



Royal  
Botanical  
Gardens

# Cootes Paradise South Shore Forest Ecological Condition Update 2021



South Shore forest edge - Churchill Park - Fall, 2019



South Shore forest edge - Churchill Park - July 2021

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**Front cover photo:** Churchill Park pit and mound reforestation site before and after site - taken by Lindsay Barr.

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## **Document Description**

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## Executive Summary

RBG's Long Term Forest Monitoring Program has been in place now for over a decade and 2021 marked the 4<sup>th</sup> round of vegetation surveys and the 13<sup>th</sup> round of bird surveys for the South Shore Forest of Cootes Paradise. The following is an update from the last report on the South Shore Ecological Conditions produced in 2017. Many of the same issues persist, however, RBG has made progress implementing the recommendations laid out in the last report, and the transformation of adjacent Churchill Park for improved access and ecological protection is progressing. The impact of COVID lockdown in 2020 had a noteworthy effect for the birds

The following summarizes environmental index measures of the vegetation and bird inventories updated in 2021, with several noteworthy trends developing over time:

### *Vegetation Community*

- The South Shore Forest tree canopy monitoring plots contain 15 native species and 2 non-native species. Black Cherry, Red Maple and Shagbark Hickory remain the most abundant species of the canopy tree layer (>10m height and >10cm dbh). Shagbark Hickory and Red Oak are the largest trees and have the most basal area.
- The forest understory tree inventory yielded 19 native species and 10 non-native species (height categories of 0.5-2m and 2-10m combined). Most of the non-native understory trees are invasive.
- Non-native plant cover in the shrub layer (woody plants, height 0.5-2m) is increasing – specifically for non-native honeysuckles.
- There has been a significant decline in plant cover in the 2-10 meter height class between 2012 and 2021. It is speculated that the cause of decline could be from small trees growing up to canopy size (over 10m height) and Ash dieback from Emerald Ash Borer, however a more thorough investigation is required.
- Non-native plant cover is increasing in the ground vegetation layer (plant height class: 0-0.5 m) and is approaching 50% while native plant cover is decreasing in the ground vegetation layer and approaching 50%.
- Species richness of native species remains higher than non-native species in the ground layer. EMAN 1x1m quadrat monitoring yielded 41 native plants and 20 non-natives while VSP 20x20m surveys yielded 81 native species and 51 non-native species in the ground vegetation layer.
- Invasive Woodland Speargrass/Blue Grass (*Poa nemoralis*) continues to increase in cover throughout the South Shore Forest, however, the rate of increase has slowed.
- Invasive Garlic Mustard cover has been declining over time on the South Shore. The maximum cover of Garlic Mustard occurred in 2012 and has steadily dropped since. Other studies have made note of this occurring in North-Eastern America.

### *Birds*

- Breeding Bird point counts yielded 47 species in 2021 which was down from 55 species in 2020. Despite this drop, species count observation for the South Shore Forest has remained fairly stable over the last decade, with the 2020 species increase potentially associated with less habitat disturbance due to COVID by visitors
- Red-winged Blackbird is the most common bird detected during surveys. American Robin, Yellow Warbler, Wood Duck, and Song Sparrow followed as the other most common species observed.

- Wood Thrush, an Endangered Species and the primary ecological measure of Churchill Park Masterplan makeover success was not detected in 2021, however, 2020 saw a record number of detections. The temporary reappearance was likely due to the COVID-19 pandemic when trail use by visitors plummeted. When people returned to a semi-normal state in the spring of 2021, no Wood Thrush were again detected on the South Shore indicating the disturbance of trail users has a large impact on the suitability of breeding habitat for Wood Thrush.
- There has been a steady, consistent decline in detections of American Redstart and Yellow Warbler on the South Shore since 2009. American Redstarts are experiencing a decline in their population throughout North America. However, for Yellow Warblers, they are one of the most common breeding birds at RBG, and none of the other bird species that share the same requirements have shown similar signs of decline. This gives an indication that a change or deterioration in breeding habitat might not be directly responsible for the decline.

Since the first State of the South Shore Forest report (Vincent, 2017) was written, several recommended actions were put into place:

- A formal study has been conducted by RBG Science and Natural Lands staff that began in 2018, trialing several different Woodland Speargrass control techniques. A series of 5 control activities were trialed for the study including cutting, pulling, freezing, burning, and herbicide application. Further details of the study will become available when a report is completed.
- To combat the spread of invasive species, specifically invasive ornamental plants, several educational workshops have been offered to the Westdale community and McMaster University.
- Phase 1 of the Churchill Park Master Plan has been implemented with Phase 2 beginning in 2022. Embedded into the Churchill Park Master Plan is RBG's reforestation work along the edge of the park which has progressed and is nearing completion. Since 2018 over 4000 native trees and shrubs have been planted, 6kg of native seed spread and over 15,000 invasive shrubs removed along the forest edge. A special thank you to RBG volunteers who have dedicated more than 560 hours to the reforestation initiative on the South Shore since 2019. Once the project is complete, invasive species work will continue and re-planting as necessary in areas where poor survival occurs. To help with tree and shrub survival RBG staff installed more than 1,600m of deer exclusion fencing.

Moving forward RBG will continue to focus on ways to mitigate environmental impacts on the South Shore Forest. This includes completing the Churchill Park Masterplan implementation, as well as items RBG 25 Year MasterPlan. This includes increasing staff presence and focusing visitor activity to Princess Point and the South Shore Commons (currently operated as an Aviary/community garden) as points of interest and strengthening the RBG connection to the community. Invasive species management is a necessary goal towards the improved ecosystem health and resiliency of the South Shore Forest. The results from this report will help determine which species to focus on and the implementation of an RBG invasive species policy will support the conservation and forest protection of the South Shore.

## Introduction

At the heart of Royal Botanical Gardens is its largest and most diverse nature sanctuary, Cootes Paradise. This sanctuary covers over 600 hectares and features a 320-hectare river-mouth marsh under restoration, 16 creeks, and 25 kilometers of shoreline. Located at the westernmost tip of Lake Ontario, and surrounded by the Niagara Escarpment, Cootes Paradise is an important migratory bird stopover and became a formal wildlife sanctuary in 1927. This sanctuary also features unique and diverse flora, consisting of Carolinian species on the uplands, and more northern species in the spring-fed shady ravines. The lands surrounding Cootes Paradise Marsh can be divided into the larger North Shore, bordered by agricultural lands and sparse residential areas, and the South Shore, a much smaller tract of land forming a narrow strip of forest between the marsh and the surrounding dense urban areas of Westdale and McMaster University in Hamilton. This report will focus on the status of the lands forming the South Shore of Cootes Paradise nature sanctuary.

The South Shore of Cootes Paradise Marsh is known for its beauty and natural heritage attractions. These factors have made the South Shore extremely popular for recreational activities including trail use, bird watching, photography, nature study, and educational programming. However, the combination of these factors along with a general proximity to urban development and subsequent encroachment has contributed to stress on this sensitive area, threatening its long-term sustainability. Threats currently facing the South Shore of Cootes Paradise include disruption of habitat, the introduction and proliferation of non-native and invasive species, dumping, bank erosion, and the creation of informal trails (Burtenshaw, 2010; McPhee, 2015; City of Hamilton 2017 and Royal Botanical Gardens, 2017). The South Shore of Cootes Paradise is also home to a variety of rare and at-risk species including plant species such as Butternut (*Juglans cinerea*), American Chestnut (*Castanea dentata*), Eastern Flowering Dogwood (*Cornus florida*), and Few-flowered Club-rush (*Trichophorum planifolium*); all of which are also threatened by the previously mentioned stressors. RBG staff has initiated several long-term monitoring studies to better understand how these factors influence the forests of the South Shore and the species that occupy them.

The first of these monitoring initiatives is the RBG Forest Monitoring Program. This program was started in 2008 with the goal of gathering high quality baseline forest information over the long-term, to identify potential threats or stressors to the terrestrial ecosystem as well as report on ecological health status. Since 2008, five forest monitoring plots on the South Shore have been surveyed every four to five years using a blend of Environment Canada's Ecological Monitoring and Assessment Network (EMAN) protocols and Vegetation Sampling Protocols (VSP) to collect various plant data. The EMAN protocol examines plant species diversity across three vertical forest layers broken



down into: the canopy tree layer, the small tree and shrub layer, and the ground vegetation layer. While VSP is used to determine overall plant coverage for the 20x20m plot. This allows RBG staff to monitor species richness, composition, dominance, tree regeneration and tree health throughout a given forest community overtime (Burtenshaw, 2010; Roberts-Pichette & Gillespie, 1999).

Monitoring forest health and conducting plant inventories is necessary to evaluate changes in plant communities over time, including changes in native plant and non-native invasive plant populations. This can provide awareness and early signs of forest decline, which can be used in future pest and disease management strategies. RBG also monitors forest regeneration to analyze successional patterns and identify if natural regeneration is occurring. Years of forest monitoring results can be used to determine ecosystem health and can be used in conjunction with fauna surveys such as breeding bird surveys to influence future restoration and/or protection needs.

Another long-term monitoring initiative conducted at RBG are bird point count surveys. These surveys have also been conducted on the South Shore every year since 2008 in order to compliment the RBG Forest Monitoring Program. The point counts look to accumulate long-term data on bird community composition and abundance during peak breeding season. Trends in bird population data are reflective of habitat quality since resident breeding birds are dependent on local ecosystem resources (Ellis, 2017). In other words, declines in certain bird species provide an indication that the resources or habitat that the species requires may also be in decline. This study also allows for the detection of increasing trends in bird populations, which can represent a positive rebound in a population, or the proliferation of a non-native species.

## Methods

There are currently fourteen permanent long-term forest monitoring plots established across RBG's nature sanctuaries. Two of these plots can be found on the escarpment properties, two can be found in the Hendrie Valley properties, five are located on the North Shore; represented by red circles in

Figure 1, and five are located on the South Shore (the focus of this report); represented by green circles.

Circled green points indicate South Shore plots, while red points indicate plots located on the North Shore of Cootes Paradise. The purple point represents only breeding bird survey point outside of forest monitoring plots on the South Shore, located at Princess Point. Amphibian monitoring also occurs periodically although due to the history of degraded marsh habitat very few amphibians remain.

## Ecological Monitoring and Assessment Network Procedures:

Multiple quantitative monitoring programs are used as part of the ongoing assessment including

- VSP – Vegetative Monitoring Protocol
- EMAN – Ecological Monitoring and Assessment Network
- Spring Bird Point Count
- Marsh Monitoring Program – Bird Studies Canada

For a detailed breakdown of the methods used to conduct forest monitoring at RBG, refer to the *2009 Forest Monitoring Report* (Burtenshaw, 2010) and *Ecological Monitoring and Assessment Network: Terrestrial Vegetation Monitoring Protocols* (Roberts-Pichette & Gillespie, 1999).

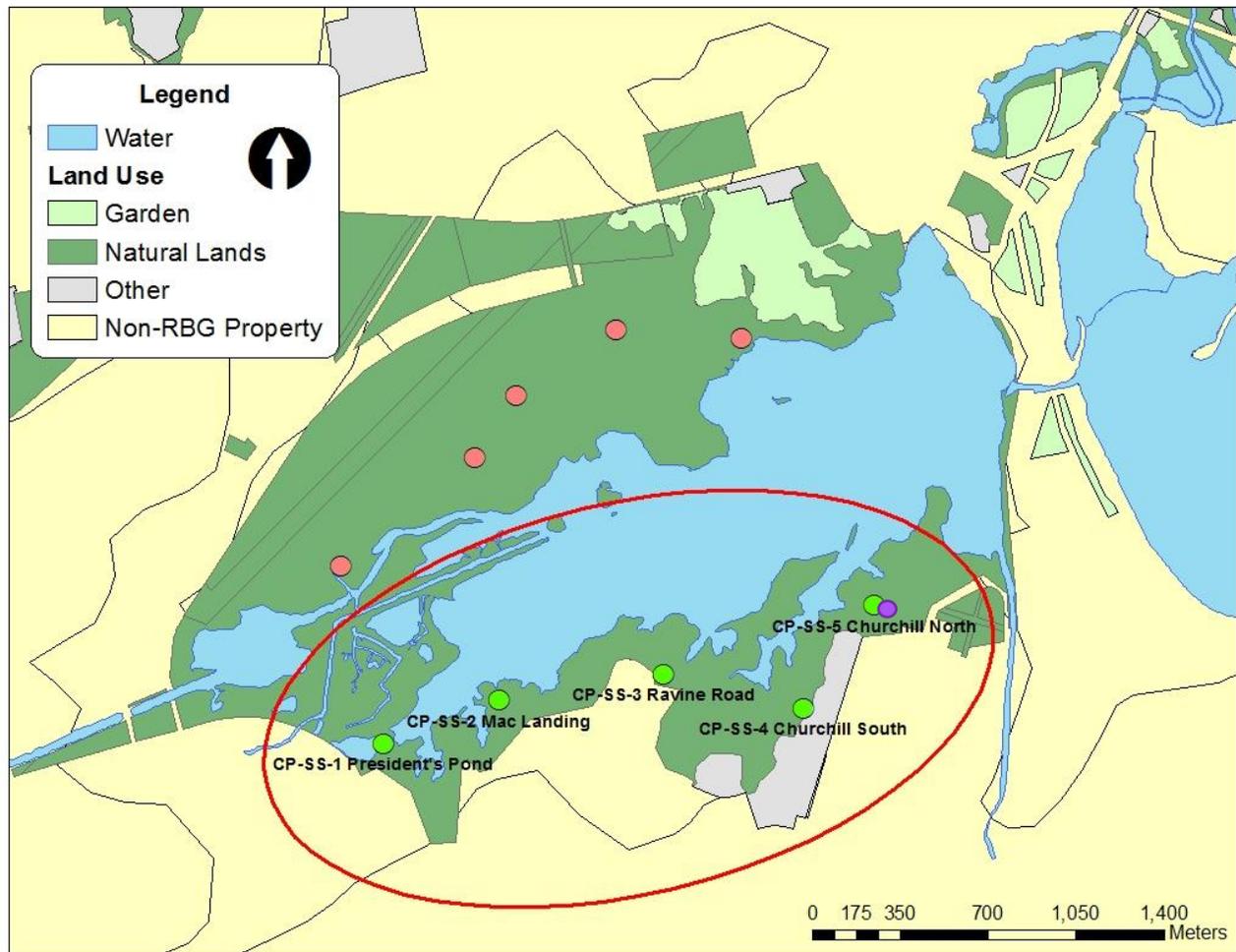


Figure 1: Locations of long-term forest monitoring plots on the South Shore of Cootes Paradise.

### Bird Point Count Surveys

Bird surveys at RBG associated with forest monitoring are conducted using passive listening point counts as described in the Ontario Breeding Bird Atlas Guide for Participants (Cadman M., 2001). On the South Shore of Cootes Paradise five of the six breeding bird survey locations coincide with RBG Forest Monitoring Plots with the additional site located at Princess Point, as shown in

Figure 1, represented by the purple point.

For a detailed breakdown of the methods used to conduct bird surveys at RBG, refer to Bird Monitoring Report 2016 (Ellis, 2017), and the Atlas of the Breeding Birds of Ontario (Cadman M. D., 2007).

## Results

### Forest Monitoring

#### Canopy Tree Layer

Abundance, relative abundance, basal area, percent basal area and density of canopy tree species at the South Shore is shown in Table 1. In total, 110 trees were measured of 17 species of which 2 were non-native (Northern Catalpa (*Catalpa speciosa*) and Sweet Cherry (*Prunus avium*)). The most abundant tree was Black cherry (*Prunus serotina*) with 21 individuals and the second tree with the highest abundance was tied with Red Maple (*Acer rubrum*) and Shagbark Hickory (*Carya ovata*) at 17. The most dominant tree in terms of basal area is Shagbark Hickory at 31.2 m<sup>2</sup> and Northern Red Oak (*Quercus rubra*) at 24.8m<sup>2</sup>. There were 8 stems of the non-native Sweet Cherry (*Prunus avium*) accounting for 7% relative abundance, in these and all other metrics, there was a slight decline in this species from 2016.

Table 1: Summary of canopy trees species from 2021 surveys sorted by relative abundance. Calculations for basal area, % basal area, and density area also presented. Plant names in *\*bold* are non-natives species

Common name	Abundance	Relative Abundance (%)	Basal area (m <sup>2</sup> )	% Basal Area	Density (trees/ha)
Black Cherry	21	19.1	15.9	14.8	105
Red Maple	17	15.5	12.3	11.5	85
Shagbark Hickory	17	15.5	<u>31.2</u>	<u>29.2</u>	85
Northern Red Oak	12	10.9	<u>24.8</u>	<u>23.2</u>	60
<b>*Sweet Cherry</b>	<b>8</b>	<b>7.3</b>	<b>1.57</b>	<b>1.47</b>	<b>40</b>
White Ash	6	5.5	0.58	0.54	30
White Oak	6	5.5	14.1	13.2	30
Eastern White Pine	5	4.5	3.16	2.95	25
Smooth Serviceberry	4	3.6	0.25	0.23	20
American Basswood	3	2.7	0.56	0.52	15
Large-toothed Aspen	3	2.7	0.44	0.41	15
Black Oak	2	1.8	1.49	1.40	10
Sassafras	2	1.8	0.39	0.36	10
Bitternut Hickory	1	0.9	0.02	0.02	5
Eastern Hemlock	1	0.9	0.14	0.13	5
Ironwood	1	0.9	0.01	0.01	5
<b>*Northern Catalpa</b>	<b>1</b>	<b>0.9</b>	<b>0.02</b>	<b>0.02</b>	<b>5</b>

Species Richness: 17    Native species: 15    Non-native species: 2

#### Small Trees and Shrubs Layer

Information for the small tree and shrub layer was collected using VSP which has proven to be the most informative method when looking at this forest vegetation layer.

The most dominant woody species in the **0.5-2 meter** height class of the forest understory layer was White Ash at 35.75% relative cover and the second species was Black Raspberry at 33.52% relative cover. In total, there were 23 woody species detected in this height class of which 15 were native. Eight species were non-native and

included Amur Honeysuckle (*Lonicera maackii*), which was the third most dominant woody species overall and had a relative cover of 4.47% (Table 2 B). Five non-native species were new to this vegetation layer which were European Barberry (*Berberis vulgaris*), Multiflora Rose (*Rosa multiflora*), Norway Maple (*Acer plantanoides*), Winged Euonymus (*Euonymus alatus*) and a honeysuckle that couldn't be identified to species – though it was non-native by ruling out the native species. Between 2012 and 2021 the overall average plant cover of this vegetation layer reduced by 2%. Black Raspberry (*Rubus occidentalis*) average cover and relative cover increased significantly on the South Shore while many of the native shrubs such as Grey Dogwood (*Cornus racemosa*), American Witch-hazel (*Hamamelis virginiana*) and Nannyberry (*Viburnum lentago*) all reduced in both average % cover and relative cover (Table 2 A and B).

The most dominant species in the **2-10 meter** height class of the forest understory layer was American Witch-hazel with an average % cover of 6.4% and 35% relative cover (Table 2 **Error! Reference source not found.**). While the average % cover of Witch-hazel on the South Shore decreased by 5.6% between 2012 and 2021 its relative abundance increased by 14.71%. There was a significant decrease in White ash at this height class between 2012 and 2021 from 23.19% relative cover to 3.8% (Table 2 C and D). The non-native species count decreased in this height class by 2 species. One of which was recruited into the canopy layer (Northern Catalpa) and the other (Common Buckthorn) was removed from the plot as part of invasive species management. The most significant change between 2012 results and 2021 is the reduction in the average vegetation cover in this height class. In 2012, on average, 72.44% of the plot would have vegetation cover in the 2-10m height class. In 2021 the average cover dropped to 26.82%.

Table 2: Tables A-D showing 2012 and 2021 average % cover and relative cover of the forest understory/small tree and shrub vegetation layer for two height classes: 0.5-2 meters and 2-10 meters.

A. 2012 Shrub Layer 0.5-2 m height class			B. 2021 Shrub Layer 0.5-2m height class		
Species	avg % cover	relative cover	Species	avg % cover	relative cover
White Ash	4.2	21.04%	White Ash	6.4	35.75%
Gray Dogwood	3.8	19.04%	Black Raspberry	6	33.52%
American Witch-hazel	3.2	16.03%	<b>*Amur Honeysuckle</b>	<b>0.8</b>	<b>4.47%</b>
Nannyberry	2.62	13.13%	Nannyberry	0.62	3.46%
Choke Cherry	1.22	6.11%	Black Cherry	0.6	3.35%
Riverbank Grape	1.2	6.01%	Riverbank Grape	0.6	3.35%
<b>*Common Buckthorn</b>	<b>1.02</b>	<b>5.11%</b>	Sassafras	0.6	3.35%
<b>*Tartarian Honeysuckle</b>	<b>0.8</b>	<b>4.01%</b>	<b>*Tartarian Honeysuckle</b>	<b>0.42</b>	<b>2.35%</b>
Maple-leaved Viburnum	0.42	2.10%	Choke Cherry	0.4	2.23%
Black Cherry	0.4	2.00%	<b>*European Barberry</b>	<b>0.4</b>	<b>2.23%</b>
Alternate-leaved Dogwood	0.4	2.00%	Allegheny Blackberry	0.22	1.23%
Red Maple	0.2	1.00%	Gray Dogwood	0.22	1.23%
<b>*Amur Honeysuckle</b>	<b>0.2</b>	<b>1.00%</b>	<b>*Multiflora Rose</b>	<b>0.22</b>	<b>1.23%</b>
Beaked Hazelnut	0.2	1.00%	American Witch-hazel	0.2	1.12%
Hawthorn species	0.04	0.20%	Shagbark Hickory	0.04	0.22%
Shagbark Hickory	0.02	0.10%	Red Maple	0.02	0.11%
Black Raspberry	0.02	0.10%	<b>*Common Buckthorn</b>	<b>0.02</b>	<b>0.11%</b>

avg cover of veg. layer	<b>19.96%</b>
species richness	<b>17</b>
native species	<b>13</b>
*non-native species	<b>3</b>
other	<b>1</b>

Eastern Poison Ivy	0.02	0.11%
Large-toothed Aspen	0.02	0.11%
<b>*Honeysuckle species</b>	<b>0.02</b>	<b>0.11%</b>
<b>*Norway Maple</b>	<b>0.02</b>	<b>0.11%</b>
Slippery Elm	0.02	0.11%
<b>*Winged Euonymus</b>	<b>0.02</b>	<b>0.11%</b>

avg cover of veg. layer	<b>17.9%</b>
species richness	<b>23</b>
native species	<b>15</b>
*non-native species	<b>8</b>

#### C. 2012 Shrub Layer 2-10m height class

Species	avg % cover	relative cover
American Witch-hazel	21.2	29.27%
White Ash	16.8	23.19%
Black Cherry	8.6	11.87%
Shagbark Hickory	4.42	6.10%
Red Maple	4.2	5.80%
Northern Red Oak	3	4.14%
Gray Dogwood	2.4	3.31%
Nannyberry	2	2.76%
Smooth Serviceberry	1.6	2.21%
Eastern Hop-hornbeam	1.4	1.93%
Riverbank Grape	1.2	1.66%
American Basswood	1	1.38%
<b>*Glossy Buckthorn</b>	<b>1</b>	<b>1.38%</b>
Large-toothed Aspen	1	1.38%
<b>*Sweet Cherry</b>	<b>1</b>	<b>1.38%</b>
Black Ash	0.8	1.10%
<b>*Common Buckthorn</b>	<b>0.4</b>	<b>0.55%</b>
<b>*Northern Catalpa</b>	<b>0.4</b>	<b>0.55%</b>
Hawthorn species	0.02	0.03%

avg cover of veg. layer	<b>72.44%</b>
species richness	<b>19</b>
native species	<b>14</b>
*non-native species	<b>4</b>
other	<b>1</b>

#### D. 2021 Shrub Layer 2-10m height class

Species	avg % cover	relative cover
American Witch-hazel	15.6	58.17%
Nannyberry	2.4	8.95%
Black Cherry	2.2	8.20%
White Ash	1.02	3.80%
Red Maple	1	3.73%
Shagbark Hickory	1	3.73%
Eastern Hop-hornbeam	0.8	2.98%
Northern Red Oak	0.8	2.98%
<b>*Sweet Cherry</b>	<b>0.8</b>	<b>2.98%</b>
American Basswood	0.4	1.49%
<b>*Glossy Buckthorn</b>	<b>0.2</b>	<b>0.75%</b>
Paper Birch	0.2	0.75%
Riverbank Grape	0.2	0.75%
Smooth Serviceberry	0.2	0.75%

avg cover of veg. layer	<b>26.82%</b>
species richness	<b>14</b>
native species	<b>12</b>
*non-native species	<b>2</b>

## Ground Vegetation Layer

Figure 2 is an updated figure from *State of the South Shore* report (Vincent 2017) that incorporates data from 2021. As of 2016 there was a steady decline in overall native species ground vegetation and inverse increase in non-native species. As of 2021 it appears the trends in decline and increase in species composition begins to level off and stabilize at 57% relative abundance for native species and 43% relative abundance for non-native species.

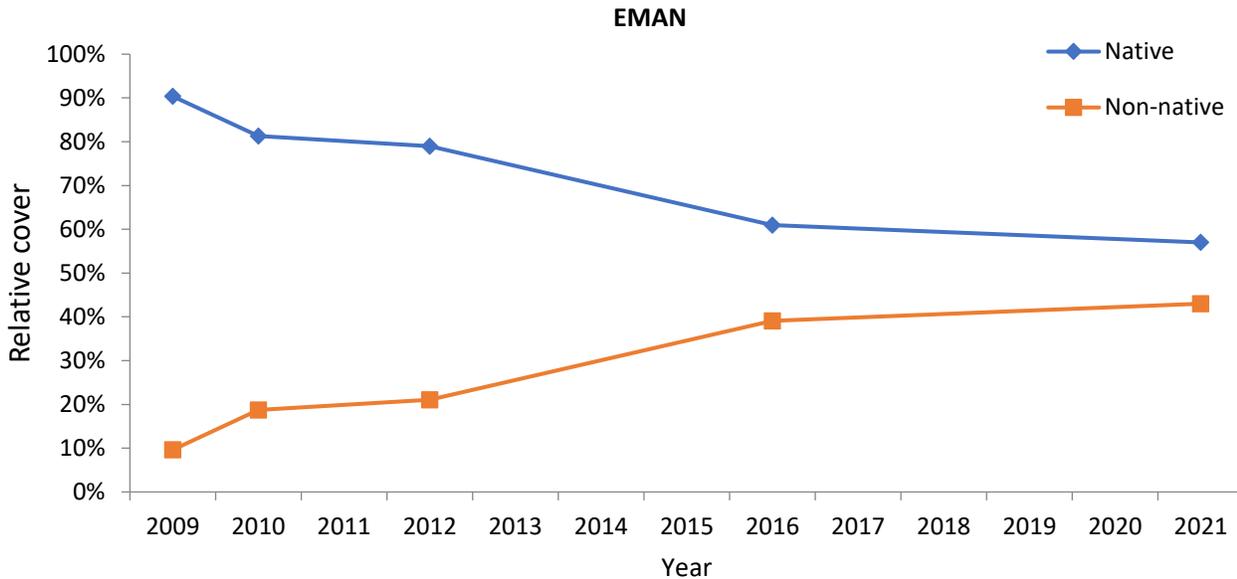


Figure 2: Changes in relative cover of native and non-native ground vegetation cover through time using the EMAN monitoring protocol

### Comparison of Ground Vegetation for EMAN and VSP

The two sampling methods used for forest monitoring to quantify ground vegetation cover are slightly different and bring different perspectives to the ground cover in the 20x20m plots. EMAN protocol uses five 1x1m quadrats to sample a small area intensely and records the number of stems of each species along with percent cover. VSP accounts for the entire 20x20m plot and records the total percent cover each species occupies within the understory layer but is done on a coarser scale than EMAN. Both techniques provide useful data on understory composition and dominance; however, they are not directly comparable.

Table 3 shows how the two monitoring methods compare to each other and shows the similarities and differences. In both methods, Woodland Speargrass (*Poa nemoralis*) has the highest relative percent cover for the South Shore at 27% using EMAN and 33% with VSP, varying only by approximately 6% between the methods. Only one more species is shared in the table which is May-apple (*Podophyllum peltatum*) that had a relative abundance of 14% using EMAN and 9% with VSP. With EMAN May-apple had the second highest percent cover while with VSP it was fourth.

The number of species recorded by each protocol varies quite widely with more than double the species observed with VSP compared to EMAN (Table 4). Double the number of native species were recorded through VSP sampling and 2 ½ more non-natives were also recorded as well compared to EMAN. However, the proportion of native and non-native species is similar across the two methods with 55% of species being native

for EMAN and 53% for VSP and 27% and 33% for non-natives for EMAN and VSP, respectively. Showing that both methods accurately catch patterns in native and non-native relative percent cover.

Table 3: Top 5 species for ground vegetation by relative % cover for two different monitoring protocols (EMAN and VSP) used in forest monitoring for the South Shore of Cootes Paradise, RBG. \*Bolded are non-native species.

Top 5 species in 2021 (EMAN)		Top 5 species in 2021 (VSP)	
Common Name	Relative % cover	Common Name	Relative cover (%)
<b>*Woodland Speargrass (<i>Poa nemoralis</i>)</b>	<b>27.2</b>	<b>*Woodland Speargrass (<i>Poa nemoralis</i>)</b>	<b>32.6</b>
May-apple	13.8	<b>*European Lily-of-the-valley</b>	<b>9.8</b>
American Hog-peanut	6.4	White Ash	9.5
Tall or Canada Goldenrod	5.1	May-apple	8.7
<b>*Sweet Bedstraw</b>	<b>4.4</b>	Black Raspberry	4.3
Broad-leaved Enchanter’s Nightshade	4.3	Broad -leaved Enchanters Nightshade	4.2
White Ash	4.2	Tall or Canada Goldenrod	3.0
Blue-stemmed Goldenrod	3.1	Pennsylvania Sedge	2.8
Riverbank Grape	2.6	Jack-in-the-pulpit	2.6
White Snakeroot	2.4	<b>*Sweet Bedstraw</b>	<b>1.7</b>

Table 4: Comparing the ground vegetation richness of EMAN and VSP forest monitoring protocols used in the South Shore. Others are plants that have not been identified to species.

	Richness			
	Total	Native	Non-native	Other (not including bolded non-natives)
EMAN	75	41	20	14
VSP	154	81	51	22

Plotting the number of native and non-native species through time for the different monitoring protocols show some slight variations among the years and overall trends, but still allows for generally the same conclusions to be made from the data (Figure 3 **Error! Reference source not found.**). VSP does give a better idea to the “true” number of non-native plants through time, but a rough scaling factor of approximately 2-2 ½ could be applied to EMAN species numbers to adjust if needed.

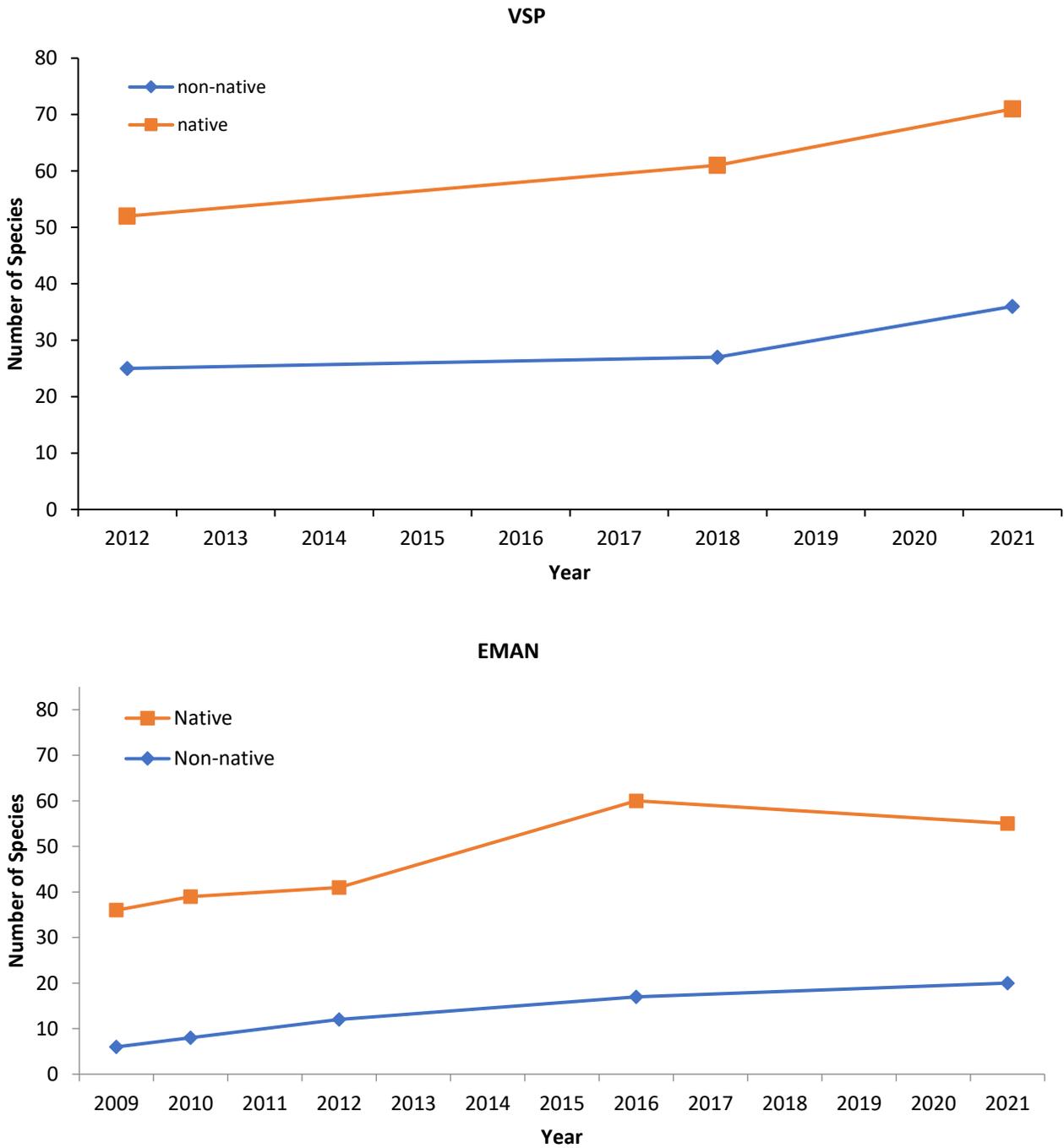
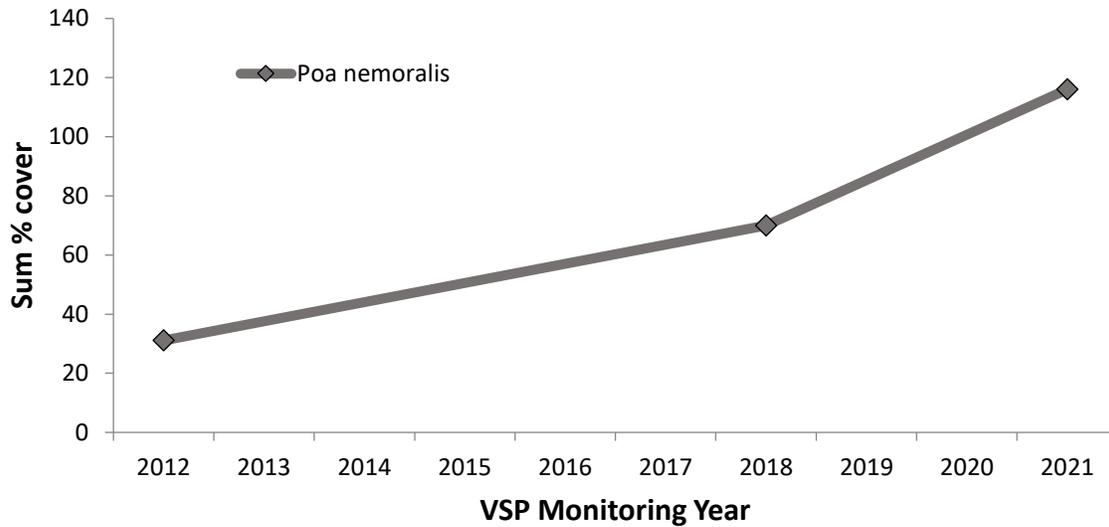
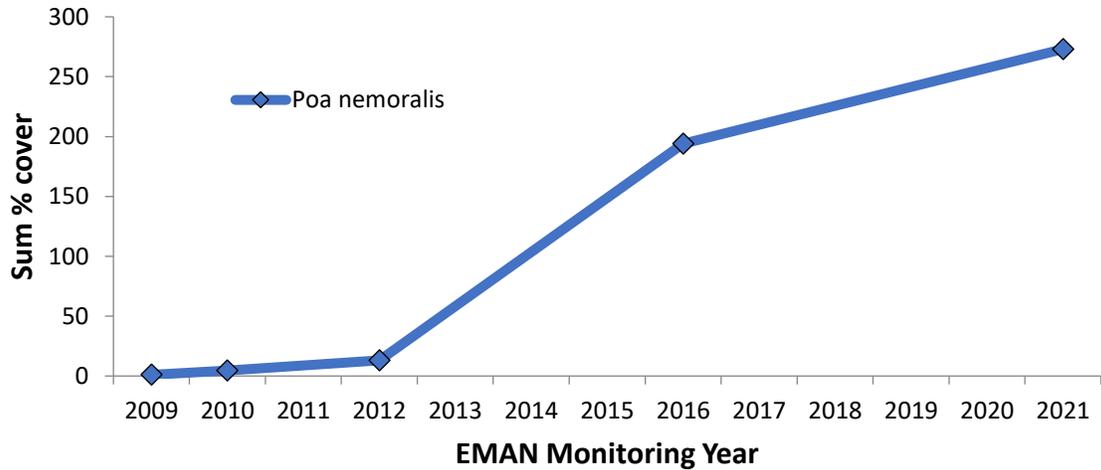


Figure 3: Comparing species richness through time with all sites combined in the South Shore for two different forest monitoring protocols: EMAN and VSP.

Woodland Speargrass (*Poa nemoralis*) in the EMAN and VSP Monitoring Protocols shows a marked and continuing increase in sum % cover for this problematic non-native grass across the South Shore (Figure 4).

Figure 4: Changes in sum % cover for Woodland Speargrass (*Poa nemoralis*) in the South Shore with two different type of forest monitoring.



**List of Non-native Species for the Current and Previous Sampling Year for Both EMAN and VSP**

When comparing data of native and non-native species for the most recent two years of sampling for EMAN, 11 species were detected in 2021 that had not been detected in 2016 (Table 5; orange highlight). There were 8 species that were not detected in 2021 that had been detected in 2016 (Table 5; green highlight).

For VSP, 15 species were detected in 2021 that had not been detected in 2016. There were also 8 species that were not detected in 2021 that had been detected in 2016 (Table 5).

Table 5: Table of all the non-native species found across all sites on the South Shore. Tables show EMAN and VSP monitoring protocols. Orange shading represent species that had not been detected in 2021, but were detected in previous years. Green shading represents species detected 2021 but not in previous years.

EMAN Common Name	Relative cover (%)	
	2016	2021
Woodland Speargrass	22.55	27.2
Sweet Bedstraw	0	4.38
Garlic Mustard	3.60	2.14
Amur Honeysuckle	0.23	1.89
Common Nipplewort	1.34	1.74
Common Buckthorn	0.93	1.49
Glossy Buckthorn	5.58	1.49
Canada Bluegrass	0	0.95
Common Speedwell	0.29	0.30
Dame's Rocket	0	0.30
Winged Euonymus	0	0.25
Multiflora Rose	0	0.20
White Mulberry	0	0.15
Erect Hedge-parsley	0	0.10
European Privet	0	0.10
Lonicera species	0.99	0.10
Common Burdock	0.35	0.05
Common Dandelion	0.46	0.05
Eastern Helleborine	0	0.05
Euonymus species	0	0.05
Canada Thistle	0	0.00
Common Mouse-ear Chickweed	0.12	0
Manitoba Maple	0.12	0
Medic species	0.06	0
Morrow's Honeysuckle	0.12	0
Smooth Bedstraw	1.80	0
Sweet Cherry	0.46	0
Woodland strawberry	1.34	0
Black Nightshade	0.06	0

VSP Common Name	Relative cover (%)	
	2018	2021
Woodland Speargrass	34.03	32.57
European Lily-of-the-valley	14.58	9.83
Sweet Bedstraw	0	1.68
Common Buckthorn	1.26	1.49
Amur Honeysuckle	0	1.43
Garlic Mustard	2.19	1.18
Canada Bluegrass	0	0.90
Glossy Buckthorn	0.49	0.65
Common Nipplewort	2.48	0.36
Multiflora Rose	0.53	0.36
Common Speedwell	0.49	0.31
English Ivy	0.24	0.28
Common Dandelion	0.53	0.11
Common Burdock	0.29	0.08
Herb-Robert	0.73	0.06
Lonicera species	0.78	0.06
Norway Maple	0.05	0.06
Common St. John's-wort	0	0.06
Tartarian Honeysuckle	0	0.06
Erect Hedge-parsley	0	0.06
Sweet Cherry	0	0.03
European Privet	0.73	0.03
Woodland Strawberry	0.24	0.03
Dame's Rocket	0.24	0.03
Orchard Grass	0.24	0.03
Oxalis species	0.24	0.03
Symphytum species	0	0.03
Creeping Bellflower	0	0.03
Solanum sp.	0	0.03
Japanese Barberry	0	0.03
Eastern Redbud	0	0.03
Common Name	2018	2021
White Sweet-clover	0	0.03
White Mulberry	0	0.03
Wood sorrel	0	0.03
Self-heal	0	0.03

VSP Common Name	Relative cover (%)	
	2018	2021
Common Mullein	0	0.03
Morrow's Honeysuckle	0.49	0
Eastern Helleborine	0.29	0
European Barberry	0.24	0
Common Mouse-ear Chickweed	0.24	0
Wild Carrot	0.05	0
Winged Euonymus	0.05	0
Grass species	0.05	0
Common Plantain	0.05	0

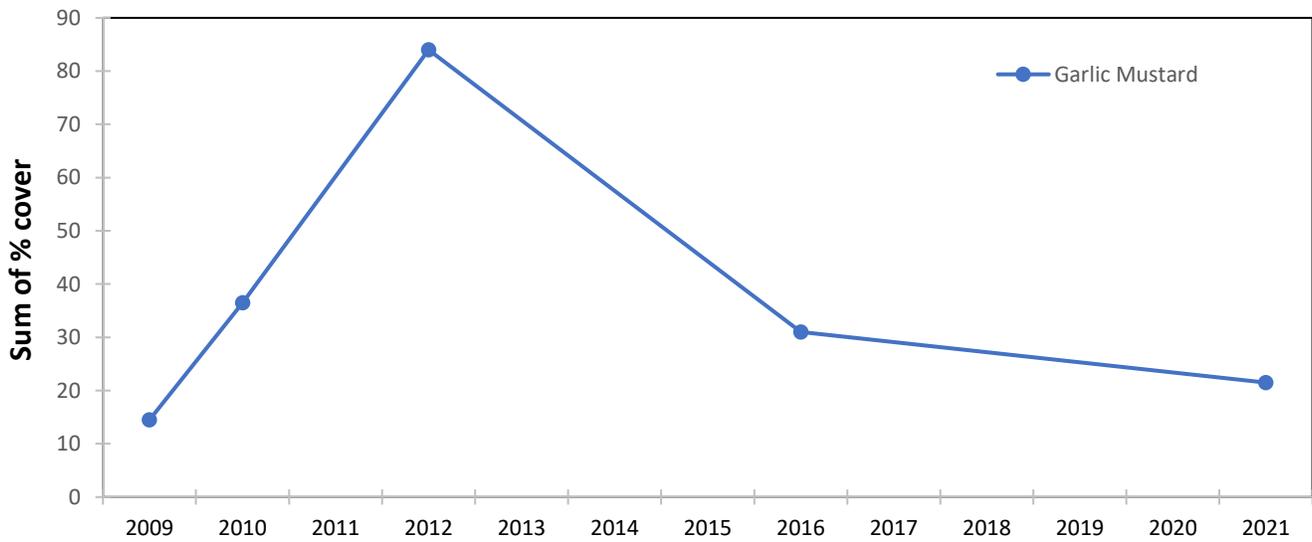


Figure 5: Changes in the sum of the % cover of Garlic Mustard over time as found in the 1x1m ground vegetation monitoring plots (EMAN) for the South Shore of Cootes Paradise

When looking at the sum of the percent cover of Garlic Mustard over time Figure 5 shows that 2012 had the most cover of any monitoring year. Since 2012, Garlic Mustard has declined and is now closer to 2009 levels when monitoring began.

## Bird Monitoring

### Overall Species Richness

Figure 1 displays the relatively stable trend in species richness on the South Shore of Cootes Paradise since bird monitoring began in 2009. Despite slight fluctuations year-to-year, the general trend is a slight increase in the number of species observed each year. The number of species observed on the South Shore was the highest in 2018 with 57 species, and the lowest number of species was in 2011 when 41 species were observed during surveys. There was a notable drop of 8 fewer species detections from 2020 to 2021, 55 to 47 respectively.

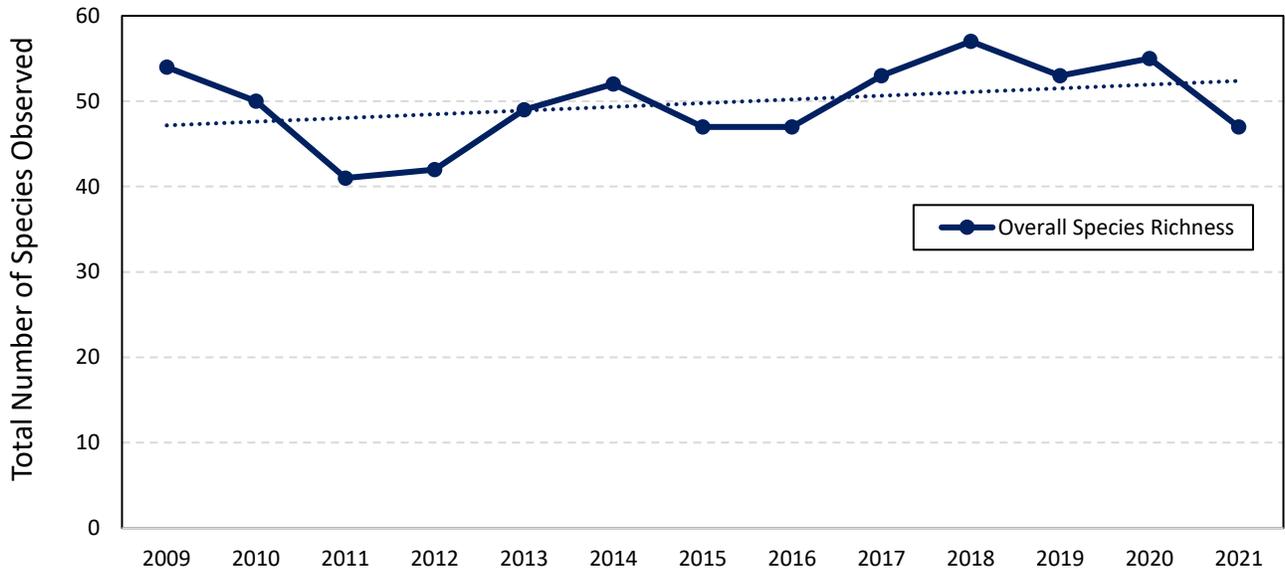


Figure 6: Number of species observed during RBG's bird monitoring program from 2009-2021.

### Relative Abundance

The most abundant bird species for the South Shore of Cootes Paradise in 2021 can be observed in Figure 7. It likely does not come as a surprise that the Red-winged Blackbird was the most abundant bird, accounting for 16% of all bird detections during surveys; followed by the American Robin (7%), Yellow Warbler (5%), Wood Duck (4%), and Song Sparrow (4%). Of interesting note is the Wood Duck appearing in the top five most common species. There were a few successful breeding pairs of Wood Duck observed on multiple occasions at CP-SS-1 President's Pond, which likely accounted for the increase in abundance. Wood Duck are a more secluded species, so surveyors were happy to observe these families over the course of the sampling window.

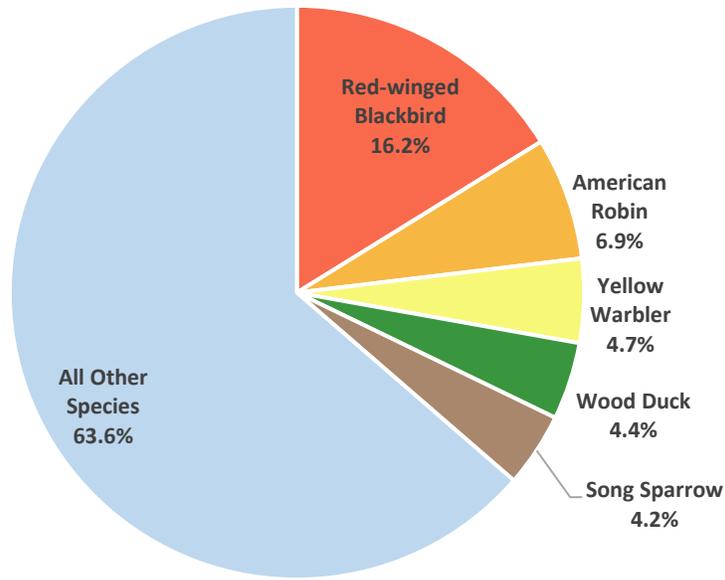


Figure 7: Top five most abundant birds observed during breeding bird surveys in 2021 on the South Shore of Cootes Paradise.

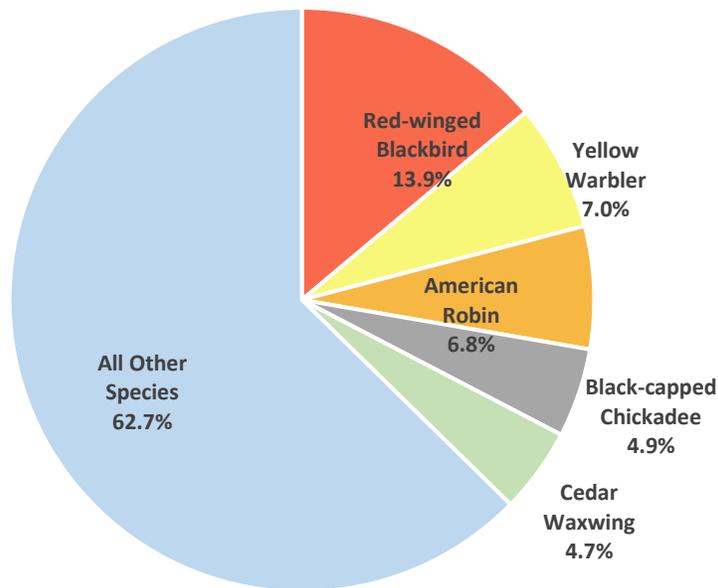


Figure 8. Top five most abundant birds observed during breeding bird surveys throughout the last 12 years (2009-2021) on the South Shore of Cootes Paradise.

Overall, there have been 8,057 bird detections on the South Shore during bird surveys since 2009. Examining all survey years, the top five species observed include the Red-winged Blackbird (13.9%), Yellow Warbler (7%), American Robin (6.8%), Black-capped Chickadee (4.9%), and Cedar Waxwing (4.7%) (Figure 8).

Interestingly, when compared to the 2021 relative abundance, the top three species are the same but the fourth and fifth most abundant in 2021 differ from the overall fourth and fifth. Black-capped Chickadee was the

eleventh most abundant bird in 2021 (3.3% of all detections), whereas it's the fourth most abundant across all years. Even more interestingly, Cedar Waxwing the twenty-eighth most common bird in 2021, accounting for 1.1% of all bird detections on the South Shore in 2021.

### Invasive Bird Species

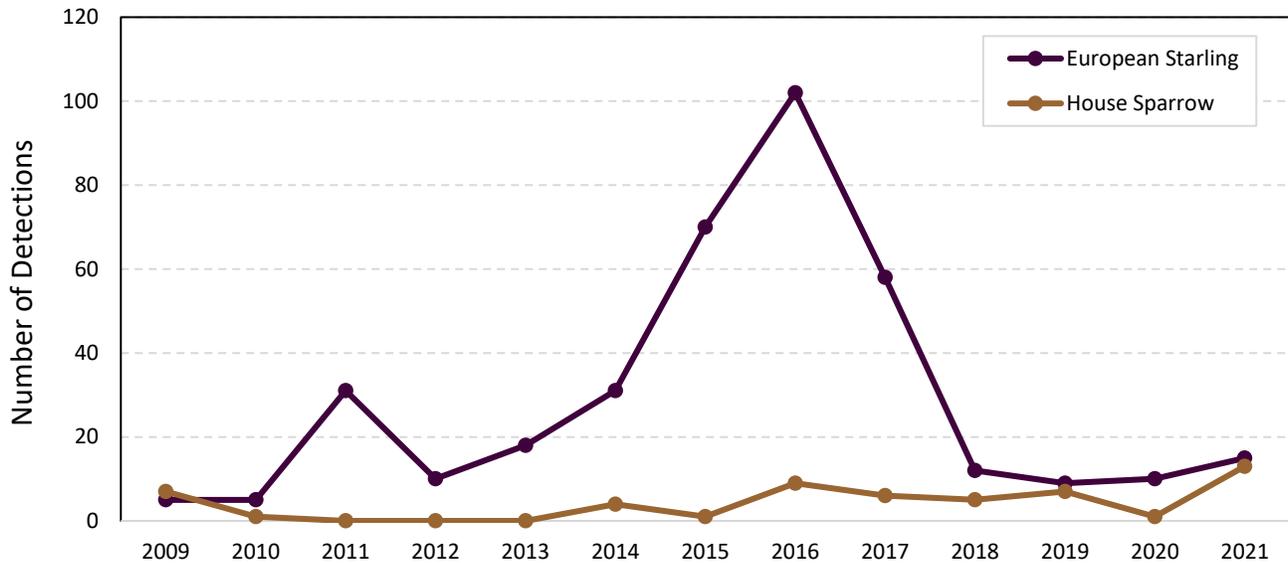


Figure 9: Most common invasive bird species observed on the South Shore of Cootes Paradise from 2009-2021.

The South Shore of Cootes Paradise is no stranger to invasive birds that pose a threat to native bird populations. The two most regularly observed invasive bird species that use the habitat in, and surrounding, RBG’s bird monitoring plots are European Starling and House Sparrow. European Starling presence has fluctuated over the course of bird monitoring, which is partly due to the count of 55 in-plot birds observed in 2016 at the Princess Point plot.

On the other hand, House Sparrow numbers have remained relatively low and stable over the course of monitoring. Yet, the highest number of House Sparrows encountered during surveys occurred in 2021, when 12 were recorded. This number is the sum of all detections at the Churchill South plot, which is adjacent to a municipal park. The proximity of the monitoring plots to urban infrastructure greatly increases the probability of these invasive birds entering the plots.

### Species-at-Risk Birds

Since 2009, there have been five Species-at-Risk detected during bird monitoring surveys on the South Shore (Bald Eagle, Barn Swallow, Chimney Swift, Eastern Wood-pewee, and Wood Thrush). Some of these species have been detected so few times throughout the course of monitoring, that no significant trends can be extracted from the data.

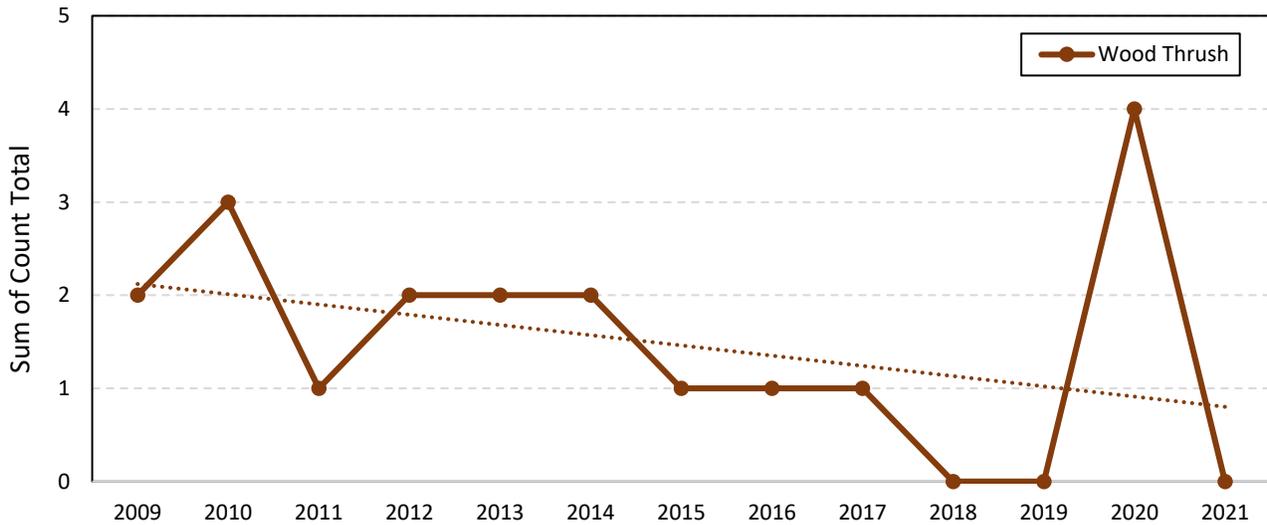


Figure 10: Trends in Wood Thrush detections on the South Shore of Cootes Paradise during Breeding Bird Surveys from 2009-2021.

Wood Thrush (*COSSARO Status: Special Concern; COSEWIC Status: Threatened*) have never been a particularly abundant species on the South Shore of Cootes Paradise; however, they are typically detected during bird monitoring. Since 2009, there is a decline in the number of Wood Thrush detections, with the last three of four years detecting zero birds. There is a lack of interior forest on the South Shore, and the restoration efforts at Churchill Park (see Churchill Park Masterplan) are aiming to amend this issue.

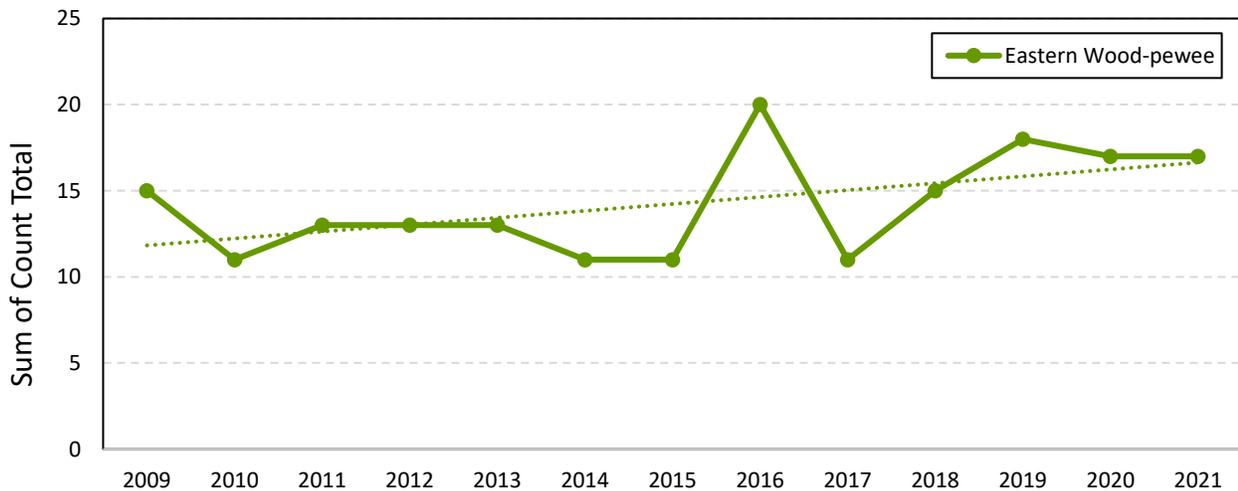


Figure 11: Eastern Wood-pewee detections on the South Shore of Cootes Paradise during Breeding Bird Surveys from 2009-2021.

Eastern Wood-pewee (*COSSARO and COSEWIC Status: Special Concern*) is a highly consistent Species-at-Risk that is detected during bird monitoring on the South Shore. The number of detections varies over the years, however there is a general increasing trend in detections. The Churchill North monitoring plot has had Eastern Wood-pewee present every year since surveys began.

**Non-SAR Bird Trends**

An alarming trend in two wood-warblers on the South Shore have been detected during bird monitoring surveys. Both the American Redstart and Yellow Warbler are experiencing decline during monitoring on the South Shore. Despite year-to-year variation, the overall trend of American Redstart observations has been declining since monitoring began in 2009 (Figure 12). There were at least 16 individual American Redstart observed in 2009 and 2013, but numbers like that have not been observed since that time, with only a maximum of 6 individuals observed twice in the last five monitoring seasons.

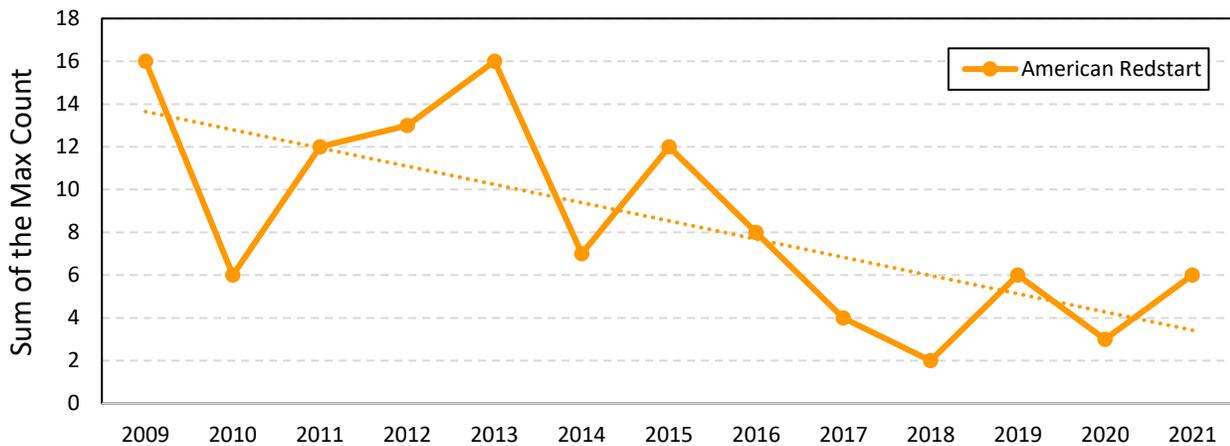


Figure 12: Trends in American Redstart detections on the South Shore of Cootes Paradise during Breeding Bird Surveys from 2009-2021.

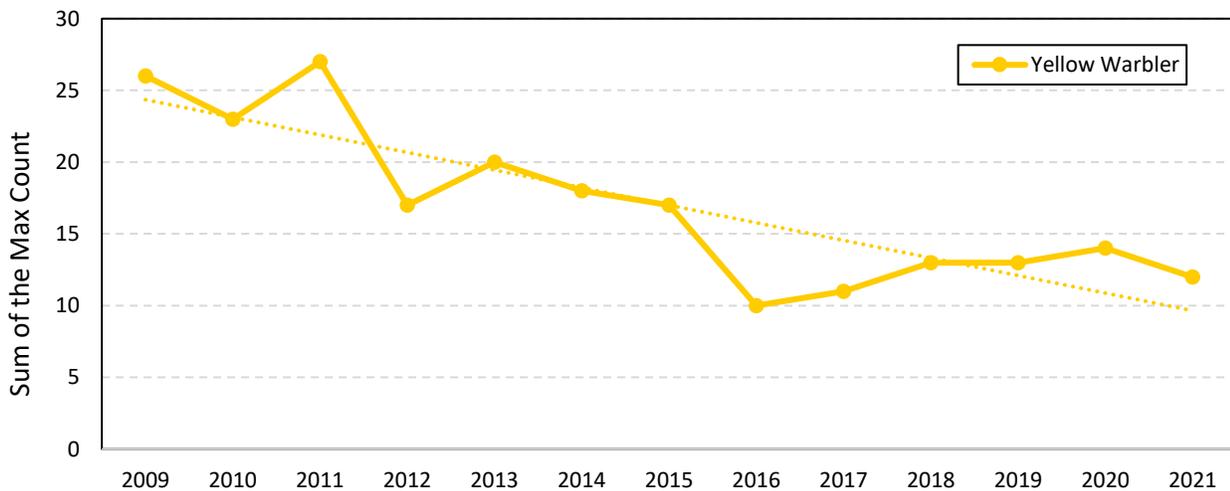


Figure 13: Yellow Warbler trends observed during Breeding Bird Surveys on the South Shore of Cootes Paradise from 2009-2021.

Unfortunately, a similar trend can be observed with the Yellow Warbler on the South Shore. For the first three years of monitoring, it was common to have around 25 individual Yellow Warbler observed during bird monitoring surveys. However, for the last five monitoring seasons, the number of individuals observed is hovering between 10 and 14. This trend was first observed by Vincent (2017) and has only continued since that time. Continued monitoring of bird presence across RBG property will help to provide a better understanding of the fluctuations in bird abundance across RBG lands.

Two non-SAR bird species that have increasing detections on the South Shore are Cedar Waxwing and Indigo Bunting (Figure 14). Both birds are common across the South Shore, with varying degrees of presence since monitoring began in 2009. Of the two species, the one with the most variation would be the Cedar Waxwing. An impressive jump occurred with Indigo Bunting from 5 observations in 2019 to 22 in 2021. Further monitoring is recommended to track changes in both species' presence on the South Shore of Cootes Paradise.

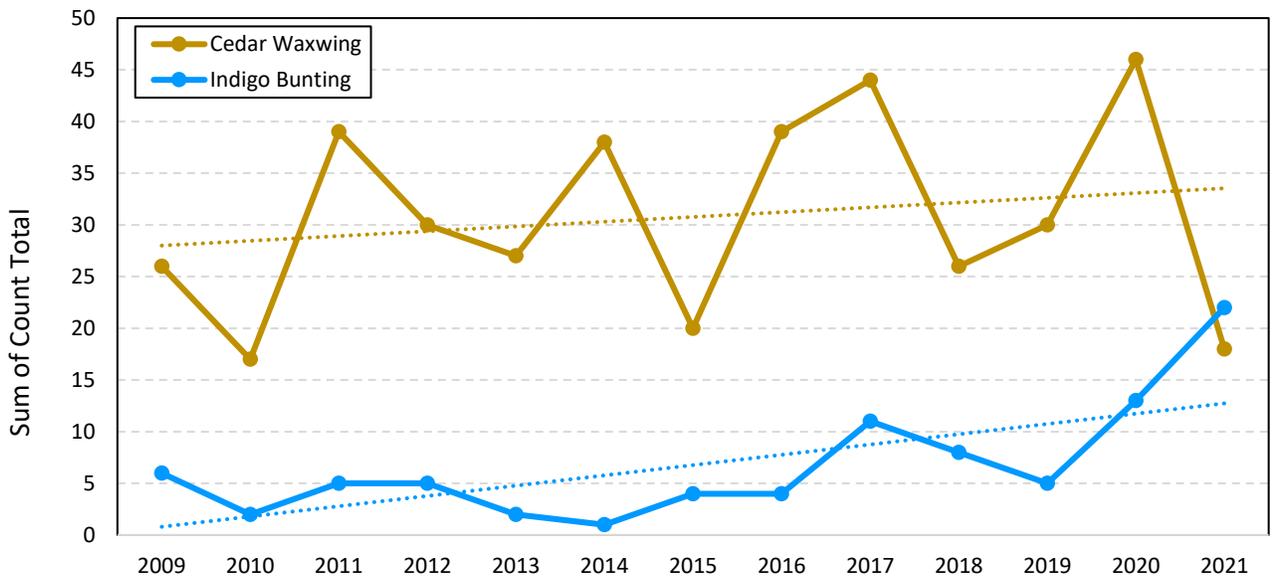


Figure 14: Trends in Cedar Waxwing and Indigo Bunting detections on the South Shore of Cootes Paradise during Breeding Bird Surveys from 2009-2021.

### Marsh Monitoring

Marsh Monitoring surveys have been sporadic on the South Shore since monitoring began. No formal surveys have been conducted since 2019. At that time, plots at Princess Point, Double Marsh, and Westdale Inlet were surveyed. No amphibians were observed at Princess Point. Green Frog, Gray Treefrog, Northern Leopard Frog, and American Toad were seen at Double Marsh. At Westdale Inlet Green Frog, Gray Treefrog, and American Toad were detected. As a result of the Chedoke spill and increasing CSO events in Westdale, less amphibians would be anticipated with the area of the marsh near Chedoke Creek generally without amphibians.

## Discussion

### Forest Monitoring

#### Canopy Tree Layer



Inventories of the canopy tree layer on the South Shore of Cootes Paradise indicate that species composition, dominance, and density have remained relatively stable since long term forest monitoring began at RBG in 2008/9 showing no significant trends. Black Cherry, Shagbark Hickory, and Red Maple have remained the dominant species in the canopy within monitoring plots on the South Shore (Table 1). Shagbark Hickory has shown a slight decline while Black Cherry has shown a slight increase since 2016. When basal area is considered Shagbark Hickory and Red Oak have the highest. Together, the oaks (Red, White and Black) make up almost 40% of the basal area of the South Shore.

Two non-native trees were present in the canopy layer: Sweet Cherry and Northern Catalpa. Sweet Cherry was the only non-native tree species that made up a substantial portion of the canopy layer, representing the fifth most dominant species observed with a relative abundance of 7.3%. The relative abundance of Sweet Cherry has remained relatively stable since monitoring began in 2008. Although Sweet Cherries do not pose an immediate threat to forest health, they do compete with native species for canopy space. They should be removed and/or continue to be monitored in detail during future forest monitoring surveys, as they have shown persistence in the canopy layer and have slowly increased in abundance over time.

Although long-term forest monitoring plots indicate relatively stable canopy conditions, more concerning changes were noticed when examining historic aerial imagery and referencing Ecological Land Classification (ELC) of the forest. Refer to Vincent, 2017 for maps and figures that show how the proportion of intact forest cover that has declined since 1934 by 34%. Although this is only an estimate using aerial imagery, it clearly indicates that a large portion of previously forested area has declined to woodland, savannah, or thicket on the South Shore of Cootes Paradise. This decline can likely be attributed to broad scale stressors impacting forests throughout southern Ontario, such as Emerald Ash Borer, Spongy Moth (formerly known as Gypsy Moth or LDD) and other native insect outbreaks (Two-lined Chestnut Borer, Fall Cankerworm, and American Plum Borer), Dutch Elm Disease, Bitternut Canker, the spread of invasive species, drought, and increased urban encroachment around property borders. White Ash relative abundance appears to remain stable compared to what was reported in 2016 in the State of the South Shore report (Vincent, 2017). This is likely due to the recruitment of the understory layer where the younger saplings (not yet affected by the Emerald Ash Borer) are replacing the dying canopy tree layer ash or perhaps there are some trees experiencing resistance to the Emerald Ash Borer. It can be expected that changes in ash composition and other species will become more noticeable within forest monitoring plots over the long term.

In the spring of 2021, an aerial spray of the bacterial insecticide *Bacillus thuringiensis* var. *kurstaki* (Btk) was applied to the Cootes Paradise South Shore forested areas. The operation was carried out by Zimmer Air Services, Inc., who conducted the two sprays on May 25<sup>th</sup> and June 1<sup>st</sup>. It was noted last year that a portion of the forest at the very west end of the South Shore (by the “President’s House”) exhibited more defoliation than the rest of the sprayed area. This result may have been due to 1) the area being at the very end of the spray zone, 2) prevailing winds and the location of Cootes drive making it difficult for the helicopter to effectively spray the area, and most likely 3) caterpillar movement from outside the spray area. As a result of the application of Btk, there was very minimal defoliation on the forests of the South Shore in 2021. This operation assisted in the protection of our forested ecosystems and helped play a role in maintaining these ecosystems for generations to come.



Newly hatched Spongy Moth caterpillars feeding on planted Paper Birch

Tree health surveys will also help detect more subtle changes in the canopy. These surveys, following the EMAN protocols, were completed for 2008, 2012, 2016 and 2021 however, multiple years of data (25+ years) collection is required before significant trends can be accurately displayed and interpreted.

### Small Tree and Shrub Layer

Changes have been observed in the small tree and shrub layer (understory layer) on the South Shore between VSP surveys from 2012 and present (Table 2 **Error! Reference source not found.**). Woody species observed in both height classes (0.5-2 meters and 2-10 meters) were examined to summarize our findings. The most notable observation was the change in average vegetation cover overall for the 2-10 meter height class layer, from 72.4% to 26.8%, between 2012 and 2021. It’s possible that this reflects recruitment into the canopy layer of some of the small trees like Black Cherry, Shagbark Hickory and Red Maple (all which have shown reduced average cover between years). Ash in this category may have been recruited to the canopy layer but it’s more likely that many have succumbed to the affects of Emerald Ash Borer. It is noted that American Witch-hazel has also decreased in average cover (in both height categories of the understory). While it has decreased in average cover between years, in the 2-10 meter height class, it remains the dominant species. In fact, the species’ relative cover has increased which suggest that it is even more dominant in this layer than in previous years because of the lack of other vegetation. The increase in non-native species, which are known to be invasive, in the 0.5 to 2 meter height category is suggesting that invasive species are spreading throughout the South Shore. VSP surveys will provide valuable data moving forward. A thorough examination of the data (looking at woody vegetation in all height categories) should be considered for future reports. A literature review looking at trends in vegetation cover that suggest forest decline and/or increased disturbance is suggested.

### Ground Vegetation

Over time (since ground monitoring began in 2009) it is clear that a decline in native plant cover and an increase in non-native plant cover is occurring (Figure 2). As of 2021 it appears that these trends begin to level off and stabilize at 57% relative abundance for native species and 43% relative abundance for non-native species.

Woodland Speargrass (also called Woodland Blue Grass) was highlighted as an invasive species significantly increasing in abundance and cover in the 2017 State of the South Shore report (Vincent, 2017) and we continue

to see this trend in 2021. While the cover of Woodland Speargrass relative to the other ground vegetation remains similar to 2016 when we look at the sum of percent cover over time, we continue to see an upward trend. This is especially concerning with regards to species at risk conservation at RBG, as the largest populations of endangered Few-flowered Club-rush are found on the South Shore. Few-flowered Club-rush is a perennial herbaceous sedge that usually occurs on the slopes of mature oak forests (Harrison, 2015), (Smith & Rothfels, 2007). RBG currently maintains the only extant population of Few-flowered Club-rush in Canada, conducting intensive monitoring and surveying work to maintain the population. During vegetation surveys around Club-rush populations in 2012, Woodland Speargrass was found at all microsites and was noted to pose a serious threat to the endangered plant (Harrison, 2015), (Smith, 2014 personal communication). Without intervention, Woodland Speargrass will almost certainly play a major role in the ongoing declines of this sensitive species.

In past survey years (2012 and 2017) Garlic Mustard was reported as the most dominant ground vegetation species throughout the South Shore. Interestingly we have seen a decline in Garlic Mustard over time from a total sum of cover of 84 in 2012 to 31 in 2016 to 21.5 in 2021 (Figure 5). This brings it down to a similar level to what was first recorded when ground monitoring began in 2009. It would be prudent to investigate what the data from VSP monitoring shows and take a closer look at other trends in species overtime to get a clearer picture of what is going on. Blossey et. Al (2020) study on Garlic Mustard populations documented declines in eastern North America with distinct local and regional dynamics as a function of patch resistance time. They report that declines in naturalised species often appear driven by natural enemies, diseases or evolutionary adaptations that selectively reduce populations and their impacts; also, that negative soil feedback provides a potential mechanism for the reported disappearance of ecological dominance of Garlic Mustard. The authors suggest that removing garlic mustard could interfere with the negative soil feedback processes that work to bring about population declines and recommend that local managers set aside locations for observational investigations, to see whether the phenomena they describe occur outside of their study region, or in other species. At RBG, Garlic Mustard is managed as small scales, with the majority being in highly disturbed areas and restoration sites.

There is relevant concern over the growing non-native cover of the ground vegetation layer and decline of native plant cover. The highly populated urban areas surrounding the South Shore have major impacts on sensitive natural areas. As a result, these areas have experienced habitat declines due to increased off-trail use, off-leash dogs damaging the understory and disturbing wildlife, bank erosion, the spread and proliferation of non-native species, and the dumping of yard waste and other debris (City of Hamilton, Royal Botanical Gardens, 2017). These issues caused by increased visitation are also likely compounded by the general lack of RBG presence on the South Shore. At present, RBG maintains no facilities on the South Shore of Cootes Paradise, with a lack of gated entry points at trailheads. The South Shore features 2 main entrances with parking (Princess Point, and Caleb's Walk), 8 sanctioned trail entrances, and another 7 unsanctioned trail entrances. Having so many access points limits RBG's ability to monitor public access and provides increased opportunity for negligent behavior in the natural lands.

The overall trends observed in the ground vegetation layer are concerning. This forest layer had the greatest proportion of non-native species, a proportion that has increased



**1x1 m EMAN Ground Vegetation Monitoring**

substantially in the last 10 years. These are the observations expected for a natural system with a significant invasive species problem. When interpreting forest monitoring results one can typically make predictions for the future trends of a layer by looking at the layer below it. This is because new species, whether native or non-native, first infiltrate at the forest floor level before growing into the understory and then the canopy. Seeing increases in non-native invasive plants in the ground vegetation layer is a warning sign for negative changes throughout the forest in the future.

## Bird Monitoring

### Overall Species Richness

The number of bird species detected during breeding bird surveys on the South Shore of Cootes Paradise has not shown any substantial changes despite year-to-year variation (Figure 6). Species richness was at its lowest in 2011 when the species count dropped to 40 (with previous years hitting highs of 54). Since 2015, species richness has not dropped below 47, and the highest count was 57 species in 2018. Based on these observations, the number of species detected during the breeding bird surveys is expected to remain relatively stable.

### Relative Abundance

The composition of the bird community on the South Shore appears to slightly change year to year. Generally, Red-winged Blackbird is the most common bird detected during surveys. Rounding out the top five species changes year to year. Since monitoring began in 2009, the Yellow Warbler, American Robin, Black-capped Chickadee, and Cedar Waxwing have been the species to follow the Red-winged Blackbird in the top five species observed (Figure 8). In 2021 the Red-winged Blackbird was the most abundant bird, followed by American Robin, Yellow Warbler, Wood Duck, and Song Sparrow (Figure 7). The addition of the Wood Duck to the top five most abundant species was because of the presence of two nesting pairs and their ducklings at the President's Pond monitoring site.

### Invasive Bird Species

Two non-native bird species have been regularly detected during breeding bird surveys conducted on the South Shore; European Starling and House Sparrow. Of these species, the European Starling has been by far the most dominant species and have experienced a boom and bust in detections since monitoring began. As shown in Figure 9, Starling detections began dramatically increasing beginning in 2013 and peaking in 2016 when 102 Starling observations were made during surveys. Since then, the number of Starling detections have dropped significantly to a low of 9 detections in 2019. Since 2017, there have been less than 20 Starling detections during each year of surveys.

Another non-native species that has been more present on the South Shore is the House Sparrow. Even though their detection numbers are low, the detection numbers have been on the rise since 2016. In 2021, there were the highest number of detections of House Sparrow since monitoring began with 13 detections. In 2020, nesting boxes at Princess Point have been removed and that monitoring plot saw a dramatic decrease in the presence of House Sparrow. That being said, the presence of House Sparrow in some of the monitoring plots will never be solved as they are in close proximity to urban environments such as municipal parks.

European Starling and House Sparrow are cavity nesters and pose a threat to native cavity nesters, such as woodpeckers and bluebirds, by competing for nesting habitat. Starlings not only compete with native birds for habitat and resources, they also likely contribute to the spread of a variety of invasive shrubs such as Common and Glossy Buckthorn, Multiflora Rose, and Autumn Olive. For further information on this relationship, see Vincent, 2017.

## Species-at-Risk

### *Wood Thrush*

Wood Thrush have experienced serious decline on the South Shore since monitoring began in 2009. Unfortunately, this decline is consistent with the detections on the rest of RBG property. 2020 saw a record high number of detections, which was likely due to the COVID-19 pandemic when trail use by visitors plummeted. Interestingly, when society returned to a semi-normal state in the spring of 2021, no Wood Thrush were detected on the South Shore. Therefore, the disturbance of trail users and their behaviour (possibly off-leash dogs or off-trail use) has a large impact on the suitability of breeding habitat for Wood Thrush.

### *Eastern Wood-pewee*

Eastern Wood-pewee is one of the species-at-risk that is experiencing stability, even a slight increase, in detections across the South Shore since monitoring began in 2009. The highest number of detections for Eastern Wood-pewee occurred in 2016 but have leveled out in the last three monitoring seasons. This pattern is reflective of the general trends observed across the remainder of RBG property. This is a positive result despite threats such as forest composition changes caused by over-browsing by deer, increase in egg predators (blue jays and red squirrels), and reduced availability of flying insects (OMNRF, 2021). The loss of widespread habitat for this species might result in inflated numbers on RBG property, as it is one of the largest preserves of land in the surrounding area. Further control and maintenance of invasive plant species will maintain the integrity of the South Shore forest as suitable habitat for Eastern Wood-pewee.

## Non-SAR Bird Trends

### *Wood-warblers*

There has been a steady, consistent decline in detections of American Redstart and Yellow Warbler on the South Shore since 2009 (Figure 12 and

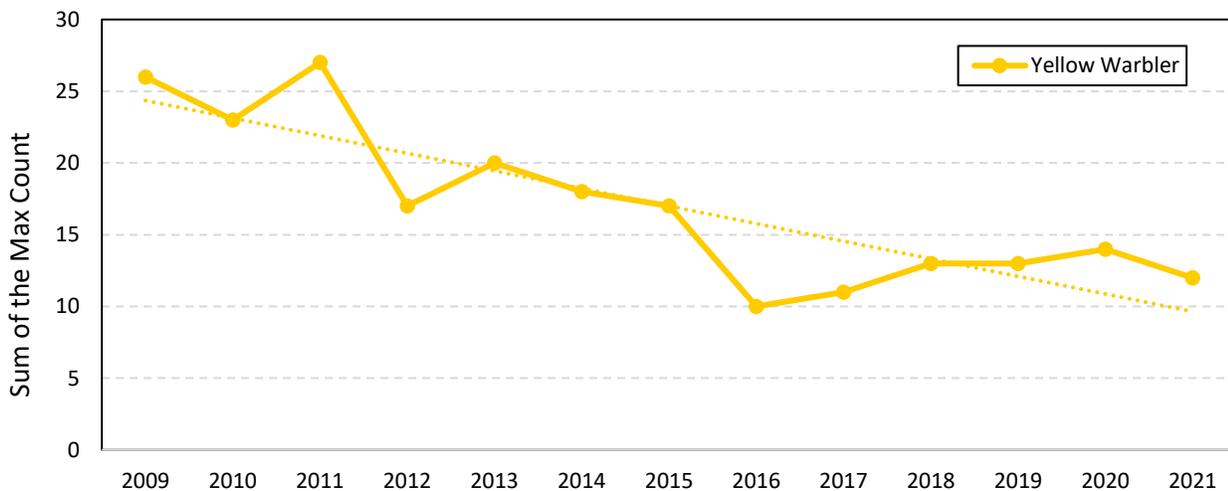


Figure 13). The American Redstart decline appears to be more intense and continuous than the Yellow Warbler, however both trends are alarming. Yellow Warbler detections appear to have levelled out since hitting their lowest number of observations in 2016.

American Redstarts are experiencing a decline in their population, with up to a 47% decline in the United States alone (Cornell Lab of Ornithology, 2022), where habitat loss is one of the main threats to its population. The South Shore contains a large amount of forest edge habitat, which is not favourable for American Redstart as

they prefer interior deciduous woodlands of at least 1,000 acres in size (Cornell Lab of Ornithology, 2022). The size of the South Shore habitat might not change, but the restoration efforts to reduce the ratio of forest edge to interior habitat would greatly benefit the American Redstart.

The decline of Yellow Warbler on the South Shore is peculiar, as they are one of the most common and widespread bird species in Ontario. Yellow Warblers nest in a variety of habitats, including moist deciduous thickets and disturbed/early successional habitats such as suburban yards, field, pastures, and hydro-corridors (Cadman M. D., 2007). RBG and the surrounding area in Hamilton provide a high number of these habitat types. None of the other bird species that share the Yellow Warbler's habitat requirements have shown similar signs of decline. This gives an indication that a change or deterioration in breeding habitat might not be directly responsible for the decline. For more information see Vincent, 2017.



**Yellow Warbler on nest at Princess Point**

Two species that have slightly increased in abundance since monitoring began are Cedar Waxwing and Indigo Bunting (Figure 14). Cedar Waxwing detections are extremely variable from year to year, which could be partly since most of their presence on the South Shore is through fly-bys and not in-plot counts. This means that flock size could range anywhere from a few birds to more than a dozen. This instability and unpredictability are the cause for the statistical noise in the data. In comparison to the American Redstart, Cedar Waxwing prefer edge habitat and suburban backyards (Audubon, 2022). As previously mentioned, the South Shore has plenty of edge habitat and is near a suburban neighbourhood.

The increase of Indigo Bunting detections is more stable and less variable than Cedar Waxwing. In 2021, 22 individual Indigo Buntings were observed during surveys, which is the highest since monitoring began. Since 2019, Indigo Bunting numbers have been increasing dramatically on the South Shore. Unlike American Redstart, Indigo Bunting prefer edge habitat, of which there is plenty on the South Shore. Interestingly, this same increase since 2019 is reflected in the trend for Indigo Bunting detections across all RBG bird monitoring plots. RBG should continue monitoring across the South Shore is to track changes in species presence and abundance.

## **Recommendations and Updates**

## Invasive Species Management

### Woodland Speargrass

One of the most interesting yet concerning results to come from forest monitoring on the South Shore was the proliferation of Woodland Speargrass in the ground vegetation layer. As previously discussed, this non-native species has shown the greatest increase in cover on the forest floor. Woodland Speargrass threatens a wide variety of native vegetation including the endangered Few-flowered Club-rush populations. Because this species does not have formal Best Management Practices, one important recommendation would be to consider strategies to manage this quickly spreading invasive grass.

A formal study has been conducted by RBG Natural Lands and Science staff that began in 2018, trialing several different Woodland Speargrass control techniques – a recommendation from the 2017 State of the South Shore report. A series of 5 control activities were trialed for the study including cutting, pulling, freezing, burning, and herbicide application. Further details of the study will become available when a report is completed, but this is a step in the right direction for invasive species management at RBG and provides hope for dealing with this new problem species.



**Woodland Speargrass dominating forest floor on the South Shore**

### Other Non-native Plant Invasions

Invasions of non-native plants continue to pose a threat to the forests of the South Shore of Cootes Paradise. Neighbours to RBG continue to maintain gardens containing a variety of non-native, invasive plants. These can be seen in resident homes, as well as McMaster University. Examples found at McMaster include, but are not limited to, Silvergrass (*Miscanthus sinensis*), Winged Euonymus (*Euonymus alatus*), European Spindle Tree (*Euonymus europaeus*), and Japanese Barberry (*Berberis thunbergii*). For more information, please refer to Vincent, 2017. 2021 marked the first year European Barberry, Norway Maple and Winged Euonymus were found in the small tree and shrub layer. In 2017 it was recommended that the public be educated in invasive species, specifically invasive ornamentals. Conservation Halton's stewardship program in partnership with and Hamilton Conservation Authority and Cootes to Escarpment EcoPark System have provided workshops (Healthy Neighboursheds) to the community that highlight invasive species, how to get rid of them in your garden and what to plant in replace. The Ward Councillors office has also been extremely supportive. There is currently a campaign to increase green infrastructure in Ward 1 which includes native plant gardening. A partnership with Hamilton's Green Venture. The Westdale and McMaster community will continue to benefit from educational programs and action based projects like these.

## Forest Protection and Restoration

RBG has Forest Management Goals in place to improve property-wide forest habitat. These goals are imbedded into the Churchill Park Master Plan, which is currently being implemented. Improved forest protection is also part of the current RBG strategic Plan and 25year Masterplan. Churchill Park Phase 1 has been completed and

Phase 2 begins in the summer of 2022. Aiming to achieve these goals throughout the South Shore helps to mitigate forest declines that have been observed. Our Forest Management Goals are as follows:

1. Defragment the forest area that was reduced to the ravine slopes, which translates to increasing interior forest area and reducing the amount of forest edge through strategic reforestation.
2. Encourage people to stay on the trails through various means of communication, present clear and accessible trailheads and create trail destination points that contain and focus visitors.
3. Increase ecosystem resilience by enhancing the forest edge through invasive species management and planting native species.
4. Remove invasive species, especially in the interior forest and critical forest habitat for species-at-risk.
5. Plant native species in areas where there is a high amount of disturbance (ex. where a number of ash have died).
6. Remove nature trails were ongoing disruption and decline or endangered species demand it.

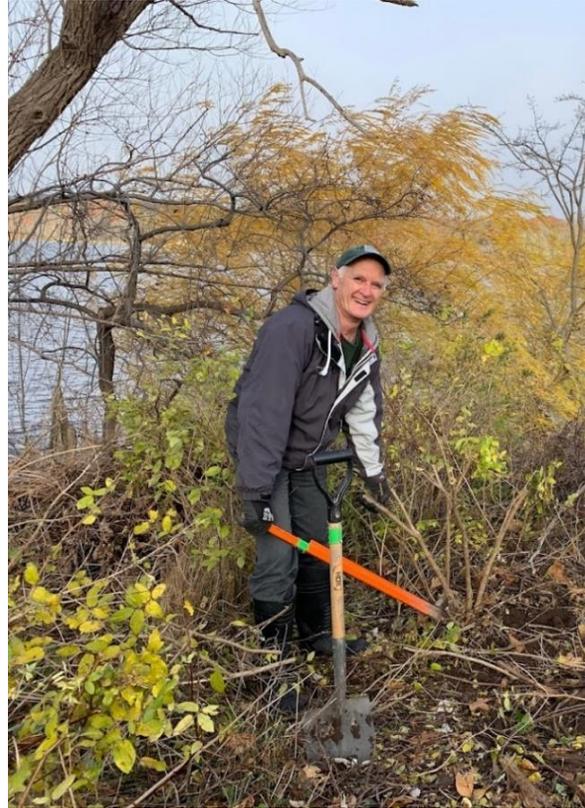
To achieve goals 1 and 3 on the South Shore, reforestation efforts have been undertaken around forest edges at Churchill Park to increase interior forest habitat and boost ecosystem resilience. Extending forest boundaries decreases the forest-edge ratio and provides more suitable habitat for interior species. To date, approximately two-thirds of the Churchill Park forest edge has been fenced and undergone re-naturalization work. In addition, one soccer field in the park was decommissioned and re-naturalized using pit and mound restoration techniques in 2020. Since 2020, there have been 2,969 native trees and shrubs planted and 6kg of native wildflower seed mix spread at the pit and mound restoration site.

This is in addition to previous years' work which is equal to or greater than the number of trees and shrubs planted. RBG staff installed more than 1,600m of deer exclusion fencing to ensure the planted trees and shrubs have a high chance of survival. RBG volunteers have dedicated more than 580 hours to the reforestation initiative on the South Shore since 2020.



**Tulip Tree planted**

In working towards accomplishment of goal 4, invasive species have been removed from identified problem areas, such as the control of invasive species along problem border areas (ex. McMaster University, Churchill Park forest edge) and around Species-at-risk populations. In 2020 and 2021, RBG staff and volunteers removed more than 15,000 invasive shrubs along the edge of Churchill Park and the Ravine Road Trailhead entrance. Additionally, RBG staff and volunteers removed 12 truckloads and 3 trail-loads of herbaceous invasive plant material removed from the South Shore. The removal of invasive species in these targeted areas has helped improve overall forest health and reduce competition for desirable native species.



**Volunteers removing invasive shrubs along the South Shore of Cootes Paradise**

Goal 5 has been addressed in 2 areas where a high amount of ash have died. Additional native trees have been planted near the McMaster entrance to Ravine Road Trail with the help of McMaster student volunteers. In 2018 and 2019 tree plantings associated with the Churchill Park reforestation project included plantings in an ash dieback area at the north end of the park. RBG will continue to monitor areas where ash once dominated and replant as necessary.



**Tree and shrub planting at Churchill Park**

Ecosystem disturbance on the South Shore of Cootes Paradise can be attributed to pressures from the surrounding urban environment. Off-trail use, dogs off-leash, yard-waste dumping, encroachment, encampments, campfires etc. are all disturbances that are impacting the forest ecosystem. Increasing staff presence along with education and outreach initiatives with the adjacent community should reduce these impacts and address goal 2; however, RBG should consider the feasibility of limiting public access to a lower number of more manageable main entrances and/or maintaining some form of facilities on the South Shore. In 2021 RBG began to staff the Princess Point entrance which has improved some visitor behaviour such as leaving garbage behind. When Phase 2 of the Churchill Park Master Plan is completed, RBG trailheads will be well defined and unofficial trail entrances will be better managed with fencing and re-naturalization work.

## **Conclusion**

RBG's Long Term Forest Monitoring Program provides valuable data that will only become more significant over time. RBG has only skimmed the surface of the information that it supplies and with that it shows that many of the same issues causing decline that were presented in the last report persist, however, RBG has made progress implementing some of the recommendations that were laid out. One invasive grass species Woodland Spear grass continues to advance in its colonization of the forest understory. However, the Endangered status Wood Thrush have demonstrated an interest in returning if human disturbance of the habitat is reduced.

Moving forward RBG will continue to focus on ways to mitigate environmental impacts on the South Shore forest. Increasing staff presence and focusing visitor activity is embedded into the RBG Master Plan which highlights Princess Point and the South Shore Commons (currently operated as an Aviary) as points of interest and strengthening our connection to the community. Invasive species management is a necessary goal towards the improved ecosystem health and resiliency of the South Shore forest. The results from this report will help determine which species to focus on and the implementation of an RBG invasive species policy will support the conservation and forest protection of the South Shore.

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