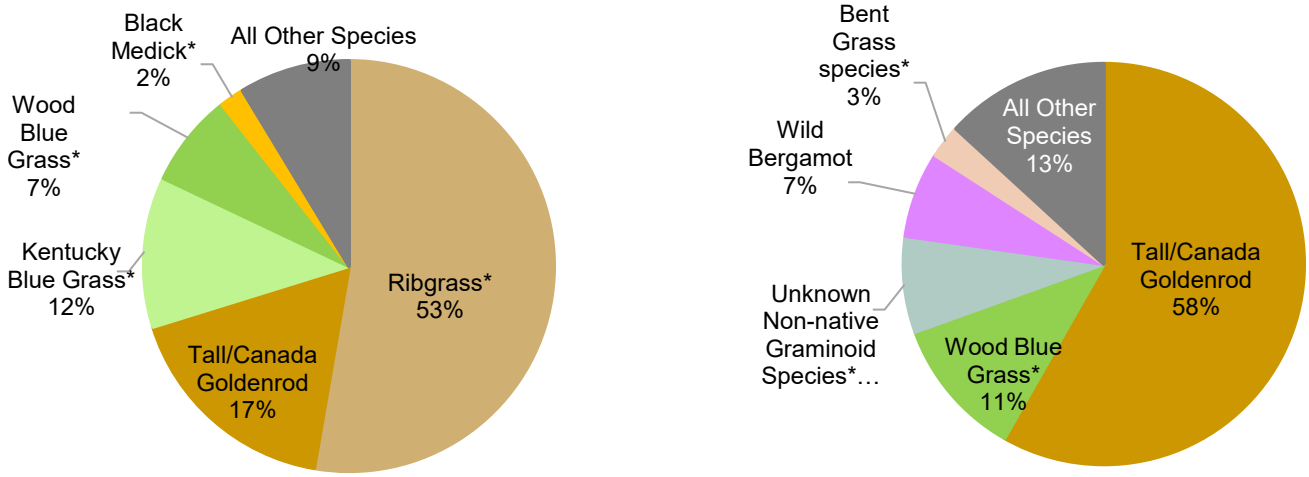

Figure 2. Relative cover of the top five highest cover species in 2009 (left) and 2025 (right) quadrat avg/plot.

Species Richness

Species richness has varied over time but follows a general pattern of an observed increase in species detected after a controlled burn occurred. When looking at species richness for plants observed in the percent cover data, the richness is typically equal to or greater than plants observed in the abundance data, which likely provide a better representation of the plant community across the entire prairie. Species richness in quadrat surveys has ranged from 20 in 2009 species to 39 species in 2014 (Figure 3). Results also vary greatly year to year, but a general trend of increased species richness during years when a controlled burn occurred: 2009, 2010, 2013, 2017, 2021, 2023, and 2025.

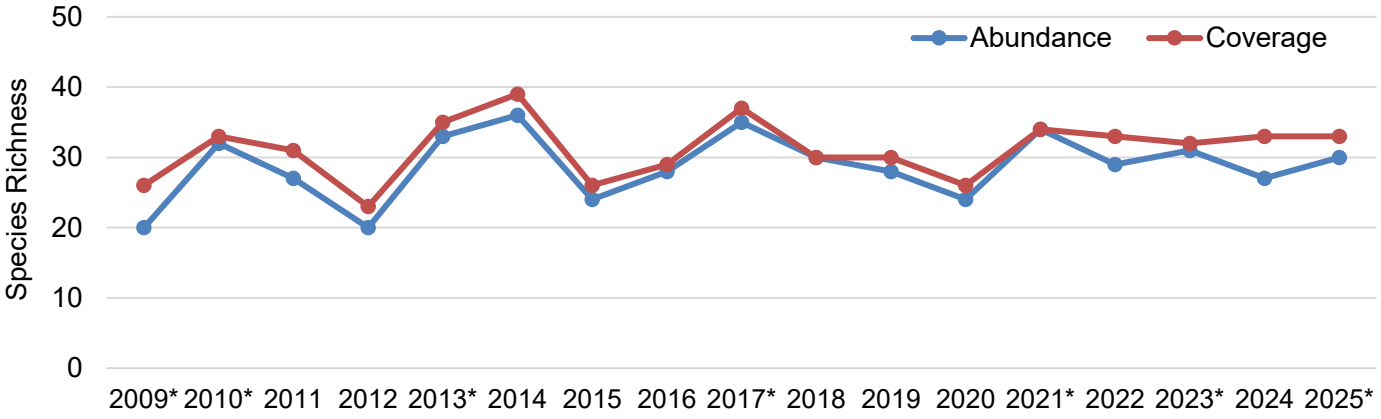

Figure 3. Species richness at Princess Point 2009 to 2025 for both percent cover and abundance methods – avg/plot.

Plots Grass Species

Abundance

While total abundance is the low the relative abundance of prominent native grasses shows strong interannual variability, with dominance shifting primarily between Big Bluestem and Yellow Savannah Grass over the monitoring period. Yellow Savannah Grass is the dominant species in the early years (2010 – 2014), reaching a peak of 92.0% in 2011, before declining sharply to 0% in 2015. Following this, Big Bluestem becomes highly dominant in certain years, most notably in 2015 (100.0%) and again in 2020 (91.7%), indicating periods where it comprises the majority of grasses observed. After 2020, Big Bluestem maintains a consistent presence with increasing abundance toward 2025 (78.4%). Yellow Savannah Grass re-emerges intermittently, suggesting on going fluctuation between these two species. Virginia Wild Rye is largely absent throughout the dataset, only appearing in recent years (2023-2025).

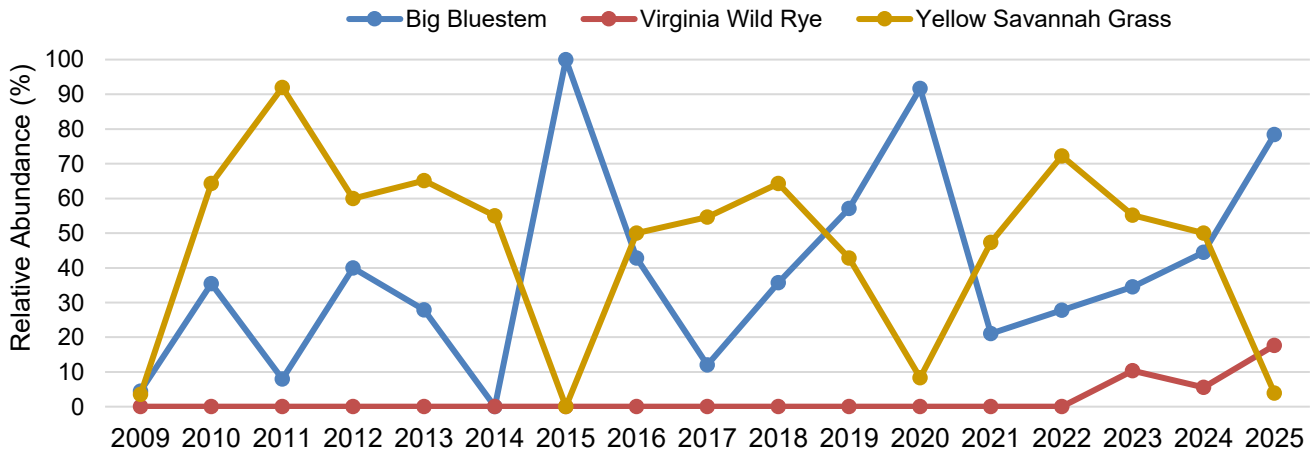

Figure 4. Species composition of prominent native grasses at Princess Point from 2009- 2025, avg/plot.

Relative Cover

Patterns of relative cover broadly reflect the abundance trends but provide insight into species dominance in terms of spatial extent. Yellow Savannah Grass exhibits sustained high cover from 2014 through 2023, frequently exceeding 70%, while peaking at 85.1% in 2016, indicating that it occupies a large proportion of available space even in years where its relative abundance fluctuates. In contrast, Big Bluestem shows more moderate but variable cover throughout most of the monitoring period, followed by a marked increase in 2025 (61.5%). Path Rush is a prominent component in the early years (2009-2013), with cover exceeding 50% at times, but declines rapidly thereafter to eventually being absent. Virginia Wild Rye appears only in later years and at low cover values.

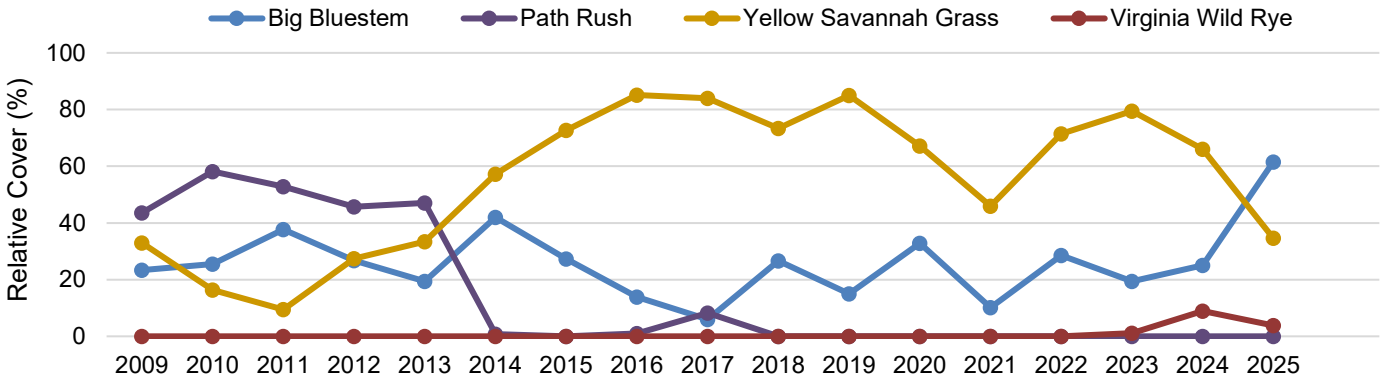

Figure 5. Species composition and relative cover of prominent native grasses at Princess Point 2009 – 2025, avg/plot.

Plots Forb Species

Abundance

Tall/Canada Goldenrod (*Solidago sp.*)consistently dominated the forb community throughout the monitoring period, maintaining high relative abundance in most years. Following moderate values in 2009-2010 (49.8-56.9%), abundance increased sustainability, reaching peak levels 2012 (89.2%), 2016 (85.3%), and 2020 (92.0%). Although periodic declines were observed, notably in 2013 (46.7%) and 2023 (58.1%), the species remained the most prevalent forb across all years.

Other common forb species exhibited lower relative abundance and greater interannual variability compared to Tall/ Canada Goldenrod. Black Medick showed the most pronounced fluctuations, with elevated abundance early in the monitoring period (17.7% in 2009) and again in later years peaking at 14.7% in 2023. Cow Vetch also demonstrated intermittent increases, particularly between 2022 and 2023, followed by subsequent declines. Wild Bergamot exhibited a more gradual upward trend, increasing in abundance after 2015 and reaching a maximum of 8.0% in 2025, suggesting ongoing establishment and persistence within the community. In contrast, Common Ragweed remained consistently low throughout the monitoring period.

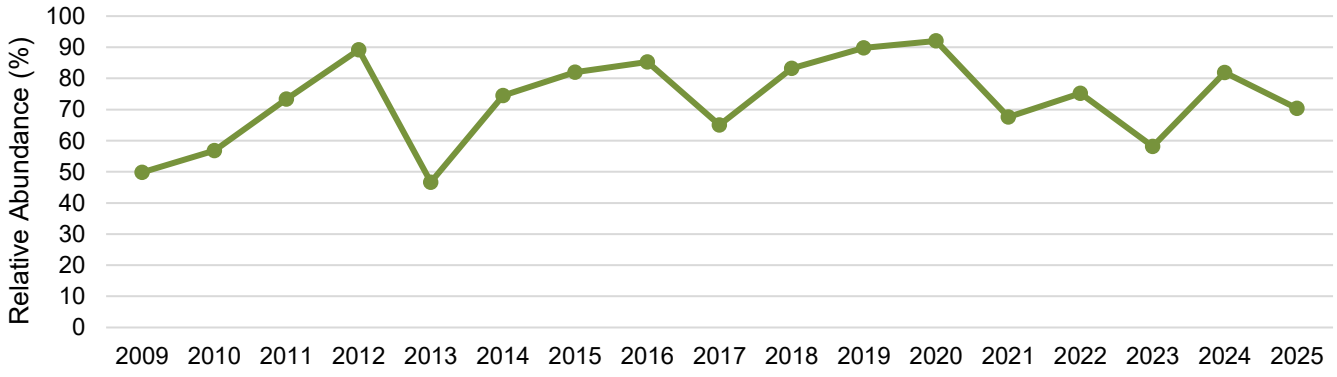

Figure 6. Relative abundance of Tall/Canada Goldenrod at Princess Point from 2009 – 2025, avg/plot

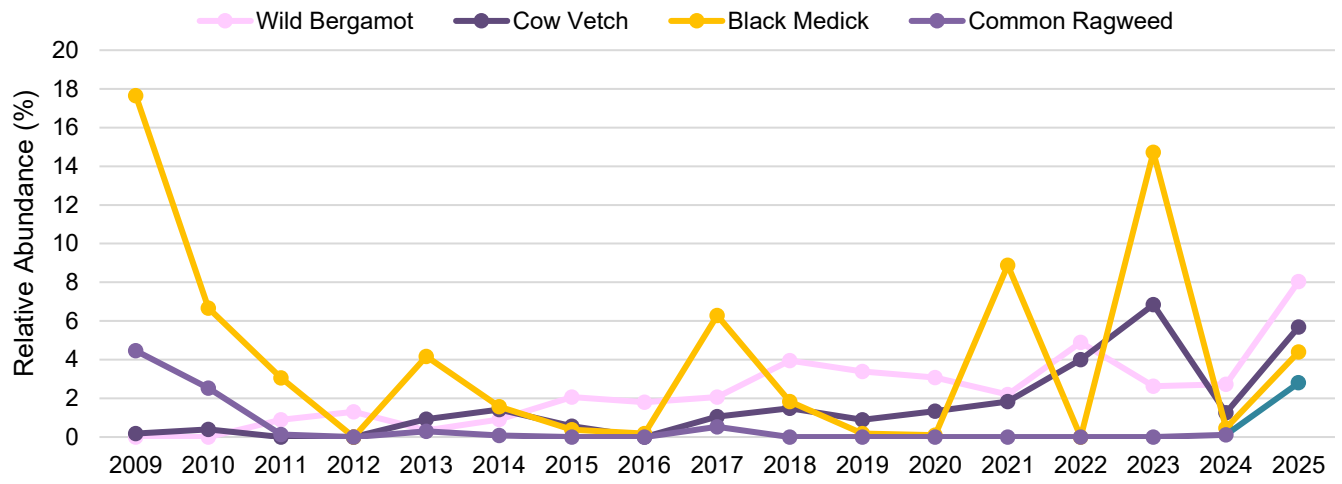

Figure 7. Relative abundance of top four most prevalent forb species at Princess Point from 2009 – 2025, avg/plot

Relative Cover

The relative cover of Tall/Canada Goldenrod shows a clear trajectory of early establishment followed by sustained dominance across much of the monitoring period. Cover increases rapidly from 23.2% in 2009 to over 70% by 2011, and continues to rise, exceeding 80% for most years between 2012 and 2021, with peak values observed in 2016 (91.5%) and 2020 (92.7%). This indicated that goldenrod became the primary structural component of the forb layer during this period. A notable decline occurs between 2022 and 2023, with cover dropping to 60.5% and 52.8% respectively, before rebounding to 80.3% by 2025.

The relative cover of other common forb species remains low for much of the monitoring period but shows a clear increase in recent years, particularly after 2020. Cow Vetch exhibits the most pronounced spike, increasing sharply to 18.2% in 2023 before declining again, suggesting episodic expansion rather than sustained dominance. Wild Bergamot demonstrates a more gradual and sustained increase, rising steadily from negligible values prior to 2016 to a peak of 12.1% in 2024. Canada Thistle and Black Medick remain consistently low throughout the dataset, with only minor fluctuations.

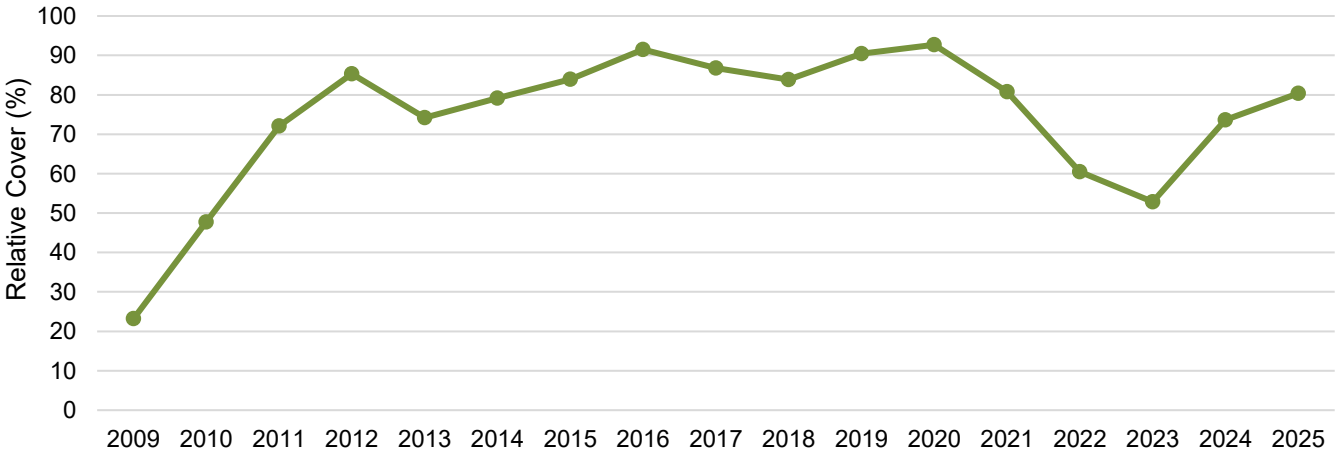

Figure 8. Relative cover (%) of Tall/Canada Goldenrod, the most prevalent forb at Princess Point 2009 - 2025.

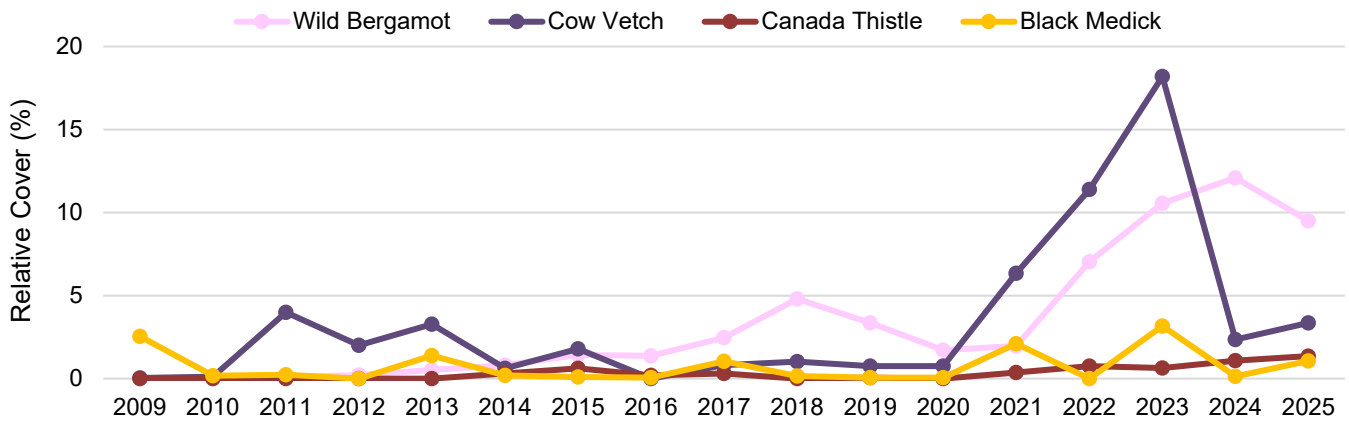

Figure 9. Species composition using relative cover (%) of most prevalent species at Princess Point 2009 - 2025.

Non-native Plants

Non-native species composition from 2020-2025 is largely dominated by forb species, with Cow Vetch consistently representing the greatest proportion, peaking at 77.5% in 2023 before declining to 52.7% by 2025. Other forbs show notable interannual variability, with Black Medick and Canada Thistle exhibiting periodic increases (particularly in 2021 and 2025), suggesting responses to disturbance or management efforts such as prescribed burns. In contrast, species such as Common St. John's-wort and Wild Carrot remain at low abundance or decline over time. The forb community remains the most consistent component of the non-native assemblage, though its composition shifts between years.

Graminoid trends should be interpreted with caution, as variability in identification – particularly among visually similar grass species – likely contribute to the abrupt changes in recorded abundance. The apparent emergence of Wood Blue Grass from 0.0% to 75.7% in 2025, along with increases in Kentucky Blue Grass and Quack Grass, may reflect improvements or inconsistencies in identification rather than true ecological shifts. While there is some indication of increasing graminoid presence in recent years, the magnitude of change is uncertain. Shrub and tree categories are represented almost exclusively by Common Buckthorn and White Mulberry, respectively, each showing complete dominance (100%) in years recorded.

Table 1. Relative abundance (%) of non-native plant species by form from 2020 – 2025, averaged/plot.

	2020	2021	2022	2023	2024	2025
Forb						
Cow Vetch	33.3%	61.0%	72.6%	77.5%	50.0%	52.7%
Canada Thistle	0.0%	3.6%	4.8%	2.8%	22.9%	21.4%
Black Medick	2.6%	20.2%	0.0%	13.5%	3.1%	16.8%
Common St. John's-wort	25.6%	4.0%	0.7%	0.3%	0.0%	5.3%
Silvery Cinquefoil	0.0%	1.8%	2.7%	0.7%	6.3%	1.5%
Wild Carrot	2.6%	0.4%	0.0%	0.6%	4.2%	1.5%
Common Sowthistle	0.0%	0.0%	0.0%	0.0%	0.0%	0.8%
Graminoid						
Wood Blue Grass	0.0%	0.0%	0.0%	0.0%	0.0%	75.7%
Kentucky Blue Grass	0.0%	0.0%	0.0%	0.0%	0.0%	12.8%
Quack Grass	0.0%	0.0%	1.4%	0.0%	10.9%	9.7%
Orchard Grass	0.0%	0.6%	0.4%	18.0%	0.0%	0.9%
Timothy	0.9%	0.1%	0.4%	0.0%	0.0%	0.9%
Shrub						
Common Buckthorn	0%	100.0%	100.0%	0%	0%	100.0%
Tree						
White Mulberry	0%	100.0%	0%	0%	0%	0%

Relative Cover

Non-native and native plant cover has nearly reversed in cover since monitoring began in 2009. In 2009, 77.2% of all plant cover was composed of non-native plant species (Figure 10), and native plant cover occupied 22.8%. Since then, there has been fluctuation in the relative cover of non-native and native plant cover, with a general trend displaying a decrease in non-native plant cover the year of and following a controlled burn. 2018 had the highest native plant cover, reach nearly 79.2%, which is followed closely by 2025 when native plant cover reached 78.4%.

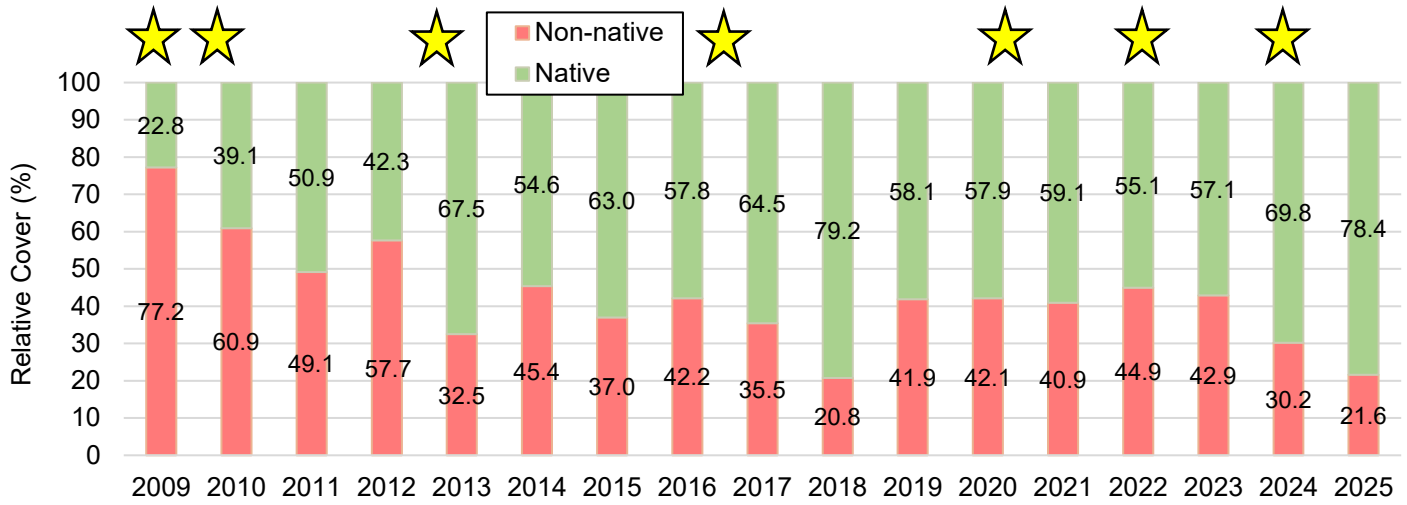

Figure 10. Relative cover of non-native species and native species observed in quadrat monitoring at Princess Point from 2009 to 2025. Stars indicate the years with a controlled burn occurring in April. Data averaged/plot.

Transect Data

Tall/Canada Goldenrod shows consistently high but also highly variable relative abundance over the monitoring period – generally remaining above 50% in most years (Figure 11). Early peaks are observed in 2010 (90.3%) and again in 2016 (90.8%), suggesting periods of strong dominance within the plant community. This is followed by notable fluctuations, including declines in 2011 (47.7%), 2014 (51.8%), and a more pronounced drop in 2023 (31.7%), which represents the lowest recorded value. However, the species shows resilience, with recover in subsequent years, reaching 64.7% in 2024 and 66.0% in 2025. Overall, the trend indicates that while goldenrod remains a dominant component of the meadow, its abundance is subject to interannual variability, likely reflecting changing site conditions, management practices, or competition with other species.

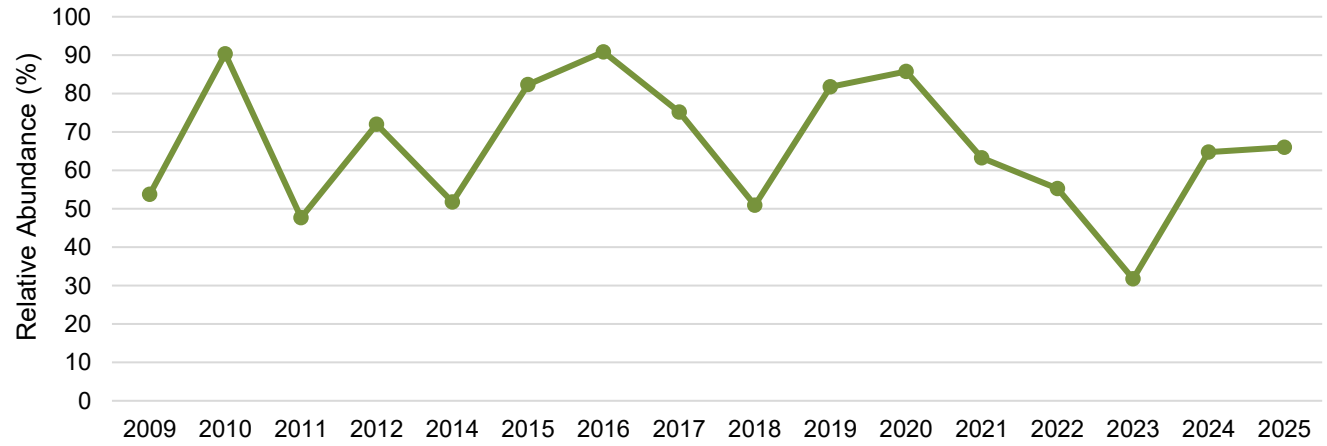

Figure 11. Tall/Canada Goldenrod relative abundance observed in transect surveys at Princess Point 2009 - 2025.

The relative abundance of other common species shows increasing diversity and establishment over time, particularly in the later years of monitoring (Figure 12). Big Bluestem exhibits a notable early spike in 2014 (30.36%) but remains relatively low and stable thereafter, with a modest increase after 2020. Yellow Savannah Grass and Wild Bergamot show gradual increases, with both species reaching higher abundances in the 2021-2023 period, indicating successful establishment and spread. Cow Vetch displays a different pattern, with minimal presence prior to 2020 followed by a sharp increase, peaking at 26.20% in 2023, before declining again. Collectively these trends suggest a shift towards a structurally mature grassland habitat.

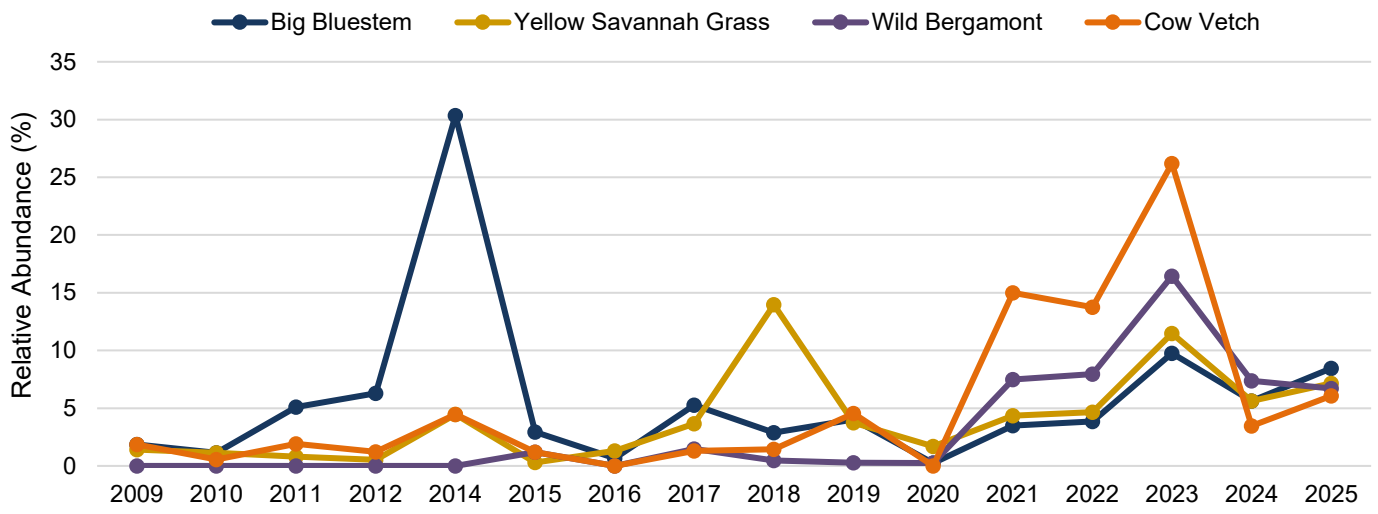

Figure 12. Common abundant species at Princess Point observed during transect monitoring from 2009 - 2025.

Photo Monitoring

Results from photo monitoring at Princess Point suggest gradual increases in vegetation density since monitoring began in 2009 (Figure 13). Vegetation density in the 0.0m to 1.0m strata has been consistently dense since monitoring began, with some variation in the 0.5m to 1.0m layer. In the first few years of monitoring, vegetation was present above 1.0m in height but was not dense (lighter colouration) in comparison to more recent years where vegetation in the 1.0m to 1.5m layer has become denser (darker colour). 2024 had the tallest and densest vegetation on record.

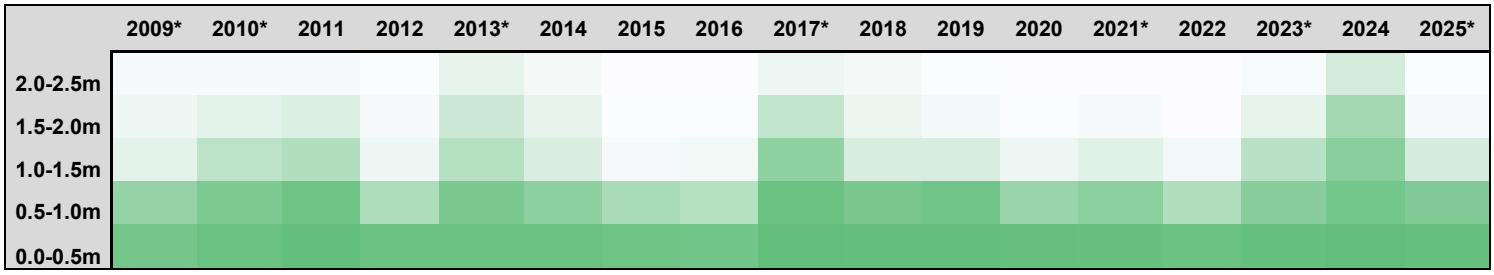

Figure 13. Photo monitoring results from seventeen monitoring sessions at Princess Point from 2009 - 2025. Dark colouration represents denser vegetation growth in comparison to lighter colouration.

Bird Monitoring

Species Richness

Bird species richness at Princess Point had been slowly increasing since monitoring began in 2011 with 22 species up until 2022 with 33, with a peak in 2017 of 35 species recorded (Figure 14). The past three years have shown a significant drop, with 2023 having a richness of just 17, and a close second of 19 in 2025.

When comparing to Rock Chapel and Berry Tract, Princess Point typically experiences the highest species richness.

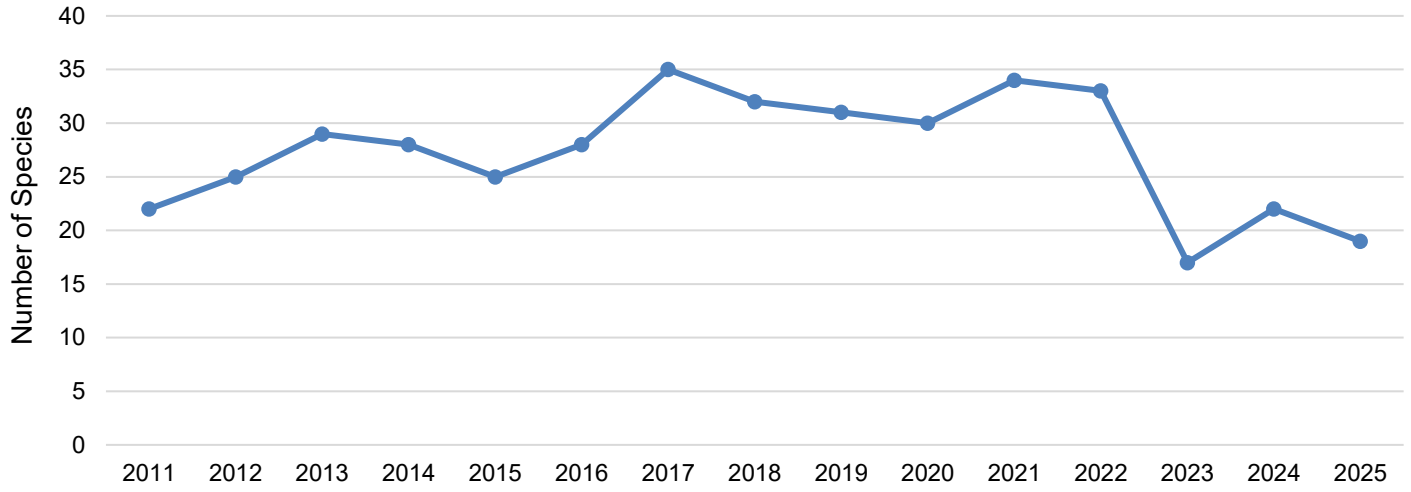

Figure 14. Total Bird species richness at Princess Point, 2011-2025.

Relative Abundance

In 2025, the most abundant species at Princess Point were American Robin, Baltimore Oriole, Blue Jay, Common Grackle and Northern Yellow Warbler all accounting for 10% each (Figure 15). The second most abundant species were the Northern Flicker and Eastern Warbling Vireo at 7%, followed by the Black-Capped

Figure 16. Most abundant bird species at Princess Point in 2012 (left) and 2025 (right)

Chickadee in third at 6%. All other species observations make up the remaining 30%. When comparing to 2012, the top most abundanct bird was the Red-winged Blackbird at 20% of observations. In second was the Cedar Waxwing (14%), followed by the Tree Swallow (8%). Tied for fourth was the Song Sparrow and Northern Yellow Warbler at 7%, and an unknown Gull species in fifth at 6%. All other species accounted for 38% of observations.

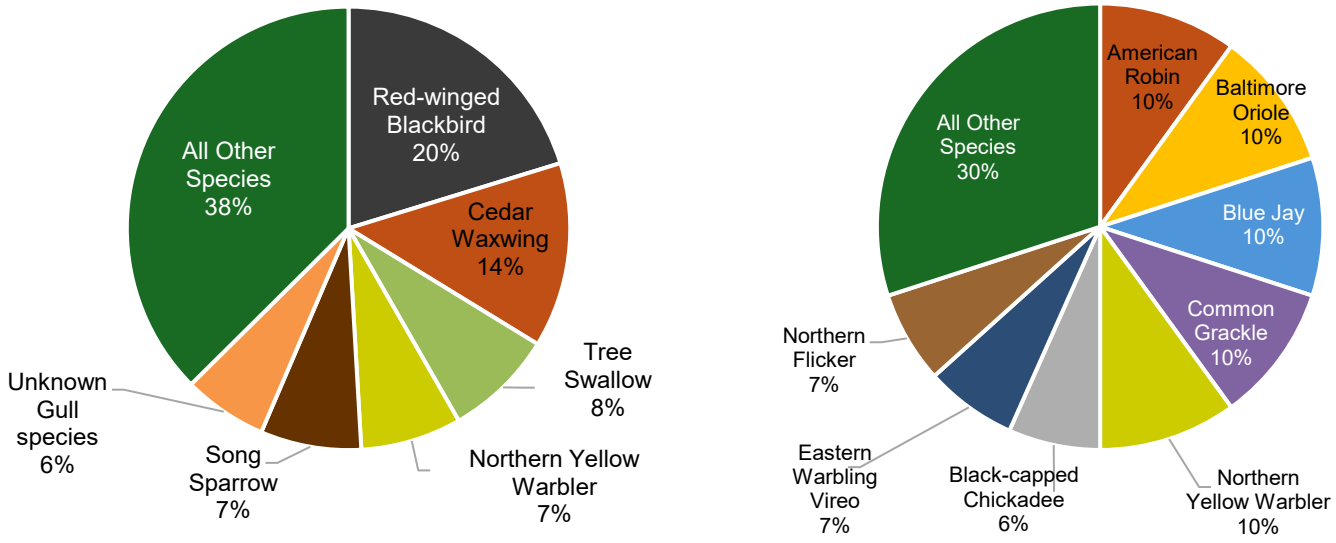

Figure 15. Relative abundance of the top five species at Princess Point in 2012 (left) and 2025 (right), avg/visit.

Detections

Bird detections at Princess Point peaked in 2017 with 55 detections and has been declining ever since with an average of 29 from 2018 to 2025. This past monitoring season saw its lowest record in 13 years with just 21 detections (Figure 17).

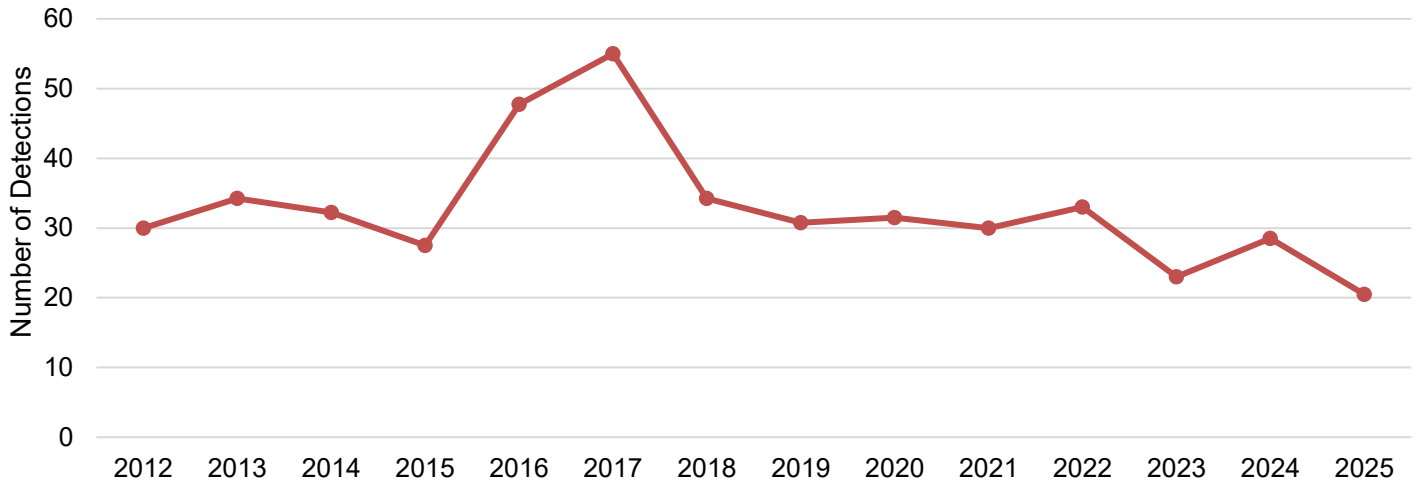

Figure 17. Number of bird detections at Princess Point from 2012 to 2025, avg/visit.

Species Specific Trends over Time

Tree Swallows are commonly seen at Princess Point, and the first six years of monitoring saw an average of 13 individuals each year (Figure 18). There was a peak in 2017 with 32 observations, and a decline in the years following with none seen during 2021, 2023 and 2025.

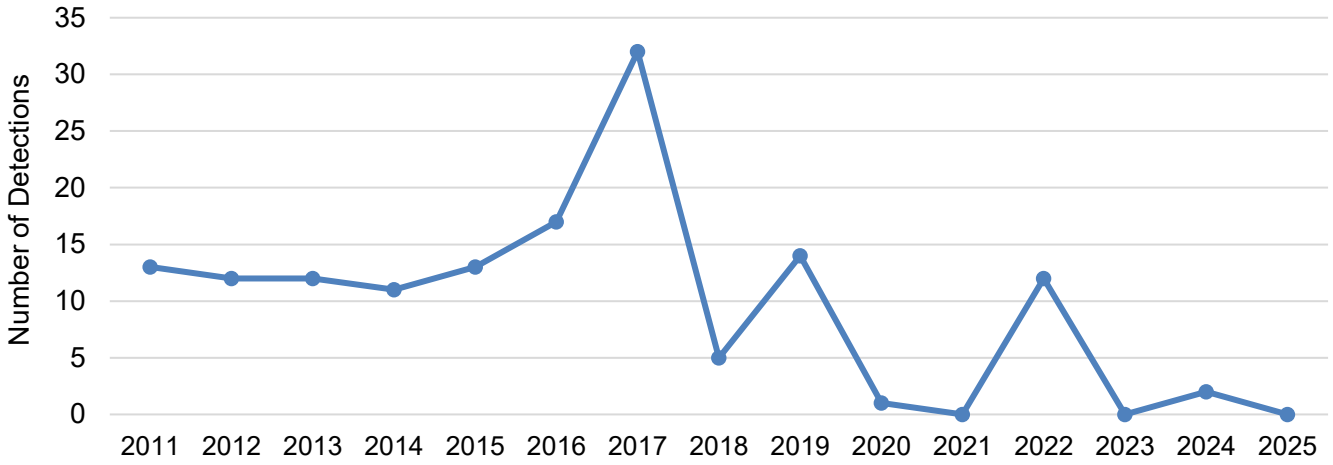

Figure 18. Tree Swallow detections at Princess Point from 2011-2025.

Butterfly Monitoring

Species Richness

Butterfly species richness at Princess Point varied widely from 2011 to 2021, with the lowest recorded richness in 2017 with just 5 different species. The past five years from 2021 to 2025 have shown a significant increase with 2024 and 2025 being tied for the highest years with 17 species (Figure 19). This is the highest among all monitoring sites.

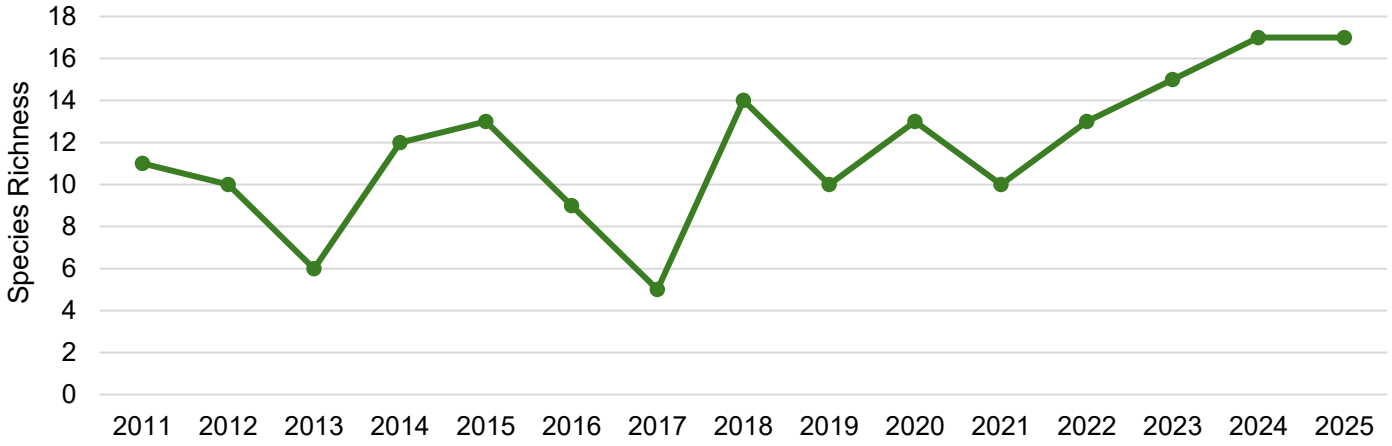

Figure 19. Total Butterfly species richness at Princess Point from 2011 to 2025.

Detections

Butterfly detections at Princess Point began with a count of 127 in 2011 and dropped to its lowest in 2017 with just 13 (Figure 21). There was a steady increase in detections from 2019 to 2023 which had 142 observations, followed by a decline the past two years and a count of just 76 in 2025.

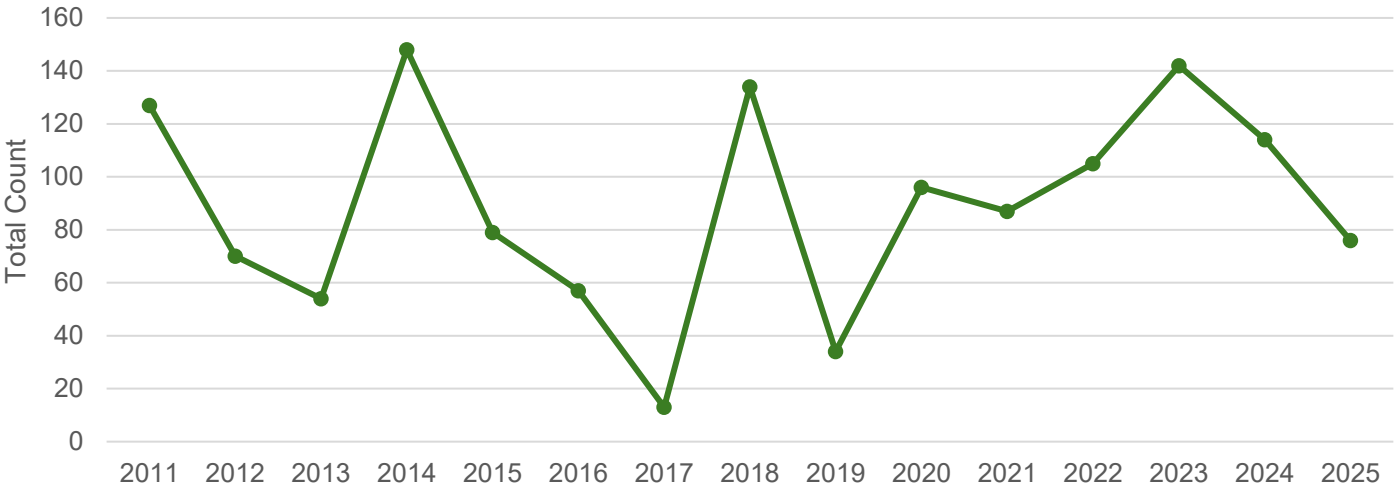

Figure 20. Total Butterfly detections at Princess Point from 2011 to 2025.

Relative Abundance

In 2025, the most abundant species at Princess Point was the Cabbage White being 29% of observations, followed by Clouded Sulphur in second at 13% (Figure 21). The third most abundant was a Skipper sp (9%), and a tie for fourth with the Black Swallowtail and Cresent sp (8%). The fifth most abundant was the Silver-spotted skipper at 7%, and all other species account for 26% of observations. When looking at 2011 the most abundant species was the European Skipper (42%), second most abundant was Cabbage White (24%), followed by Silver-spotted Skipper (15%). The fourth most abundant was Banded Hairstreak (9%), in fifth was Little wood satyr (4%) and all other species account for the remaining 6%.

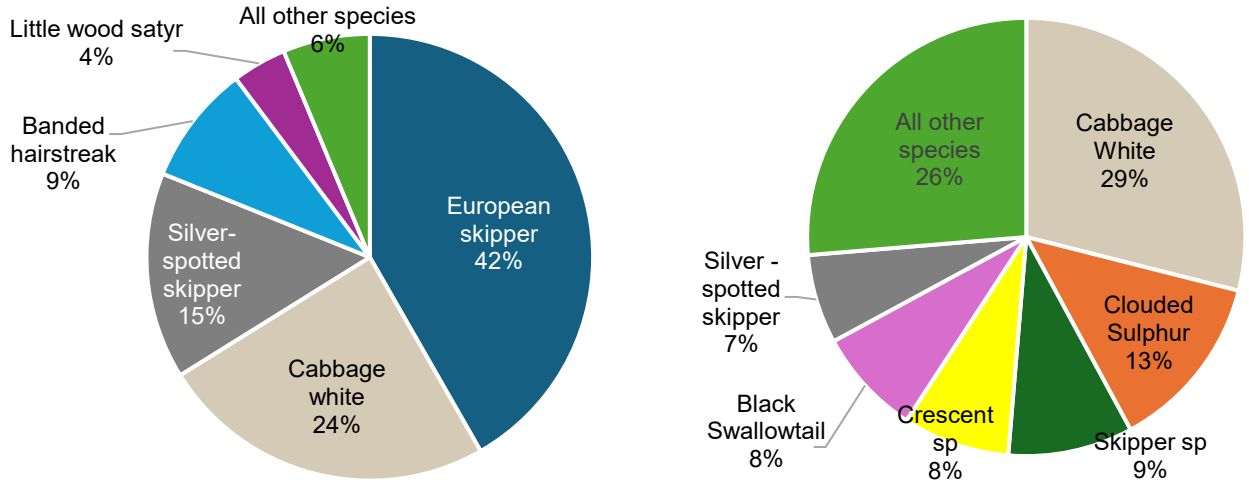

Figure 21. Top five most abundant butterfly species at Princess Point in 2011 (left) and 2025 (right).

Monarch Butterfly

Monarch Butterflies, a species at risk listed as endangered in North America, are commonly seen during our surveys, and had their highest count at Princess Point in 2018 with 20 individuals. Since then, their counts have fluctuated, with 2025 having the lowest count since 2016 with just 2 individuals observed (Figure 22).

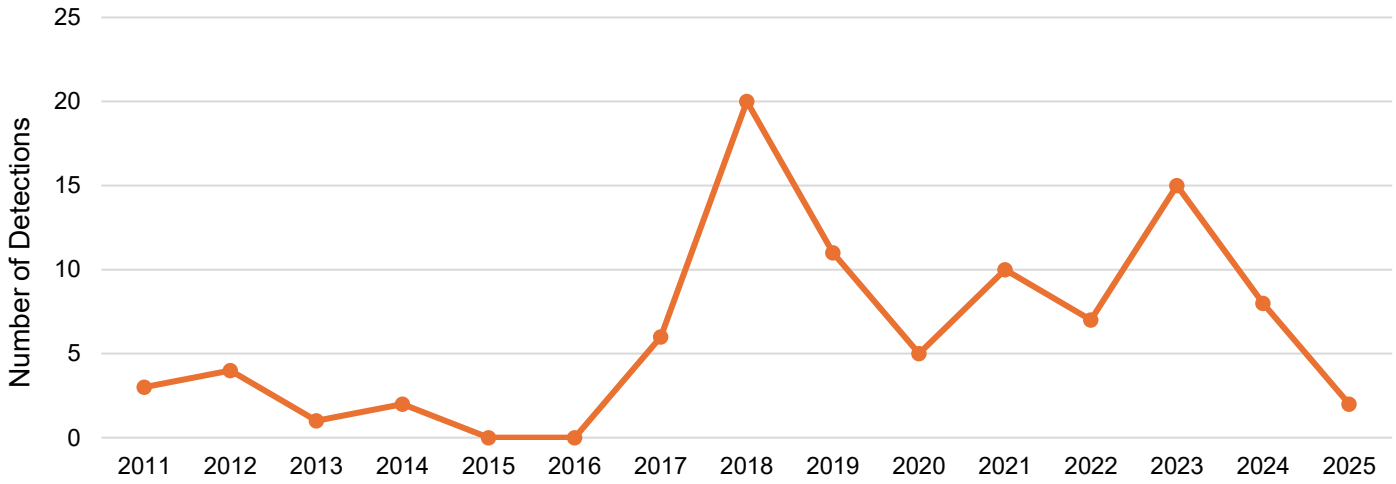

Figure 22. Monarch butterfly detections at Princess Point, 2011-2025.

Comparison Across RBG's Grassland Sites

Vegetation Monitoring Comparison

Using monitoring plot data Figure 23 below shows species richness trends across three sites for Rock Chapel's Monarch Meadows, Princess Point, and Berry Tract South for the period of comparative monitoring between 2021 to 2025. 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.

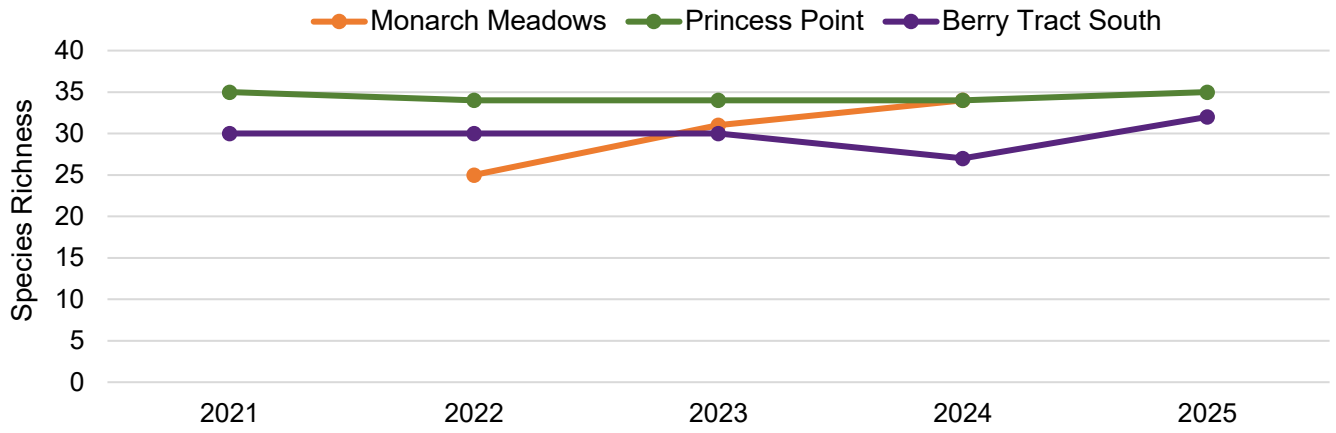

Figure 23. Vegetation species richness across all three grassland restoration sites from 2021 – 2025, avg/plot.

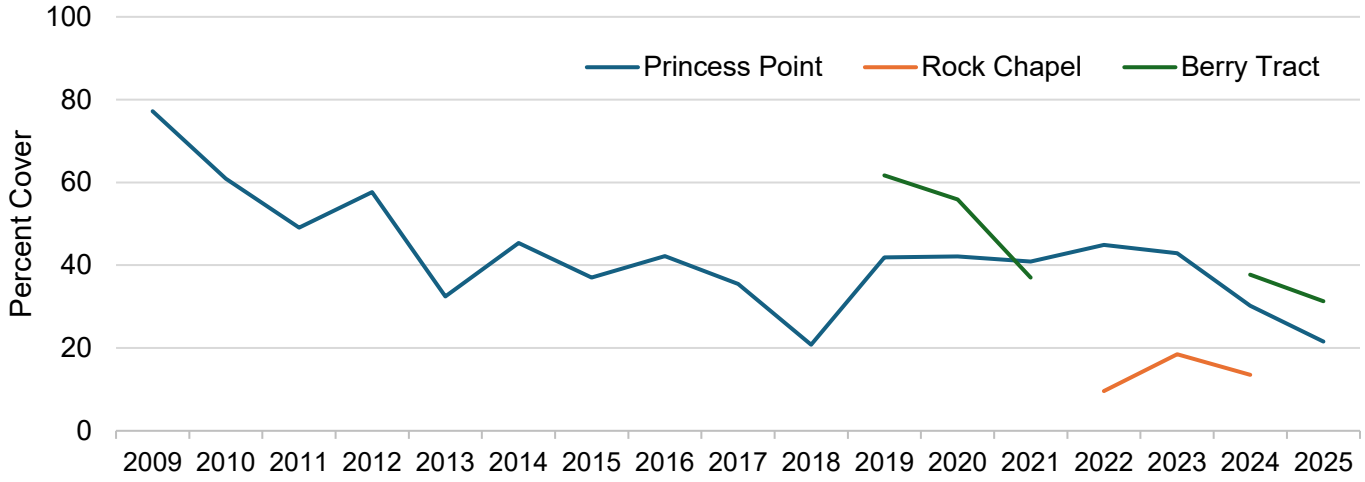

Figure 24. Non-native species coverage trends at Rock Chapel, Princess Point and Berry Tract Grasslands, avg/plot.

A comparison in the trend over time illustrates a general decline for all sites, with the principal plant community being dominated by native plant species. The Rock Chapel site faced far lower early challenges with non-native plants during the early part of establishment of seed species with non-native plant species never occupy more than 20% of the plant cover. Rock Chapel's principle non-native plant is Queen Annes Lace (*Daucus carota*), Princess Points non-native species have shifted dramatically overtime, currently most affected by Cow Vetch (*Vicia cracca*), while Berry Tract continues to have challenges with bare soil and a currently unidentified grass species (*Poa sp*) .

Bird Monitoring Comparison

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 at Rock Chapel 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 declining slightly, ranging from 30 detections per visit in 2020 to around 20 detections in 2025.

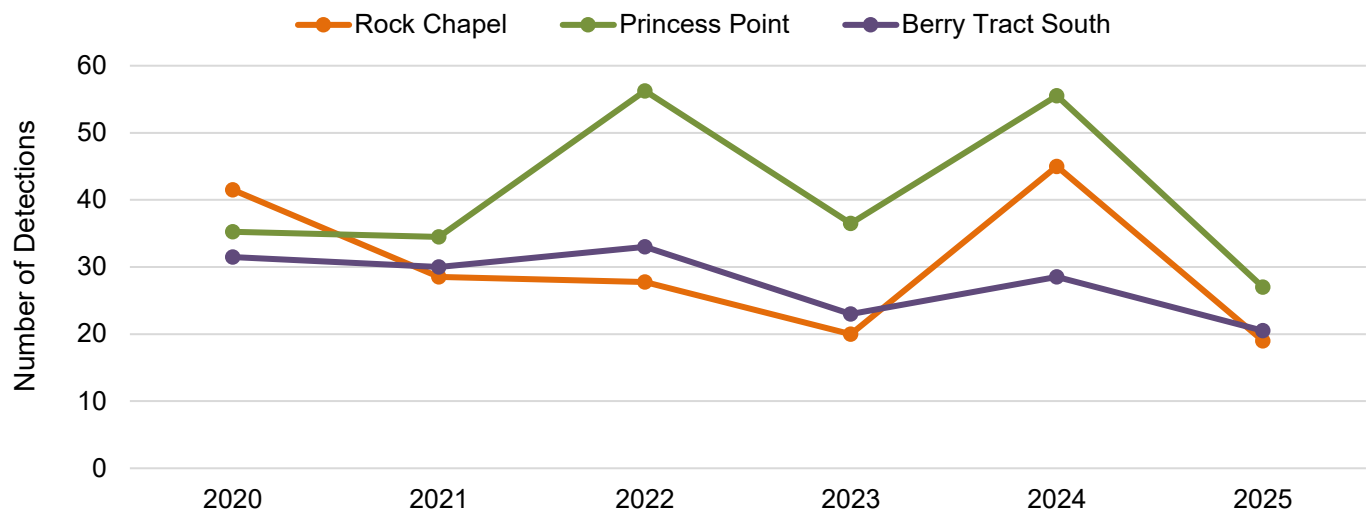

Figure 25. Bird detections per visit bird across all three grassland restoration sites 2020 – 2025, avg/plot.

Because Princess Point consistently has the highest number of detections, it is not surprising that it also generally supports the greatest species richness (Figure 26). However, species richness at Princess Point has been declining since 2021, 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 ensure that this downward trend does not persist.

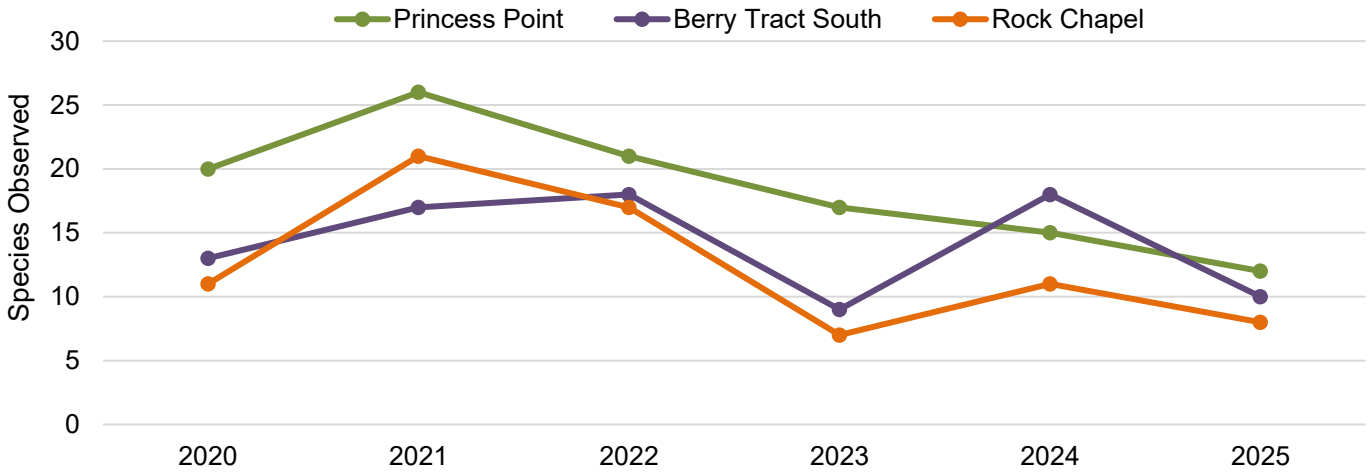

Figure 26. Bird species richness from 2020-2025 at three grassland monitoring sites at RBG, avg/plot.

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 27). 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 time.

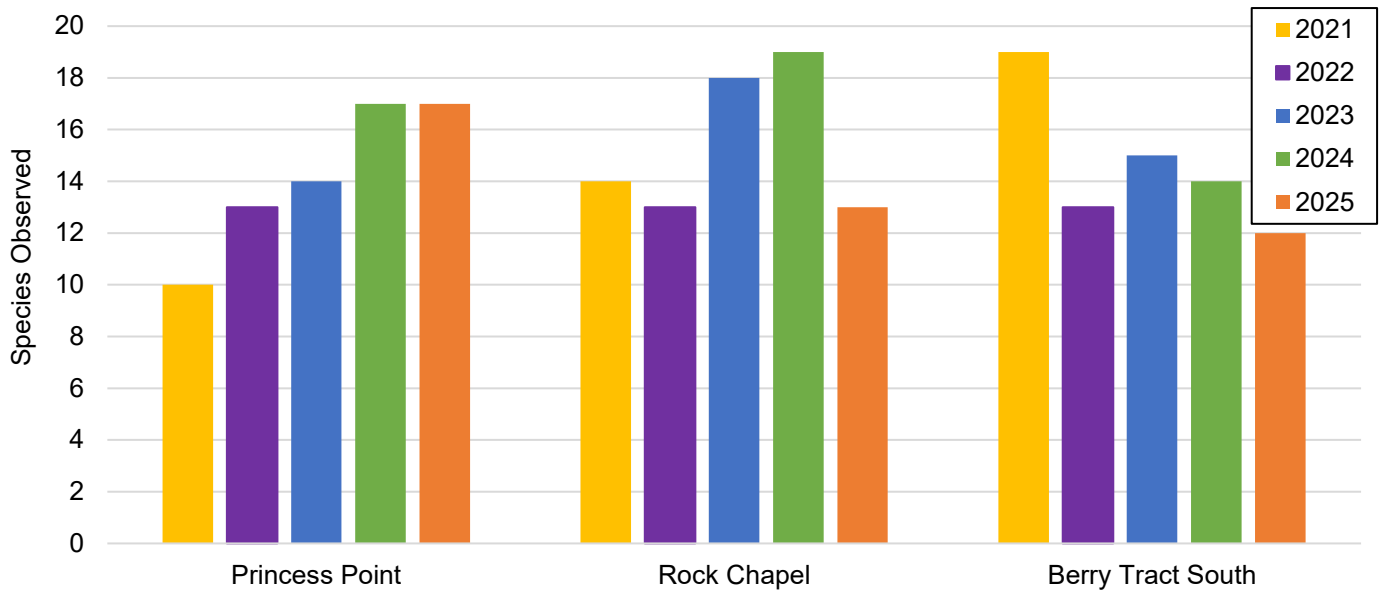

Figure 27.Total butterfly species richness trends at Princess Point, Rock Chapel, and Berry Tract South 2021 to 2025. Rock Chapel and Princess Pt have transects of about 1km, while Rock Chapels site is a longer transect.

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 2024, rebounding in 2025. Rock Chapel showed a steady increase from 2021 to a peak in 2023,with the highest detections among all sites that year, before declining in recent 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.

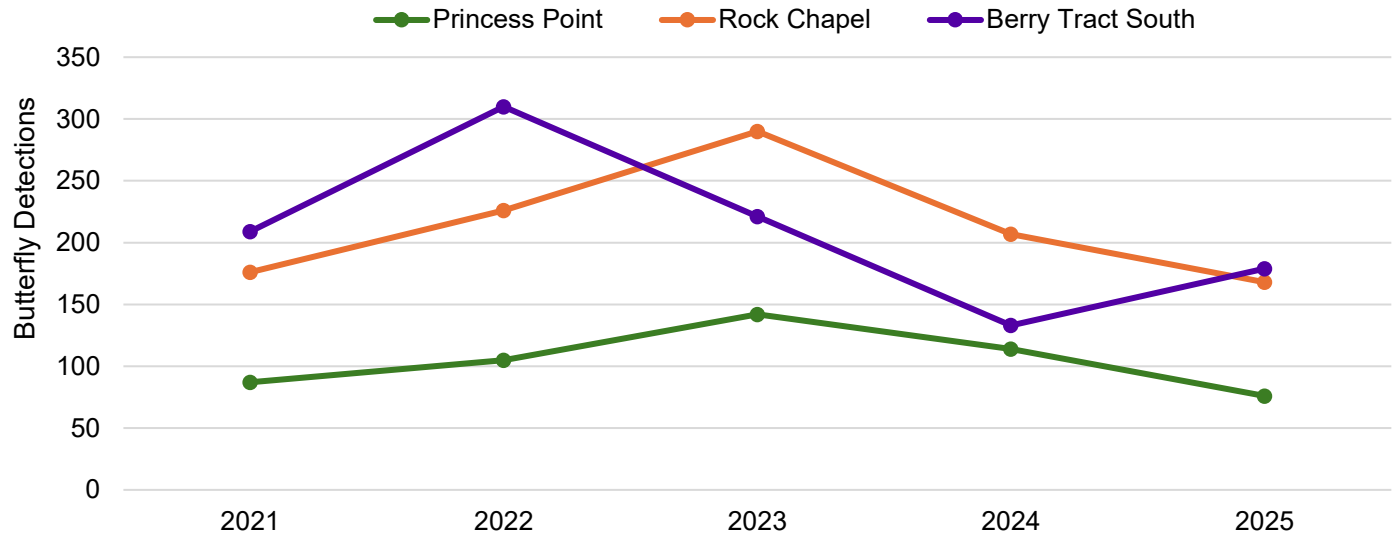

Figure 28. Total Butterfly detections trends across Princess Point, Rock Chapel, and Berry Tract South from 2021-2025. Transect lengths are of slightly different sizes, and thus note exactly comparable.

Discussion Princess Point

Since mowing the overall area ceased in 2003 and browsing Canada Geese have substantially reduced by shoreline plantings, Princess Point has undergone a dramatic ecological transformation from a largely exposed damaged turf area and woodland to a structurally complex grassland system in 2025. Vegetation monitoring indicates clear progress toward restoration objectives, with native plant cover increasing approximately 23% in 2009 to over 77% in 2025. Native prairie grass including both Big Bluestem (*Andropogon gerarrdii*) and Yellow Savannah Grass (*Sorghastrum nutans*) have both become noteworthy plant species of the site although not a level reflecting a tallgrass prairie environment. Canada/Tall Goldenrod dominate the site representing 66% of the cover in 2025, and an ideal species for migratory butterflies as they flower in September. While native plant species dominate, Cow Vetch (*Vicia cracca*) continues to be a challenging nonnative species.

Plant species richness has slowly increased over time to over 30 species within the monitoring sites in 2025, and the site continuing to undergo shifts in composition. Results also vary greatly year to year, but a general trend of increased species richness during years when a controlled burn occurred: 2009, 2010, 2013, 2017, 2021, 2023, and 2025. These changes are evident in the transition from early dominance associated non-native forbs such as Common Plantain and Canada Thistle to more structurally dominant species such as Tall/Canada Goldenrod. Overall, the vegetation data reflect a trajectory consistent with mid successional meadow development, with movement toward a more native grass dominated system. When compared to the Berry Tract and Rock Chapel grassland sites, Princess Point is more diverse and includes a slightly different collection of species and often in a more diverse mix of plants and butterflies and with higher bird diversity, strongly influenced by the adjacent marsh, forest, and extensive visitation.

Bird communities have shown a gradual decline in both numbers and diversity at the site, with 19 species found in 2025. The composition of the bird community has not ever reflected a meadow habitat with strong influence of both the adjacent marsh and the high degree of visitors through the site. The bird community has shifted over time from an early dominance by Red winged Blackbirds (2009) to a more balanced community of mixed species including American Robin, Baltimore Oriole and Common Grackle in 2025. The species with the most striking decline is Tree Swallow, formerly common with none encountered in 2025, although notable numbers continue to present at Cootes Paradise. Butterfly monitoring demonstrates strong habitat uptake and increase in diversity with richness climbing to 16 species in 2025, but with overall butterfly numbers relatively consistent over time. A striking feature of 2025 monitoring was only a single Monarch Butterfly encountered at the site in July.

Taken together, these results indicate that restoration efforts at Princess Point are continuing to successfully transition the site from a mowed turf area to a functional grassland ecosystem, but with fire dependence to transition the plant community towards tallgrass prairie. The sites biodiversity is at the same time also notably impacted by the degree of visitation to the site.

Plant Community

The plant community at Princess Point reflects a maturing grassland system characterized by strong dominance of species alongside gradual increases in diversity. The forb layer is consistently dominated by Tall/Canada Goldenrod (*Solidago sp*), which in 2025 was 66% of the plant community by percent cover. Similarly, its relative cover exceeded 80% in multiple years, indicating that it functions as the primary structural component of the forb layer. While this reflects successful establishment, such high and sustained dominance likely limits the establishment of other species through competition for light and belowground resources. Despite this, some native forbs have increased in recent years, with Wild Bergamot rising to 8% relative abundance in 2025, suggesting diversification within of the forbs.

Grassland community composition demonstrates clear successional trends and shifting dominance over time. Overall, the grass component represents only a small percent of the overall plant community within the monitoring sites but does exist in significant patches. Early dominance by Yellow Savannah Grass, which reached 92.0% relative abundance in 2011, transitioned toward increased representation of Big Bluestem, which peaked at 100% relative abundance in 2015 and again reached 78.4% in 2025. In terms of cover Yellow Savannah Grass exceeded 80% for much if the 2014-2023 period, while Big Bluestem increased to 61.5% cover by 2025, indicating a shift toward late-successional tallgrass prairie structure. The decline of early-successional species such as Path Rush, which exceeded 50% cover prior to 2013 but is now absent, further supports this interpretation. Overall, the plant community appears to be in an intermediate stage of succession, with increasing structural complexity but continued dominance by a limited number of species.

Grassland Indicator Species

Grassland indicator species at Princess Point show mixed but generally positive trends, reflecting ongoing restoration progress. Big Bluestem, a key tallgrass prairie indicator species, has increased in both abundance and cover in recent years, reaching 78.4% relative abundance and 61.5% relative cover by 2025. Yellow Savannah Grass also remains an important component of the grass community, with relative cover frequently exceeding 70% between 2014 and 2023, although its abundance fluctuates substantially between years.

In contrast, Virginia Wild Rye, another indicator species, has remained largely absent throughout the monitoring period, only appearing at low levels between 2023 and 2025. This suggests that not all seeded or desired indicator species are establishing equally, potentially due to competitive pressure from dominant species or site-specific conditions. In the forb layer, Wild Bergamot has shown gradual increases, reaching 8% relative abundance and over 12% relative cover in recent years, indicating successful establishment of at least some native indicator species associated with pollinator habitat.

Collectively, these trends suggest that while key indicator species are present and, in some cases, increasing, the community has not yet reached the species balance typical of a fully developed tallgrass prairie, with that definition defining a site as dominated by native grass species. The monitoring plots don’t fully capture the dynamics of the vegetation community at princess point. There are multiple areas where Yellow Savannah Grass and Big Bluestem are quite dominant, resembling that definition of a tallgrass prairie. It could be site specific differences in the substrate, site preparation and/or planting/seeding methods that drove the success of these patches. Only time, and continued monitoring will tell if these patches expand or recede.

Non-Native Invasive Plants

Non-native plant species remain present at Princess Point but have declined in overall dominance since restoration began. In 2009, non-native species accounted for approximately 77.2% of total vegetation cover, compared to 23% for native species. By contrast, native species cover increased to approximately 77% by 2025, indicating a substantial reversal in dominance and demonstrating the effectiveness of restoration and management practices such as prescribed burning.

Despite this overall improvement, several non-native species exhibit episodic increased in abundance. Cow Vetch represents the most prominent non-native species, increasing from 33.3% in 2020 to a peak of 77.5% in 2023 before declining to 52.7% in 2025. Canada Thistle also showed a notable increase, reaching 22.9% in 2024 and remaining high at 21.4% in 2025. Black Medick demonstrated variability, with peaks of 20.2% in 2021 and 16.8% in 2025. These fluctuations suggest that non-native species continue to respond strongly to disturbance and environmental variability.

Non-native graminoid data should be interpreted cautiously due to known identification challenges. For example, Wood Blue Grass increased from 0.0% in all previous years to 75.7% in 2025, a change that likely reflects observer variability rather than a true ecological shift. Nonetheless, the presence of non-native grasses such as Kentucky Blue Grass and Quack Grass indicates continued pressure from invasive

graminoids. Overall, while native species now dominate the system, non-native species remain a persistent component requiring ongoing management.

Yard waste dumping represents a localized but important pathway for the introduction of new non-native and invasive plant species at Princess Point. Discarded garden material, including clippings, soil, and plant debris, can contain viable seeds, roots, and propagules from undesired species. This waste increases pressure from invasive species and can create opportunities for the establishment of species otherwise unable to invade Princess Point. Over time, this can lead to the introduction of new invasive species that may compete with native vegetation and alter community composition.

In addition to introducing new species, yard waste dumping can locally alter soil conditions through the addition of organic matter and nutrients. This altered soil condition may be more beneficial for certain invasive species which otherwise would not thrive in the low-nutrient environments typical of grassland.

Although the exposure of Princess Point to yard waste is limited to, it is still an important management consideration due to the potential for new invasive species to be introduced. Preventing these inputs through public education, signage, and enforcement will be important to reduce the risk of new invasions and support the current trend of decreasing invasive species abundance.

Climate Change Resiliency

The plant community at Princess Point demonstrates several characteristics associated with resilience to climate change, including high species diversity, dominance by deep-rooted perennial species, and the capacity for recovery following disturbance. Many native grass species present at the site, such as Big Bluestem stem (reaching 78.4% relative abundance in 2025) and Yellow Savannah Grass, are well adapted to variable moisture and temperature conditions and are expected to persist under moderate climate warming scenarios. These species contribute to ecosystem stability through extensive root systems and tolerance to drought.

However, climate modelling results indicate that not all dominant species will remain viable under future conditions. Notably, Tall/Canada Goldenrod – currently the most dominant forb, with relative abundance frequently exceeding 80% and peaking at 92%, is not forecasted to remain within suitable habitat under a 2°C warming scenario. This suggests that the current structure of the plant community may undergo significant change in the future, particularly within the forb layer where the goldenrod plays a central role in both abundance and cover.

The potential decline of goldenrod may reduce competitive pressure within the forb community, potentially allowing for the increased establishment of other native species. However, it may also create opportunities for non-native or opportunistic species to expand if suitable native species are unable to fill this niche. As a result, shifts in species composition are likely, even if overall ecosystem function is maintained.

Grassland ecosystems are generally more adaptable than forested systems due to their high species turnover and species diversity. Maintaining a diverse assemblage of native grasses and forbs will be critical to ensuring that the system can adapt to future climate pressures. Overall, while Princess Point grassland is likely to remain ecologically functional under moderate climate change, its species composition is forecasted to change. Adaptive management will be essential to support desired native species and mitigate potential expansion of non-native species under changing environmental conditions.

Wildlife Community

Breeding Bird Surveys

It’s important to note that declines in detections of certain bird species should not be interpreted as evidence that restoration efforts are ineffective. While local habitat restoration can improve breeding or stopover

conditions, 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 ultimately reach these restored sites. In addition, 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 monitoring data.

The comparison of bird community composition at Princess Point between 2011 and 2025 reveal a clear shift from dominated by Red-winged Blackbird (20%) and Cedar Waxwing (14%), with a large proportion of birds grouped into the remaining abundance (38%). This suggests a concentration of abundance in a few highly successful species. By contrast, the 2025 graph shows a much more even spread, with several species – such as Baltimore Oriole, Blue Jay, Common Grackle, Northern Yellow Warbler, and American Robin – each contributing 10% of all observations. The reduced abundance in the “All other species” category further indicates a greater number of species are being detected and contributing to a more diverse bird community.

This shift in a more balanced bird species composition may reflect improvements in habitat structure and diversity over time. The presence and relative abundance of species like Northern Flicker, Eastern Wood-pewee, Red-eyed Vireo, and Black-capped Chickadee in 2025 suggest an increase in woodland edge habitat features, compared to 2012 when open-habitat species like Red-winged Blackbird and Cedar Waxwing were more dominant. This should continue to be monitored as the Princess Point bird count plot occurs in the Oak Savannah, and if there is a shift from open habitat to more woodland edge and shrubby habitat birds, might suggest succession occurring in the open Oak Savannah habitat. The increase followed by the decline in Tree Swallow numbers likely correlates with the period when nesting boxes occurred at Princess Point. Nesting boxes were removed in 2020 once it became too difficult to manage House Sparrows and their aggressive behaviour in kicking Tree Swallows out of the boxes.

Additionally, the decline in dominance by a few species and the rise of a more balanced community could signal increased ecological stability and resilience. Communities with more even species distributions area often better able to withstand environmental stressors, as ecosystem functions are spread across multiple species rather than concentrated to a few. However, it is also important to consider external factors such as survey effort, detectability, and environmental conditions (ex. weather or air quality) that could influence species counts. While the observed trends are encouraging, continued long-term monitoring would be necessary to confirm whether these changes represent sustained ecological improvement or short-term variability.

Butterfly Surveys

In 2025, butterfly surveys at Princess Point documented 17 species and 76 total detections. These findings are in line with 2024 surveys results. Relative to previous years, species richness at the site remains high and showed no decline from 2024, maintaining the highest level recorded to date. However, overall abundance has declined slightly from 2023 levels, the second-highest abundance recorded since 2011

The persistence of high species richness is a positive indicator and may suggest that the site supports a sufficiently diverse plant community to provide host plants and habitat resources for a wide range of butterfly species. As such, these findings may be interpreted as a successful management outcome and reflect the success of native species restoration and planting efforts. Conversely, the decline in total detections should not be interpreted as evidence of ineffective management. Butterfly abundance is affected by numerous factors which occur at a scale far greater than the RBG. Weather variability, pesticide exposure, and the loss of suitable habitat across the landscape all have serious consequences on butterfly populations. In addition, migratory butterfly populations are influence by environmental conditions in southern United States and

Mexico, where increasing heat and drought have been shown to reduce population levels. Overall, the results suggest that restoration efforts at Princess Point are supporting butterfly diversity and the site, while abundance continues to be shaped by broader external pressures.

Visitor Management and Photography

In 2025, RBG developed a “photo-op” spot at Princess Point in the prairie with a long history of off-trail use for photography. The proposed site was selected for an effective, low-impact strategy to reduce off-trail use in prairie ecosystems while still meeting visitor expectations. Princess Point is without a doubt one of RBG’s most picturesque landscapes and is a natural gathering place for hobby photographers. A visually striking landscape, Princess Point is more than just a beautiful backdrop, it is an extremely sensitive and rare ecosystem, and without clear guidance, vegetation trampling is often a result of photography sessions. This leads to reduced native plant growth, increased soil compaction, and the creation of informal paths. By intentionally designing and developing a visually appealing and accessible location for photography, off-trail use should decrease.

The photo-op spot at Princess Point offers lovely views of the prairie with the majestic oaks of the savannah in the background. At the time of writing, the area is lacking signs to educate visitors on the importance of reducing off trail use in sensitive habitats. Therefore, next steps in the enhancement of the photography spot should include interpretive signage. The messaging should highlight both the beauty of the prairie, its ecological vulnerability, and reinforcing why staying on trail matters. Positive framing and language, such as inviting visitors to “capture the sunset from here”, tends to be more effective than restrictive language alone. Over time, visitors should begin to associate the location with the best photo opportunity at Princess Point, therefore shifting social behaviour, helping to normalize on-trail behaviour. When thoughtfully integrated into site design and educational visitor signage, photo-op spots can support both RBG’s conservation goals and meaningful visitor experiences.

Environmental Stewardship Recommendations

Ecosystem Management and Restoration

Controlled Burns

Fire is a natural, beneficial, and ecologically regenerative process on the landscape. Indigenous Peoples utilized fire in both forest and grassland ecosystems for thousands of years. More recent views on fire in a natural environment frame the occurrence in a negative light. Uncontrolled wildfires occur due to climate change and fire suppression for more than a century. Fire is a necessary disturbance in a grassland habitat as it reduces competition with non-native species, eliminates woody species’ growth in the open habitat, and restores nutrients to the soil.

Controlled burns have shown to be an effective restoration tool at Princess Point, as non-native plant coverage decreases initially following a burn. Therefore, this practice should continue at the site and potentially be expanded to other grassland restoration sites that RBG stewards. Historically, RBG has only conducted controlled burns in the spring and has not yet explored the possibility of a controlled burn in the fall. The timing of a controlled burn (either spring or fall) can have different ecological outcomes. Spring burns often focus on reducing the prevalence of several non-native species, while fall burns often promote and stimulate the growth of wildflowers (Mattson, 2023).

Controlled burns that occur in the fall provide unique ecological opportunities for grassland habitats. For instance, controlled burns that occur in the fall reduce accumulated leaf litter, dead vegetative debris before winter arrives, providing a blank canvas for native plants to achieve advantageous growth in the spring. Additionally, fall burning can return nutrients to the soil before winter dormancy, thereby boosting nutrient

availability for new growth in the spring. However, fall burns are often avoided because they do not leave overwintering habitat for insect and promote erosion due to lack of vegetative cover through the winter months and spring melt. Therefore, if RBG were to pursue a fall burn, perhaps only certain burn blocks should be burned on a rotational basis to ensure that insects have at least some habitat for overwintering.

Invasive Species

Poa spp.

Management of *Poa spp.*is recommended to maintain the ecological integrity and desired species composition of the grasslands at Princess Point. *Poa spp.* is most effectively managed through prescribed burns, which promote native warm-season grasses and forbs while limiting the establishment of cool-season species.

Princess Point is actively burned which has proven to reduce the dominance of *Poa spp*., as found during grassland monitoring. These burns must occur regularly as the abundance of *Poa spp.,* will increase on non burn years. Mechanical and chemical control methods are generally not considered practical or effective management options for *Poa spp.* at the landscape scale within these habitats.

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. In regenerating fields, Dog-strangling Vine has the capacity to establish rapidly and form dense monocultures, thereby displacing native vegetation and reversing restoration progress.

Management of Dog-strangling Vine will 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 and prevent regrowth. Prescribed burns are not sufficient for eradication; however, they may be incorporated as one component of the management strategy. Anecdotally, Dog-strangling Vine is more visible following a spring burn because of the cleared debris and therefore can be more easily found and targeted with the right management technique following a burn.

Early detection and rapid response are critical to limiting establishment and spread as is the case for all highly invasive species. 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 widely regarded as an escaped Eurasian cultivar. It exhibits substantially greater vigour and competitive ability than other subspecies and cultivars present in North America. This taxon is capable of forming dense, persistent monocultures, resulting in the displacement of native vegetation and a reduction in overall plant community diversity. Small patches currently exist at the shoreline edge and one patch close to the designated photography area.

Management of reed canary grass can be effectively integrated into a prescribed burn regime. Burns must be implemented during appropriate seasonal windows (April, June, August, or September) to optimize efficacy while minimizing impacts to native species. Chemical control may be applied 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.

Invasive Shrub Management

Ongoing management of invasive woody species is critical to maintaining the ecological classification and native species composition of RBG grasslands. High densities of invasive shrubs occur along site boundaries, exerting seed pressure and contributing to continued encroachment into the grassland habitat. Due to their presence on the border of sites, they are not controlled by the prescribed burns and continue to act as seed sources. For shrubs that exist within the grasslands, our observations suggest the repeated exposure to prescribed burns may have caused them to develop disproportionately large root systems. This is likely as an adaptive response, as the large root system enhances resprouting capacity post burn. As a result, prescribed burns alone are insufficient for long-term control, with mechanical and chemical treatments required to achieve eradication and reinvasion.

Invasive woody species known to impact RBG Princess Point grasslands include:

- Common Buckthorn (*Rhamnus cathartica*)
- Multiflora Rose (*Rosa multiflora*)
- Common Privet (*Ligustrum vulgare*)
- *Euonymus* spp.
- Common Barberry (*Berberis vulgaris*)
- Japanese Barberry (*Berberis thunbergii*)
- Ornamental Honeysuckle (*Lonicera* spp.)
- Eastern Redbud (*Cercis canadensis*)

Although not classified as invasive, Black Walnut (*Juglans nigra*) is establishing at Princess Point and should be selectively removed to preserve open grassland and oak savannah structure. In recent years this species has become the most abundant tree across RBG properties.

Explore Land Acquisition and Grassland Transformation

Princess Point Tallgrass Prairie exists as an isolated landscape matrix dominated by forests, marsh, and urban neighbourhoods. Given the adjacent landscape there is limited opportunity for future property acquisition should be prioritized as a grassland restoration site to enable and enhance gradual ecological reconnection. Targeting parcels adjacent to existing grassland restoration sites helps reinforce the ecological integrity of individual areas and supports the expansion of larger, more continuous grassland habitats across the landscape. These connected or closely clustered patches enhance habitat connectivity, facilitate species' movement, and promote greater genetic diversity, all of which strengthen overall ecosystem function and resilience.

At a broader scale, establishing a network of interconnected grassland habitats increases the greater ecosystem's ability to withstand disturbances, including climate change and invasive species This landscape-level connectivity ultimately amplifies the effectiveness and long-term success of grassland restoration efforts. Transformation of adjacent park areas to grasslands as well as the large Burlington Heights feature would also be an option to improve connectivity.

Visitor and Neighbour Behaviour

Off-leash Dogs and Children

Off-leash dogs can negatively affect grassland ecosystems in several ways, including disturbance and predation of wildlife, damage to native plant communities through digging and trampling, and the indirect encouragement of off-trail use by other visitors. When dogs move freely through sensitive habitat, they can

flush birds and other wildlife, disrupt feeding and nesting behaviour, and create informal paths that increase vegetation loss and soil disturbance. In Australia, dog access to natural areas and national parks is often restricted, with some sites prohibiting dogs year-round and other limit access during ecologically sensitive periods such as bird nesting season (Eeden at al. 2022.) Research has also shown that compliance with dog restrictions is not always strongly linked to enforcement levels alone (Carter, 2016; Schneider et al. 202). More detailed behavioural studies suggest that dog owners, particularly within non-complaint demographic groups, believe that off-leash exploration is beneficial for their dogs (Eeden et al. 2022). This indicates an opportunity for more targeted communication and education that explains the ecological rationale for leash requirements in natural areas, while also emphasizing the safety benefits for dogs themselves.

Free-roaming domestic cats pose an even more direct threat to grassland wildlife, particularly small mammals and low or ground nesting birds. Cats are listed among the world's 100 worse invasive species (Lowe et al. 2000), and their ecological impacts are well documented. Studies have linked free-roaming cats to local declines in bird populations and to a substantial share of wildlife mortality in urban and peri-urban landscapes (Crooks & Soule, 1999; Churcher & Lawton, 1987; van Heezik et al. 2010; Baker et al. 2008). (Loss et al. 2013) estimated that free-roaming domestic cats kill between 1.3-4 billion birds and 6.3 to 22.3 billion mammals annually. In grassland habitats, these impacts are especially concerning because many of the species rely on open ground, low vegetation, and concealed nests, making them highly vulnerable to cat predation.

Children can also contribute to grassland degradation, particularly when they leave designated trails or use open areas for unstructured play. Unlike adult visitors, children may be less aware of the ecological sensitivity of the habitat and less likely to recognize when their actions are causing disturbance. Running, climbing, and exploring off trail can trample native vegetation, compact soil, damage seedlings, and disturb habitat structure. In grasslands, even seemingly minor disturbance can be significant because many species depend on low vegetation cover, and undisturbed ground surfaces. Repeated off-trail movement by children can also create informal desire paths, which may widen over time as they are reused by other visitors, further fragmenting vegetation and increasing erosion risk. In addition, loud noise and unpredictable movement can disturb wildlife, especially during breeding and nesting when animals are more sensitive to human presence. These impacts are generally unintentional, but they highlight the need for site design and visitor education measures that help families enjoy natural areas without causing avoidable harm.

Yard Waste Dumping

Yard waste dumping can have substantial negative effects on grassland ecosystems, despite often being perceived as harmless because the material is "natural". Discarded yard waste, including grass clippings, leaves, brush, garden waste, and pruned branches can smother native vegetation, alter soil conditions, and potentially introduce pesticides or other chemicals. In grasslands, where many plant, species are adapted to relatively low-nutrient conditions, the additions of decomposing organic material can enrich the soil and favour more aggressive or weedy species over native grassland plants. This can gradually shift plant community composition and reduce the abundance of sensitive native species.

Yard waste dumping can also introduce non-native or invasive plant species through seeds, roots, or plant fragments contained in garden waste. Even small amounts of dumped material may contain viable propagules that establish in the grassland and spread over time, creating long-term management challenges. In addition, brush and leaf piles can physically cover sensitive species, reduce the availability of open ground needed by some grassland species and alter the ecology of the site.

Beyond ecological impacts, yard waste dumping can contribute to broader site degradation by creating an appearance of neglect, which may encourage further unauthorized dumping of garden debris, garbage, or other materials. Repeated dumping can therefore intensify habitat disturbance and increase maintenance

requirements. Yard waste disposal should be recognized as a management issue in grassland areas, and efforts to reduce it should include public education, clear signage an enforcement where necessary.

Emerging Threats

Grassland Pests, Climate Change, and Diseases

Native grasslands are typically less susceptible to large-scale pest and disease outbreaks than forest ecosystems, which may enhance their resiliency under future climate conditions. Forests are often dominated by relatively few tree species, making them more vulnerable to species-specific pests and pathogens – many of which are expanding their ranges and intensifying with rising temperatures. In contrast, grasslands tend to support a greater diversity of plant species, reducing the likelihood that any single pest of disease could cause widespread damage.

Grassland plants are also generally shorter-lived and more adaptable, enabling quicker recovery from disturbance compared to forests, which often respond more slowly to environmental change (Zhu et al. 2024). However, it is important to note that the lower documented incidence of pests and diseases in grasslands may partly reflect limited research and monitoring, as these impacts have been more extensively studied in forest systems.

In the context of Princess Point, these characteristics suggest that maintaining and restoring native grassland habitat could contribute to a more stable and resilient ecosystem under changing climate conditions (Zhu et al. 2024). As pressures from pests, heat, and drought intensify, grasslands may remain comparatively less vulnerable to large-scale biological disturbances.

However, climate change is expected to significantly alter species composition across all types of ecosystems. Although exact outcomes remain uncertain, climate modeling scenarios can help project how different greenhouse gas emission pathways may influence species and habitats over time. Tools such as Natural Resource Canada's Plant Hardiness Zone Maps can be used to assess which species are likely to persist under future conditions and which may shift their ranges.

These scenarios vary in intensity. A low-emission pathway (ex. SSP1 – 2.6) assumes strong mitigation efforts, thereby limiting climate warming and allowing many species to remain within their current ranges. A moderate scenario (ex. SSP2 – 4.5) projects intermediate change, where some species may shift or experience new stressors. A high-emissions scenario (SSP5 – 8.5) anticipates continued increases in emissions, resulting in greater warming, more extreme weather, and elevated risks such as habitat loss and population declines.

Climate models also distinguish between "core" and "range" habitats. Core habitat refers to areas most critical for a species' long-term survival, while range habitat encompasses the broader area a species occupies, including the regions used less frequently. Recognizing this distinction is important for guiding effective restoration and conservation planning under future climate conditions.

To assess potential changes at Princess Point, we applied a moderate climate scenario (SSP2-4.5), representing approximately 2°C of warming. By examining native plant and bird species at each site, we can evaluate whether these areas are likely to remain within species' core habitats or if range shifts may occur, informing more resilient management and restoration strategies.

As shown in Table 2 many grassland plant species are projected to retain their core habitat at Princess Point in a 2°C increase climate scenario, except for **Tall/Canada Goldenrod** which will be moved to range habitat. These findings suggest that maintaining and restoring grassland habitats at Princess Point may support greater ecological stability under future climate conditions. It is concerning however, that the most abundant

plant at Princess Point is forecasted to shift its range from the Hamilton area, as this potentially could allow for further invasive species colonization at the site, if the range shift occurs suddenly.

Table 2. Native plant species currently present in Princess Point 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	At RBG in Forecasted Range Shifts
Black Oak (*Quercus velutina)*	✓	✓
Big Bluestem (*Andropogon gerardii)*	✓	✓
Black-eyed Susan (*Rudbeckia hirta)*	✓	✓
Blue Vervain (*Verbena hastata)*	✓	✓
Calico Aster (*Symphyotrichum lateriflorum)*	✓	✓
Common Evening-primrose (*Oenothera biennis)*	✓	✓
Common Ragweed (*Ambrosia artemisiifolia)*	✓	✓
Daisy Fleabane (*Erigeron annuus)*	✓	✓
Frost Aster (*Symphyotrichum pilosum)*	✓	✓
Grass-leaved Goldenrod (*Euthamia graminifolia)*	✓	✓
Pointed-leaved Tick-trefoil (*Hylodesmum glutinosum)*	✓	✓
Red Oak (*Quercus rubra*)	✓	✓
Red Raspberry (*Rubus idaeus)*	✓	✓
Redbud (*Cercis canadensis)*	✓	✓
Riverbank Grape (Vitis riparia)	✓	✓
Tall Sunflower (*Helianthus gigantea)*	✓	✓
Tall/Canada Goldenrod (*Solidago canadensis/altissima)*	✓	×
Virginia Wild Rye (*Elymus virginicus)*	✓	✓
Wild Bergamot (*Monarda fistulosa)*	✓	✓
Yellow Savannah Grass (*Sorghastrum nutans)*	✓	✓

Forecasting range shifts in bird species is also possible using Audubon's interactive climate change map. For this, scientists took 140 million observations to delineate the range of 604 North American bird species and then used the latest climate change models to project how each species range will shift under different scenarios. We used the + 2 °C increase scenario to match the models we used for grassland plants. With this, we were able to see how the bird species that inhabit Princess Point may change in the future.

Bird species that will be most affected by a 2°C increase and will lose this area as a suitable habitat are Black-billed Cuckoo, Eastern Towhee, Eastern Wood-Pewee, Northern Yellow Warbler, Ring-billed Gull, Rose-breasted Grosbeak, Song Sparrow, Tree Swallow and White-breasted Nuthatch. That is roughly 15% of the species that have been seen at Princess Point. The temperature changes of this climate scenario will lead to more extreme weather events such a droughts or flooding and research suggests that grassland birds are sensitive to temperature warming and increased variability in precipitation (Nelson et al., 2024).

Climate change is transforming ecosystems globally by shifting temperature and precipitation patterns and increasing the frequency and intensity of extreme events, such as droughts and heat waves (Hoover et al. 2014). Grasslands are generally well adapted to these changing conditions, making them increasingly important as climate pressures intensify. Many grassland species allocate a large portion of their biomass below ground, allowing them to access deeper soil moisture and maintain ecosystem stability during periods of moderate drought.

Table 3. Bird species that have found to be present at Princess Point and their current and forecasted range using climate modeling scenario (+ 2°C by 2050). Check mark represents present/forecasted and x indicates habitat lost.

Species Name	Present in Current Range	Forecasted Range Shift to RBG
American Crow (*Corvus brachyrhynchos*)	✓	✓
American Goldfinch (*Spinus tristis*)	Data not available	
American Herring Gull (*Larus smithsonianus*)	Data not available	
American Redstart (*Setophaga ruticilla*)	✓	✓
American Robin (*Turdus migratorius*)	✓	✓
Bald Eagle (*Haliaeetus leucocephalus*)	✓	✓
Baltimore Oriole (*Icterus galbula*)	✓	✓
Barn Swallow (*Hirundo rustica*)	✓	✓
Belted Kingfisher (*Megaceryle alcyon*)	✓	✓
Black-billed Cuckoo (*Coccyzus erythropthalmus*)	✓	×
Black-capped Chickadee (*Poecile atricapillus*)	✓	✓
*Blackpoll Warbler (*Setophaga striata*)	×	×
Blue Jay (*Cyanocitta cristata*)	✓	✓
Blue-gray Gnatcatcher (*Polioptila caerulea*)	✓	✓
Brown-headed Cowbird (*Molothrus ater*)	✓	✓
Canada Goose (*Branta canadensis*)	✓	✓
*Cape May Warbler (*Setophaga tigrina*)	×	×
Carolina Wren (*Thryothorus ludovicianus*)	✓	✓
Caspian Tern (*Hydroprogne caspia*)	✓	✓
Cedar Waxwing (*Bombycilla cedrorum*)	✓	✓
Chimney Swift (*Chaetura pelagica*)	✓	✓
Chipping Sparrow (*Spizella passerina*)	✓	✓
Common Grackle (*Quiscalus quiscula*)	✓	✓
Common Tern (*Sterna hirundo*)	✓	✓
Common Yellowthroat (*Geothlypis trichas*)	✓	✓
Double-crested Cormorant (*Nannopterum auritum*)	✓	✓
Downy Woodpecker (*Dryobates pubescens*)	✓	✓
Eastern Bluebird (*Sialia sialis*)	✓	✓
Eastern Kingbird (*Tyrannus tyrannus*)	✓	✓
Eastern Towhee (*Pipilo erythrophthalmus*)	✓	×
Eastern Warbling Vireo (*Vireo gilvus*)	✓	✓
Eastern Wood-Pewee (*Contopus virens*)	✓	×
European Starling (*Sturnus vulgaris*)	✓	✓
Gray Catbird (*Dumetella carolinensis*)	✓	✓
Great Blue Heron (*Ardea herodias*)	✓	✓
Great Crested Flycatcher (*Myiarchus crinitus*)	✓	✓
Green Heron (*Butorides virescens*)	✓	✓
House Sparrow (*Passer domesticus*)	✓	✓
Indigo Bunting (*Passerina cyanea*)	✓	✓
Killdeer (*Charadrius vociferus*)	✓	✓
Mallard (*Anas platyrhynchos*)	✓	✓
Mourning Dove (*Zenaida macroura*)	✓	✓
Northern Cardinal (*Cardinalis cardinalis*)	✓	✓
Northern Flicker (*Colaptes auratus*)	✓	✓
Northern House Wren (*Troglodytes aedon*)	✓	✓
Northern Rough-winged Swallow (*Stelgidopteryx serripennis*)	✓	✓
Northern Yellow Warbler (*Setophaga petechia*)	✓	×
Orchard Oriole (*Icterus spurius*)	✓	✓
Osprey (*Pandion haliaetus*)	✓	✓
Red-bellied Woodpecker (*Melanerpes carolinus*)	✓	✓
Red-eyed Vireo (*Vireo olivaceus*)	✓	✓
Red-tailed Hawk (*Buteo jamaicensis*)	✓	✓
Red-winged Blackbird (*Agelaius phoeniceus*)	✓	✓
Ring-billed Gull (*Larus delawarensis*)	✓	×
Rose-breasted Grosbeak (*Pheucticus ludovicianus*)	✓	×
Ruby-throated Hummingbird (*Archilochus colubris*)	✓	✓

Song Sparrow (Melospiza melodia)	✓	×
Tree Swallow (*Tachycineta bicolor*)	✓	×
Unknown Cuckoo species	Not Applicable	
Unknown Gull species	Not Applicable	
Unknown Woodpecker species	Not Applicable	
White-breasted Nuthatch (*Sitta carolinensis*)	✓	×
Yellow-throated Vireo (*Vireo flavifrons*)	✓	✓

* Indicates species which do not have range here and found during migration.

Research shows that when certain plant species decline under climate stress, others can rapidly expand to fill the gaps, helping sustain overall ecosystem function (Hoover et al. 2014). This compensatory response tends to occur more quickly in grasslands – dominated by fast-growing herbaceous species – than in forests, where slower-growing trees limit the pace of recovery. However, this resilience is not unlimited. Prolong or severe drought can reduce ecosystem productivity and lead to declines in biodiversity, including lasting impacts on seed banks (Basto et al. 2018).

Wildfires

Across several bird species richness and detection graphs, a noticeable decline is evident in 2023 and 2025. Air quality indices show that these years experiences some of the most severe wildfire smoke conditions in Ontario and across Canada in recent decades. Field records from these seasons document at least 16 survey days affected by wildfire smoke, resulting in hazy conditions and poor air quality – far exceeding any previous monitoring year. Existing research suggests that birds may be adversely affected by smoke exposure with potential health impacts similar to those observed in humans.

Following the 2023 wildfires, a recent study in New York examined grassland bird vocal activity in relation to smoke exposure. The researchers found that higher smoke levels were associated with reduced vocal activity, with the more pronounced declines observed in species such as Bobolink, Eastern Meadowlark, Field Sparrow, and Savannah Sparrow (Simamora et al. 2026). Since vocalizations are essential during the breeding season – for mate attraction, territory defense, and parent-offspring communication – reductions in these behaviours may ultimately decrease reproductive success.

Taken together, these findings suggest that wildfire smoke may represent an additional stressor for grassland bird populations. While this remains an emerging and relatively understudied area of research, it is an important factor to consider when interpreting the patterns observed in the graphs previously presented in this report. Further investigation is required, particularly as wildfire frequency and intensity are expected to increase as climate change progresses.

Increased Anthropogenic Pressures and Visitor Behaviour

Off trail use and trampling at Princess Point poses one of the most significant threats to the integrity of this remnant grassland ecosystem. Repeated foot traffic compacts the soil, reducing pore space, limiting water infiltration, and root growth, which in turn stresses native prairie species adapted to well-drained aerated soils. Trampling directly damages vegetation by breaking stems, crushing seedlings, and preventing regeneration, often leading to patches of bare ground where invasive species like cool-season grasses colonize. Additionally, the loss of vegetation cover and soil structure can increase erosion along the banks of Princess Point. Trampling can also alter microhabitat conditions, thereby negatively impacting insects, ground-nesting birds, and other wildlife that depend on intact prairie habitat. Over time, even low levels of consistent off-trail use can shift plant community composition and degrade the ecological function of the prairie.

Other forms of visitor behaviour are also contributing to site degradation. Trail widening and informal trail creation expand the footprint of disturbance beyond designated access routes, resulting in further vegetation loss and fragmentation of habitat. The picking or poaching of wildflowers removes reproductive material from

the plant community and can diminish the abundance of ecologically and visually important native species. Similarly, photography-related activities, including photo shoots that involve entering sensitive areas for staging or access, can intensify trampling within the grassland.

Additional pressures include off-leash dogs, unsupervised play by children in sensitive areas, littering, and authorized campfires. Off-leash dogs can disturb wildlife, damage vegetation, and encourage further off-trail movement, while children running through the grassland may unintentionally trample plants and disrupt habitat features. Litter degrades site quality, may introduce contaminants, and can pose risks to wildlife. Additionally, the presence of litter negatively impacts visitor experience and may cause people to think poorly of RBG management practices. Unauthorized campfires present a particular concern due to the risk of accidental fire, localized soil and vegetation damage, and the introduction of further disturbance associated with gathering firewood or creating fire rings.

Informal overnight use or encampment activity may also create localized but significant ecological impacts, including vegetation clearing, soil compaction, litter accumulation, fire risk, and repeated disturbance in sensitive areas. In addition, the presence of encampment activity may influence visitor behaviour away from the site, concentrating the impact of visitors on certain areas.

Noise Pollution

The proximity of Highway 403 to Princess Point creates a persistent source of significant anthropogenic noise that extends well beyond the highway itself. Traffic noise does not remain confined to the highway corridor – it can travel long distances and penetrate to adjacent natural habitats, effectively reducing the amount of undisturbed habitat available to wildlife. Research shows that areas near roads often function as “avoidance zones”, where wildlife reduce their presence due to constant noise disturbance. For species relying on intact soundscapes, particularly bird species, this chronic noise can degrade habitat quality even when vegetation appears undisturbed. In effect, the ecological footprint of the highway extends into the surrounding conservation lands through sound alone.

The biological impacts of this increases noise are significant. Traffic noise interferes with animal communication, masking bird songs used for mating and territory defense, and forcing species to alter behaviour or even abandon the otherwise suitable habitat. Further study into sound levels and potential impacts at Princess Point should be investigated further.

Off trail Use and Vegetation Destruction

Off trail use can significantly degrade grassland ecosystems, starting with soil compaction. Compacted soils have reduced pore space, therefore limiting water infiltration and restricting root growth, which in turn diminishes overall plant health and productivity. Grassland species are particularly sensitive to disturbance, and trampling is a major threat to their persistence. Repeated disturbance can reduce native plant cover, expose bare soil, and drive shifts in plant communities toward dominance by non-native species. As off-trail use expands, it can also fragment habitat, increasing edge effects that create favourable conditions for invasive species establishment and spread.

Trail widening and informal trail creation further threaten vegetation, especially along trail margins where many sensitive plants occur. These impacts are often linked to user behaviour, such as failing to walk single file when passing others or avoiding wet sections of trail, which leads to trampling of adjacent vegetation. In areas like Princess Point, where proximity to urban populations attracts a wide range of visitors, including those with limited hiking experience, these behaviours can be especially prevalent. Clear guidance on proper trail etiquette at trailheads can help reduce theses impacts by setting expectations for responsible use.

Beyond vegetation, off-trail activity increases disturbances to wildlife. Ground-nesting birds and other species that depend on grassland habitats for bereding are particularly vulnerable to frequent human presence, noise, and pets. Even low levels of repeated disturbance can alter behaviour, reduce nesting success, and lead to habitat avoidance. This is especially concerning considering many grassland bird species are species-at-risk.

Increase visitation is also a large issue at Princess Point, as it can harm plant communities through poaching of wildflowers. Removing flowering plants disrupts seed production and dispersal, ultimately reducing population sizes and genetic diversity. Since grassland plants are tightly tied to pollinators, even small losses in flowering plants can affect pollinator activity by limiting nectar and pollen availability. Over time, selective removal of showy or desirable species can shift plant community compositions and create opportunities for invasive species to establish.

Opportunities for Future Research

Goldenrod Suppression Study

Since restoration activities began at Princess Point, both Tall Goldenrod and Canada Goldenrod have dominated in native vegetation cover. Despite being a native species, having one or two goldenrod species completely overtake and potentially suppress other native species is concerning. Therefore, a research study into the impacts of goldenrod dominance, and potentially suppression, in a tallgrass prairie habitat is vital.

Although Tall Goldenrod and Canada Goldenrod both have ecological value, their tendency to form dense stands and clumps can limit native plant growth therefore impacting diversity and inhibiting the establishment of native prairie species. Understanding when and how goldenrod shifts from a beneficial component of the ecosystems to a dominant competitor is critical for maintaining diverse and resilient plant communities.

This research is also vital from a management perspective - balancing ecological restoration with virtually unrestricted public access and long-term stewardship. A targeted suppression study provides scientific evidence-based guidance on whether intervention is necessary, which methods are most effective, and how to integrate suppression with broader restoration strategies. Ultimately, the findings can help refine adaptive management practices, ensuring that restoration efforts at Princess Point not only support plant diversity but also habitat quality for pollinators and other wildlife, while addressing the unique challenges of urban ecosystems.

Noise Pollution Impact Study

A focused noise pollution impact study at RBG would provide critical insight into how chronic traffic noise from Highway 403 is shaping local ecological conditions. By systematically measuring sound levels across intervals or gradients from the highway, researchers could map the spatial extent of noise intrusion into sensitive habitats, such tallgrass prairie and oak savannah at Princess Point. Given Princess Point’s proximity to Highway 403, it is hypothesized that this is the area of highest noise pollution at RBG. The results of this study would allow for direct assessment of how species’ presence, abundance, and behaviour changes in relation to increasing noise exposure. This type of study would move RBG’s understanding of noise pollution beyond anecdotal observations and establish clear, evidence-based understanding of how far-reaching and impactful traffic noise is across RBG’s nature sanctuaries. A preliminary study was conducted for the RBG 2020 Masterplan due to this issue.

The importance of such study lies in its ability to uncover mechanisms beyond plant community changes, that drive subtle but meaningful ecological changes. Noise pollution can mask bird song, disrupt breeding behaviour, and alter predator-prey dynamics, often without any visual signs of disturbance. At Princess Point, where long-term monitoring has already detected declines in bird species’ presence (such as the Tree Swallow), a noise-focused study could help explain some of these patterns. For example, declines in more

acoustically sensitive bird species or changes in community composition may be linked to increasing background noise rather than habitat loss alone. Understanding these relationships is essential for interpreting monitoring data accurately.

Ultimately, a noise pollution study lays the strong foundation for landscape-level change in targeted noise pollution management and mitigation strategies. If clear thresholds of ecological disturbance are identified, then solutions such as vegetative sound buffers or highway tunneling could be explored. The findings could trigger government-level assistance with mitigation projects, which would benefit many nature sanctuaries in Hamilton that are situated adjacent to major transportation corridors. By identifying noise as a measurable and manageable environmental stressor, the study would support broader conservation planning at RBG, specifically at Princess Point, to help ensure long-term persistence of its wildlife communities in an increasingly urbanized landscape.

Pollinator Inventory Study

Although butterflies have been monitored over the long term at Princess Point, a comprehensive pollinator inventory study has not yet been completed. Establishing this baseline is essential for understanding – and ultimately safeguarding – the ecological relationships within grassland communities. This work would help detect trends, identify emerging threats, and highlight conservation opportunities over time therefore supporting broader stewardship efforts and ensuring that vital pollinator services continue to sustain plant and wildlife communities as well as overall resilience.

In addition, a more complete insect inventory would strengthen the understanding of the food web supporting local bird populations. Many bird species rely heavily on insects, particularly during the breeding season when protein demands are high. Collecting these data would provide valuable insight into greater trophic level interactions and inform future land management decisions aimed at maintaining robust pollinator communities and preserving the ecological processes that help build a productive ecosystem.

Plant-Pollinator Inventory Study

Future research should prioritize identifying the plant species that most strongly support diverse and resilient pollinator communities throughout the growing season. This could involve examining flowering phenology and evaluating how floral resources are distributed over time to meet pollinator needs from early spring through until late fall. Identifying periods of limited nectar and pollen availability us particularly important, as these gaps can significantly impact pollinator survival. Understanding these seasonal dynamics will be essential for guiding effective habitat management planning.

Another valuable line of inquiry would examine the degree of specialization within the ecosystem, determining whether certain pollinators rely heavily on specific plant species or whether interactions are more generalized. This distinction is especially relevant for restoration, as specialized relationships are often more vulnerable to disturbance or species loss, with broader implications for ecosystem stability. Investigating how invasive species alter these plant-pollinator interactions would also be critical, given their ability to outcompete native plants and disrupt ecological networks.

Further research could focus on pollination effectiveness by measuring not only visitation rates but also the success of different pollinators in facilitating plant reproduction. Such work would help identify which species play the most functionally important roles within grassland communities. Together, these research directions would provide a more comprehensive understanding of plant-pollinator relationships and support more informed restoration practices, improved species selection, and long-term management strategies that promote both biodiversity and ecosystem function.

Dog-strangling Vine Suppression Trial

A study focused on suppressing Dog-strangling Vine at Princess Point would be critical in protecting ecological integrity at the site, and throughout RBG's nature sanctuaries. Dog-strangling Vine is particularly visible in the growing season following a controlled burn, however, in years where vegetative growth has accumulated at the site, scouting through the entire prairie for small clumps of Dog-strangling Vine is challenging. Therefore, understanding alternative control methods during non-burn years will be beneficial for ecosystem integrity.

Conducting a suppression study allows researchers to evaluate the effectiveness of various management strategies (chemical or mechanical). By systematically testing these methods in controlled plots, the study can provide evidence-based recommendations for long-term management. One technique that should be explored is solarization of Dog-strangling Vine stems. This requires the least amount of staff resources and no chemical application. Despite collateral damage to nearby plants, this treatment option could be beneficial. It is not known whether the tarp needs to stay in place for one growing season, or successional growing seasons to be effective. Further research is required.

Cow Vetch Study

A management-focused studying examining the impacts of Cow Vetch (Vicia cracca) at Princess Point highlighting the potential to significantly alter plant community structure and ecosystem function, along with the efficacy of different management techniques is required. As a nitrogen-fixing legume, Cow Vetch can enrich soil nutrient levels, particularly in ecosystems that are naturally nutrient-poor. While this appears to be initially beneficial, increased nitrogen availability can favour fast-growing, competitive species – often including non-native plants – at the expense of slower-growing native grasses and forbs that are adapted to low-nutrient soil conditions. Over time, this shift can reduce native plant diversity and alter the characteristic composition of the grassland community.

Casual field observations of Cow Vetch at Princess Point from RBG staff show that Cow Vetch forms dense, climbing mats that smother and suppress surrounding vegetation. Using neighbouring plants for structural support, Cow Vetch limits light availability and suppresses the growth of native plant species beneath it. This is particularly problematic in grassland habitats like Princess Point, where native plants rely on full sun to thrive. As Cow Vetch expands, it creates a positive feedback loop, where it creates a monocultured blanket of vegetation patches that smother and out-compete native species, thereby reducing plant diversity that is vital for insects, ground-nesting birds, and other wildlife.

The presence of Cow Vetch can also influence ecosystem processes beyond plant competition. Its nitrogen-fixing ability can accelerate nutrient cycling, potentially disrupting long-established soil dynamics. These changes could have cascading effects on soil microbial communities and could further reinforce environmental conditions that favour growth of invasive species. Additionally, by altering vegetation structure, Cow Vetch can affect pollinator communities by outcompeting native flowering plants that support a wider range of pollinators throughout the growing season.

Management-focused components of such study would assess the effectiveness of different control strategies, such as targeted mowing, manual removal, or chemical treatment – all of which can be conducted by RBG staff. Results often suggest that early detection and rapid response are critical, as established populations can be difficult to control due to their vigorous growth and seed production. Long-term monitoring is essential to evaluate the response and recovery of native vegetation and to ensure that management interventions do not inadvertently promote further invasion. Overall, understanding the ecological impacts of Cow Vetch, a growingly concerning invasive species at Princess Point, is key to information effective restoration and conservation efforts in vulnerable grassland ecosystems.

Conclusion

When comparing the vegetation community at Princess Point to that from 2009 and 2017 the ecological change is remarkable. Starting from an ecologically unproductive mowed area to a native meadow that supports a variety of bird and butterfly species and a striking presence of tallgrass prairie species. The evolution of the sites' plant community is ongoing. The most abundant plant species during the most recent sampling window remained as Tall/Canada Goldenrod. Native and non-native plant cover has switched since monitoring began, with most recent surveys indicating nearly 80% native plant cover and the majority of plant species seeded in and planted are found within the monitoring plots. The effect of controlled burns is notable in suppressing invasive species as well as facilitate native grass characteristic of a tall grass prairie species particularly Big Bluestem and Yellow Savanah Grass.

A diversity of birds utilize Princess Point with the species transitioning to a mix group, strongly influenced by adjacent Cootes Paradise Marsh as well as visitor disturbance, characterized by Robins, Orioles, Grackles and Yellow Warblers. However, Tree Swallows have declined dramatically at the site, likely due to the removal of artificial nesting structures at the immediate site as insect numbers associated with the area should be on the increase because of improve meadow and marsh habitat. Butterfly species richness has increased steadily overtime while general numbers remain constant, although with a notable decline in Monarch numbers in recent years during the summer. 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 Berry Tract and Rock Chapel grassland sites, Princess Point has slightly more diverse group of plants, birds and butterflies, and includes species unique to the site. This is reflective off both the much longer period of restoration efforts and the sites regular controlled burns. Visiting the Princess Point Trail provides a striking site of diversity with a backdrop of Cootes Paradise Marsh and the Niagara Escarpment. The site continues to have several environmental stewardship challenges particularly noise from adjacent Highway 403 as well as just general total visitor numbers, and including visitors at all hours of the day. The site is the single most popular visitor location at RBG facilitating access to boating, waterfront views to the escarpment, forest and meadow diversity, and within an easy walk or bus ride from urban Hamilton.

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 and in particular tallgrass prairie 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

Bird Species Name	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
American Crow (Corvus brachyrhynchos)	x				x			x		x					
American Goldfinch (Spinus tristis)	x	x	x	x		x	x	x	x	x	x	x			
American Herring Gull (Larus smithsonianus)						x									
American Redstart (Setophaga ruticilla)		x	x	x	x				x	x	x	x			x
American Robin (Turdus migratorius)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Bald Eagle (Haliaeetus leucocephalus)							x	x				x			x
Baltimore Oriole (Icterus galbula)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Barn Swallow (Hirundo rustica)							x								
Belted Kingfisher (Megaceryle alcyon)											x				
Black-billed Cuckoo (Coccyzus erythropthalmus)			x												
Black-capped Chickadee (Poecile atricapillus)		x	x	x	x	x	x	x	x	x	x	x		x	x
Blackpoll Warbler (Setophaga striata)									x						
Blue Jay (Cyanocitta cristata)	x											x		x	x
Blue-gray Gnatcatcher (Polioptila caerulea)	x	x	x	x	x	x	x	x	x	x	x	x		x	
Brown-headed Cowbird (Molothrus ater)	x		x	x	x	x			x	x	x	x	x		
Canada Goose (Branta canadensis)			x			x	x		x		x				
Cape May Warbler (Setophaga tigrina)			x												
Carolina Wren (Thryothorus ludovicianus)		x	x	x				x	x			x		x	
Caspian Tern (Hydroprogne caspia)		x	x	x	x	x	x	x	x	x	x	x	x	x	
Cedar Waxwing (Bombycilla cedrorum)	x	x	x	x	x	x	x	x		x		x			x
Chimney Swift (Chaetura pelagica)		x				x	x		x				x		
Chipping Sparrow (Spizella passerina)							x	x	x						
Common Grackle (Quiscalus quiscula)	x	x		x		x	x		x		x				x
Common Tern (Sterna hirundo)					x	x		x		x					
Common Yellowthroat (Geothlypis trichas)				x		x					x	x			
Double-crested Cormorant (Nannopterum auritum)							x	x			x	x			
Downy Woodpecker (Dryobates pubescens)		x	x	x	x	x	x		x	x	x	x		x	x
Eastern Bluebird (Sialia sialis)								x							
Eastern Kingbird (Tyrannus tyrannus)			x	x	x		x	x	x	x		x	x	x	x
Eastern Towhee (Pipilo erythrophthalmus)											x				
Eastern Warbling Vireo (Vireo gilvus)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Eastern Wood-Pewee (Contopus virens)	x	x			x	x			x	x	x			x	x
European Starling (Sturnus vulgaris)	x	x	x	x	x	x	x	x			x	x	x		
Gray Catbird (Dumetella carolinensis)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Great Blue Heron (Ardea herodias)			x	x				x			x		x		
Great Crested Flycatcher (Myiarchus crinitus)	x		x	x	x		x	x		x		x			
Green Heron (Butorides virescens)		x													
House Sparrow (Passer domesticus)				x	x	x	x	x	x					x	
Indigo Bunting (Passerina cyanea)							x	x	x	x	x	x			x
Killdeer (Charadrius vociferus)												x			

Bird Species Name	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Mallard (Anas platyrhynchos)	x				x			x			x	x			
Mourning Dove (Zenaida macroura)											x				
Northern Cardinal (Cardinalis cardinalis)	x	x	x	x	x		x	x		x	x	x	x	x	x
Northern Flicker (Colaptes auratus)	x	x		x		x		x	x		x	x			x
Northern House Wren (Troglodytes aedon)			x				x	x		x					
Northern Rough-winged Swallow (Stelgidopteryx serripennis)							x								
Northern Yellow Warbler (Setophaga petechia)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Orchard Oriole (Icterus spurius)										x	x				
Osprey (Pandion haliaetus)							x					x			
Red-bellied Woodpecker (Melanerpes carolinus)							x	x	x	x	x	x	x	x	
Red-eyed Vireo (Vireo olivaceus)			x			x	x	x		x	x				
Red-tailed Hawk (Buteo jamaicensis)									x						
Red-winged Blackbird (Agelaius phoeniceus)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Ring-billed Gull (Larus delawarensis)												x	x	x	
Rose-breasted Grosbeak (Pheucticus ludovicianus)			x	x							x			x	
Ruby-throated Hummingbird (Archilochus colubris)				x					x						
Song Sparrow (Melospiza melodia)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Tree Swallow (Tachycineta bicolor)	x	x	x	x	x	x	x	x	x	x		x		x	
Unknown Cuckoo species							x								
Unknown Gull species	x	x	x			x	x		x	x	x				
Unknown Woodpecker species										x					
White-breasted Nuthatch (Sitta carolinensis)		x				x	x		x	x	x	x	x	x	
Yellow-throated Vireo (Vireo flavifrons)					x										
Grand Total	**109**	**120**	**137**	**129**	**110**	**191**	**220**	**137**	**123**	**126**	**120**	**132**	**46**	**57**	**41**

Butterfly Species Name	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Alfalfa Butterfly (Colias eurytheme)											x				
American Painted Lady (Vanessa virginiensis)				x											
American Snout (Libytheana carinenta)	x														
Banded Hairstreak (Satyrium calanus)	x			x	x					x	x		x		
Black Swallowtail (Papilio polyxenes)	x	x		x	x	x	x	x		x	x	x	x	x	x
Cabbage White (Pieris rapae)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Canadian Tiger Swallowtail (Papilio canadensis)		x													
Clouded Sulphur (Colias philodice)				x	x			x		x		x	x	x	x
Columbine Dusky Wing (Erynnis lucilius)								x						x	
Common Ringlet (Pholisora catullus)			x		x										
Common Sootywing (Pholisora catullus)						x									
Common Wood Nymph (Cercyonis pegala)								x		x				x	x
Crescent sp.		x			x			x			x	x	x	x	x
Crossline Skipper (Polites origenes)				x											
Delaware Skipper (Atrytone logan)													x	x	x
Dun Skipper (Euphyes vestris)											x	x	x	x	x
Eastern Comma (Polygonia comma)					x				x						
Eastern-tailed Blue (Everes comyntas)	x					x	x	x	x	x		x	x	x	
European Skipper (Thymelicus lineola)	x		x	x	x			x	x						
Fiery Skipper (Hylephila phyleus)		x													
Fritillary sp.											x		x		
Giant Swallowtail (Papilio cresphontes)								x							x
Great Spangled Fritillary (Speyeria cybele)						x		x				x	x		x
Little Glassy Wing (Pompeius verna)												x			
Little Wood Satyr (Megisto cymela)	x		x	x					x	x		x	x	x	x
Long Dash Skipper (Polites mystic)	x														
Monarch (Danaus plexippus)	x	x	x	x			x	x	x	x	x	x	x	x	x
Mourning Cloak (Nymphalis antiopa)				x	x	x					x			x	x
Northern Broken Dash (Wallengrenia egeremet)	x							x		x		x		x	x
Northern Cloudy Wing (Thorybes pylades)									x	x				x	
Northern Crescent (Phyciodes cocyta)					x	x	x			x		x		x	
Northern Pearly Eye (Enodia anthedon)														x	
Orange Sulphur (Colias eurytheme)		x						x				x	x		x
Painted Lady or American Painted Lady														x	
Pearl Crescent (Phyciodes tharos)					x	x		x		x	x	x	x		
Question Mark (Polygonia interrogationis)									x					x	
Question Mark or Comma sp.												x			x
Red Admiral (Vanessa atalanta)									x				x		
Silver Spotted Skipper (Epargyreus clarus)	x	x	x	x				x	x	x	x	x	x	x	x
Skipper sp.						x		x		x				x	x
Spicebush Swallowtail (Papilio troilus)		x													
Sulphur sp.								x					x	x	
Swallowtail sp.					x										
Swallowtail spp. (black) (Papilio or Battus sp.)														x	
Tawny Emperor (Asterocampa clyton)		x													
Tiger Swallowtail sp.				x	x			x			x		x		x
Wild Indigo Duskywing (Erynnis baptisiae)											x				x
Total Count	**127**	**70**	**54**	**148**	**79**	**57**	**13**	**134**	**34**	**96**	**87**	**105**	**142**	**114**	**76**
Species Richness	**11**	**10**	**6**	**12**	**13**	**9**	**5**	**14**	**10**	**13**	**10**	**13**	**15**	**17**	**17**