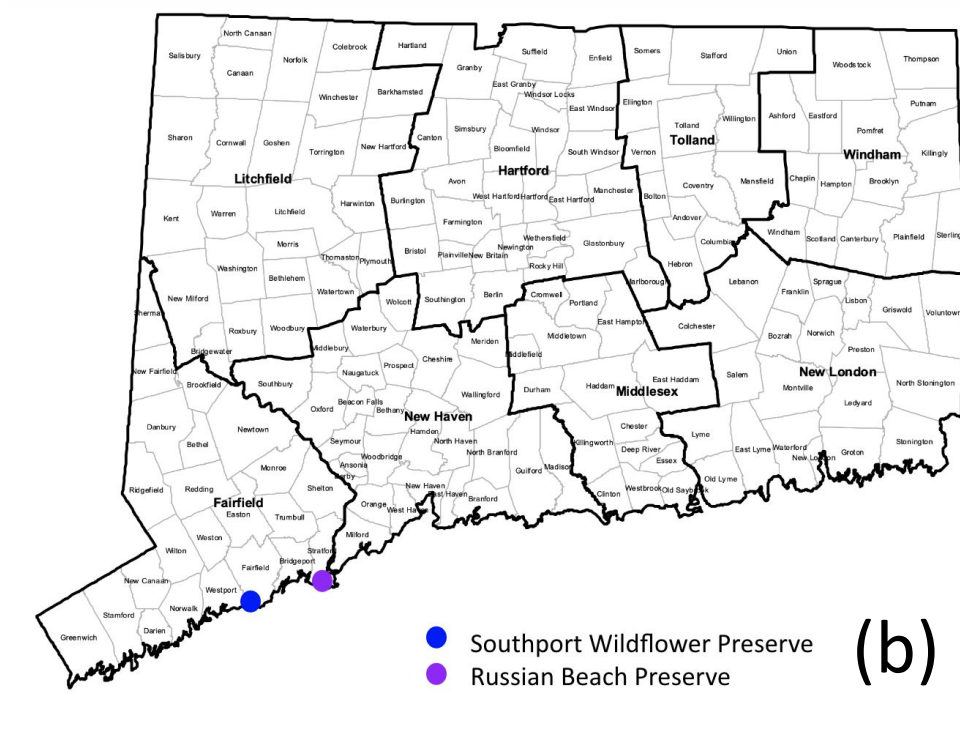




# A Tale of Two Preserves: Plant Diversity and Pollinator Abundance

## Plant & Pollinator Diversity

- Connecticut is home to a diversity of pollinators, including over 300 species of bees, as well as flies, beetles, butterflies, and wasps.<sup>2</sup>
- Habitat fragmentation, the use of insecticides, climate change, invasive species and parasites are contributing to a decline in pollinator species worldwide.<sup>2</sup>
- Pollinators benefit from plant species with ample pollen and nectar sources.<sup>1</sup>
- We conducted an observational study on pollinator species at the Sasqua Wildflower Preserve in Southport, CT, and Russian Beach in Stratford, CT, which contain a variety of native and invasive plants.
- Our goal was to assess a relationship between plant biodiversity and pollinator abundance by counting the floral visitors at each preserve.



- (a) Harper and Angela count pollinators at the Sasqua Wildflower Preserve, managed by the Aspetuck Land Trust.<sup>3</sup>
- (b) A map showing the locations of Sasqua Wildflower Preserve and Russian Beach
- (c) Harper and Angela observe pollinators at Russian Beach, managed by the Town of Stratford and Lordship Improvement Association.<sup>4</sup>

## Objectives & Hypotheses

- Evaluate what plants attract the greatest number of pollinators
  - We collected data on floral visitors to 17 different plant species at the 2 locations.
- Evaluate level of pollinator diversity at both preserves
  - We recorded the category of pollinator at each sighting: native bee, honey bee, butterfly, fly, and other (including wasps and beetles).
- Hypotheses:
  - Null hypothesis: There is no significant difference in pollinator activity among plant species.
  - Alternative hypothesis: There is a significant difference in pollinator activity among plant species.

## Plant & Insect Species Observed



- (d) Honey bee (*Apis mellifera*) on spotted Joe Pye weed (*Eutrochium maculatum*)
- (e) A Halictid bee (*Halictus* spp) on goldenrod (*Solidago* spp)
- (f) Common Eastern bumble bee (*Bombus impatiens*) on goldenrod (*Solidago* spp)

## Methods

- We made 7 weekly trips to each location, from 7/22/2020 to 9/4/2020
- Visits were conducted during the late morning (9-11 AM) because this is a time of increased pollinator activity.
- Technology:** All data was recorded on an EpiCollect5 form and plant species were identified using Seek.
- Pollinator species were identified using *The Bees in Your Backyard* as a reference.<sup>5</sup>
- On the first visit to each site, we made an inventory of all flowering plant species.
- Our counting procedure was adapted from the Xerces Society.<sup>1</sup>
  - Each week, we chose 3 sample areas to observe, selecting species that were in bloom.
  - We used a string to measure each sample plot to a controlled area (25 sq ft).
  - We took a photo of each plot area and recorded site details (Figure g).
  - We identified the main plant species in the observation area and the color of the flowers.
  - During a **5-minute window**, we counted the number of pollinators that flew within the plot area, and noted their category.

Question	Answer
Preserve Site	Russian Beach
What is the date?	04/09/2020
What is the location?	41.150318, -73.121629
What is the temperature?	80
Wind speed	40
What is the humidity?	10
Percentage of cloud cover	0% - clear/sunny
Date of last significant precipitation	03/09/2020
What is the location?	41.150273, -73.121639
Photo of plot area	
What is the time?	09:18:39
Number of native bees observed	5
Number of honey bees observed	0
Number of butterflies observed	0
Number of flies observed	0
Number of other species (beetles, wasps, dragonflies, ants)	1

(g) Sample section of EpiCollect form noting site details

- Recorded any significant disturbance that occurred during observation, including a lawn mower, cars, or nearby train tracks.
- Recorded the location, time and environmental variables which may affect pollinator activity (temperature, windspeed, humidity, percentage of cloud cover, and the date of last significant precipitation).

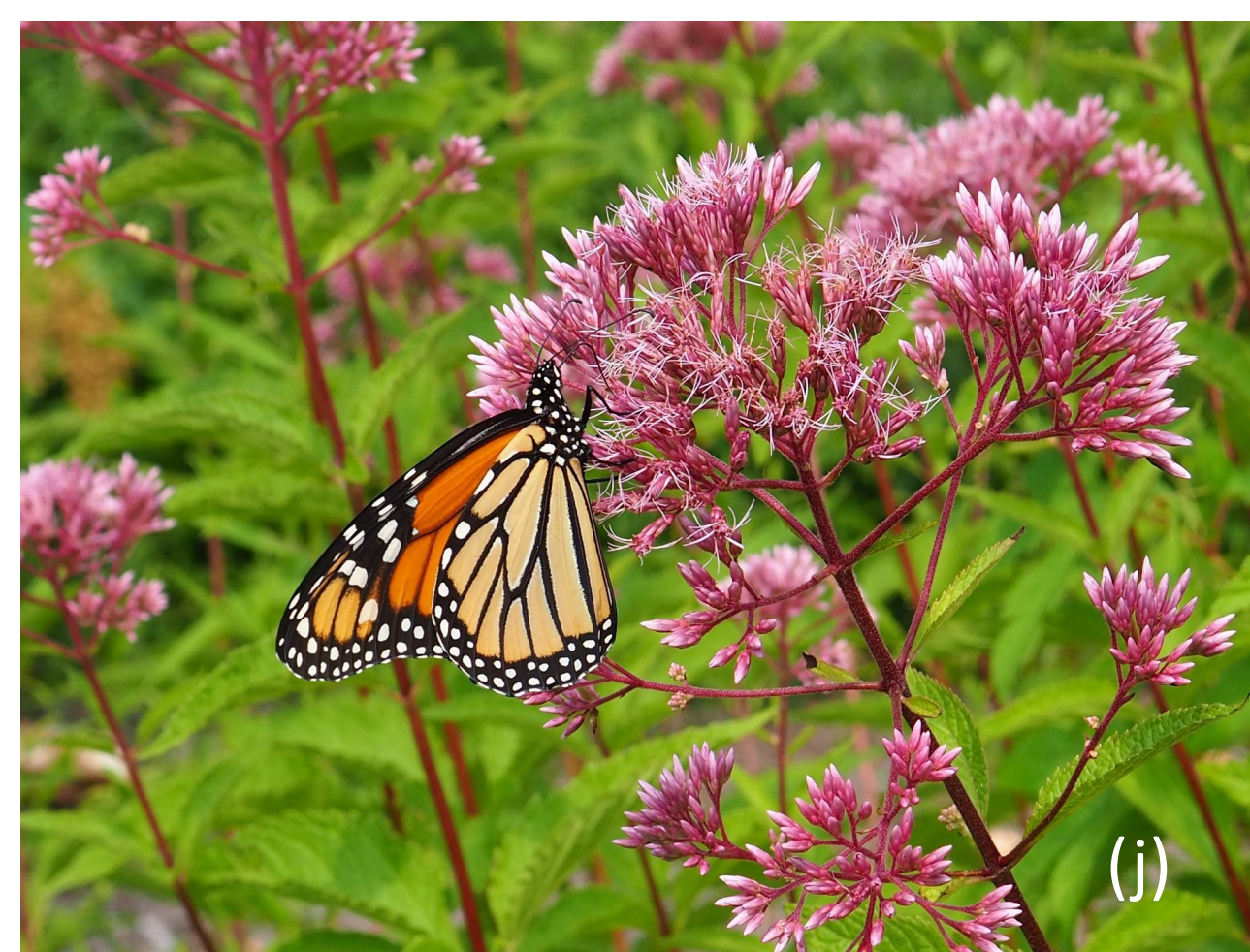
(h) Flowering plant species studied at each preserve

(i) Common Eastern bumble bee (*Bombus impatiens*) on spotted Joe Pye weed (*Eutrochium maculatum*)

(j) Monarch butterfly (*Danaus plexippus*) on spotted Joe Pye weed (*Eutrochium maculatum*)

(k) Cabbage white (*Pieris rapae*) on purple loosestrife (*Lythrum salicaria*)

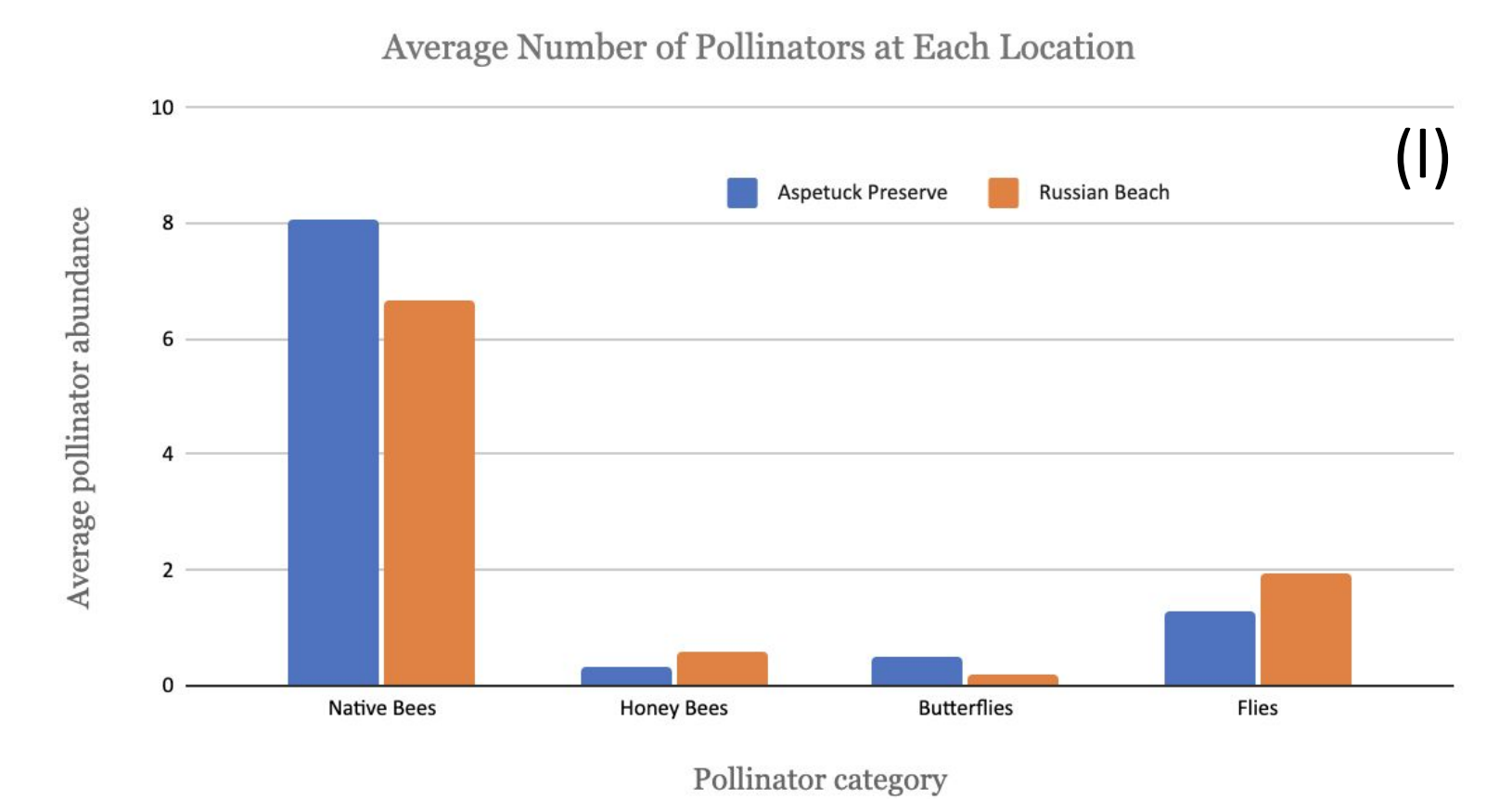
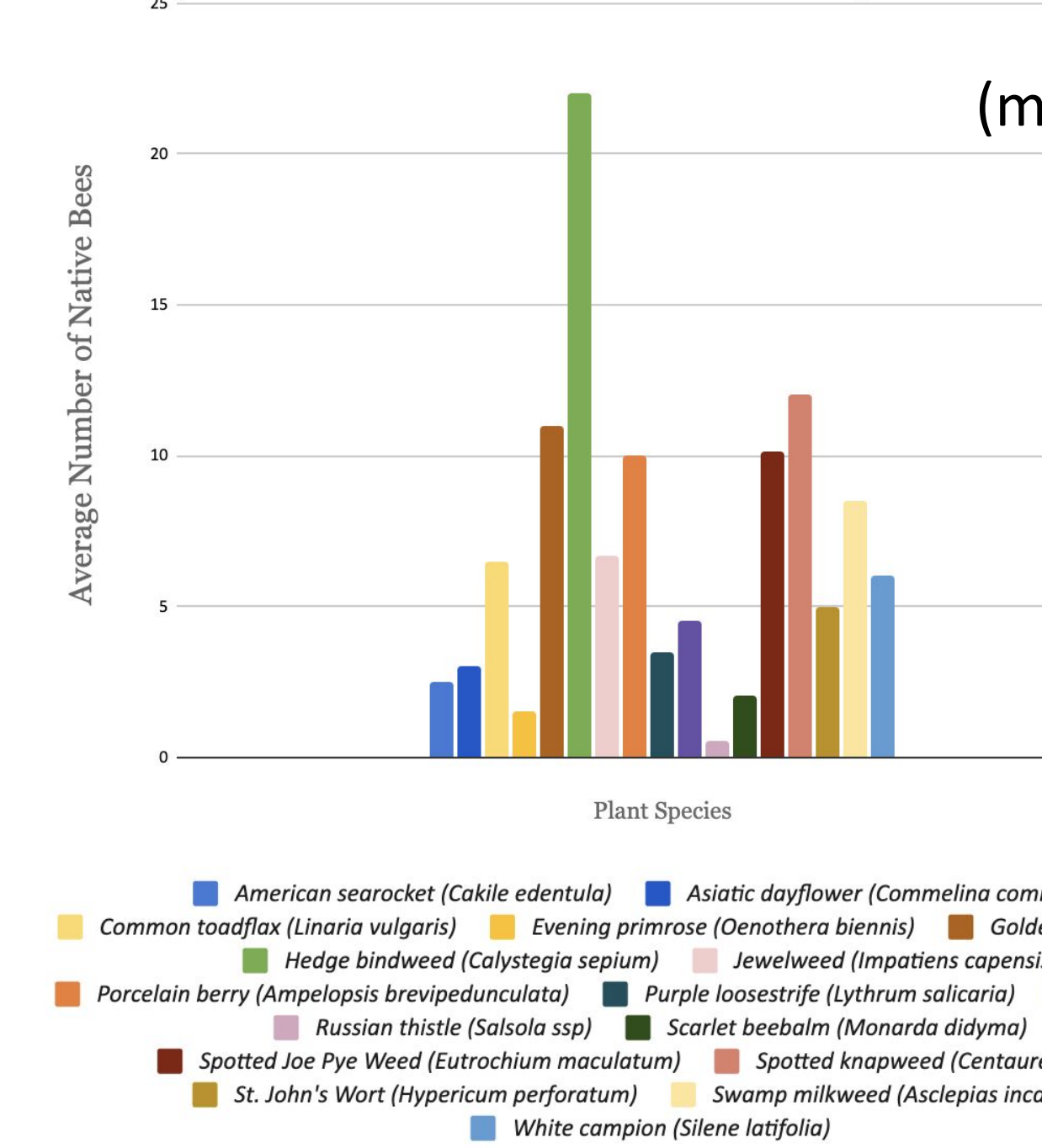
Plant Species	Aspetuck Preserve	Russian Beach
American searocket ( <i>Cakile edentula</i> )		x
Asiatic dayflower ( <i>Commelina communis</i> )	x	
Common loach ( <i>Linaria vulgaris</i> )		x
Evening primrose ( <i>Oenothera biennis</i> )		x
Goldenrod ( <i>Solidago</i> spp)	x	x
Hedge bindweed ( <i>Calyptegia sepium</i> )	x	x
Jewelweed ( <i>Impatiens capensis</i> )	x	
Porcelain berry ( <i>Ampelopsis brevipedunculata</i> )	x	
Purple loosestrife ( <i>Lythrum salicaria</i> )	x	
Rose ( <i>Rosa</i> spp)		x
Russian thistle ( <i>Salsola</i> spp)		x
Scarlet beebalm ( <i>Monarda didyma</i> )	x	
Spotted Joe Pye weed ( <i>Eutrochium maculatum</i> )	x	
Spotted knapweed ( <i>Centauria stoebe</i> )		x
St John's Wort ( <i>Hypericum perforatum</i> )		x
Swamp milkweed ( <i>Asclepias incarnata</i> )	x	
White campion ( <i>Silene latifolia</i> )	x	



## Data Analysis

- A **diversity of pollinators** were observed at both sites, but there were significantly **more native bees** observed than any other group of pollinators (Figure l).
- Data suggests that **native bees prefer certain plant species** (Figure m).
  - Despite the wide standard error, due to a limited sample size, there was a significant difference between native bee abundance on some of the plant species (e.g. Asiatic dayflower and spotted Joe Pye weed).
- The chi-square test was performed for each group of pollinators (Figure n).
  - The null hypothesis was rejected at a 95% confidence interval for the native bees, honey bees, and butterflies, suggesting that there is a **significant difference in pollinator activity among plant species**.
  - The null hypothesis was not rejected at a 95% confidence interval for butterflies, likely because of the small sample size (only 14 butterflies were observed in total, compared to 309 native bees). It was rejected at a 61% confidence interval.

Average Abundance of Native Bees on Plant Species



Pollinators	Chi-Square Value	Critical Value	df	P
Native bees	131.8	26.3	16.0	<0.05
Honey bees	28.0	26.3	16.0	<0.05
Butterflies	17.0	26.3	16.0	0.39
Flies	27.8	26.3	16.0	<0.05

## Conclusions

- Native bees, honey bees, butterflies, flies, and other pollinators have a vital ecological role which can be supported by **maintaining plant biodiversity and sustainable management practices**.
  - Pollinator habitat can be enhanced by **planting native plant species** such as Joe Pye weed and goldenrod, which had a higher native bee abundance, rather than ornamental plants.
  - Sasqua Wildflower Preserve and Russian Beach contain flowers that bloom at different times, demonstrating the importance of pollen and nectar sources throughout the season.
  - Maintaining natural, **unmowed native plant habitat** and **limiting the spread of invasive and ornamental plants** at these preserves is key for long-term pollinator protection.
- Pollinator monitoring can **engage citizens** and promote awareness.
  - Individual homeowners can take part in pollinator conservation by planting native plants on their properties and monitoring pollinators.

## References & Resources

- <sup>1</sup> *Citizen scientist pollinator monitoring guide* [Pamphlet]. (2008). The Xerces Society for Invertebrate Conservation. Retrieved February 7, 2021 from <https://ento.psu.edu/files/pennsylvania-native-bee-survey-citizen-scientist-pollinator-monitoring-guide>
  - <sup>2</sup> *Pollinators in Connecticut*. (2019, October 30). Connecticut Department of Energy and Environmental Protection. Retrieved February 7, 2021, from <https://portal.ct.gov/DEEP/Wildlife/Learn-About-Wildlife/Pollinators-in-Connecticut#pollination>
  - <sup>3</sup> *Sasqua wildflower preserve*. (n.d.). Aspetuck Land Trust. Retrieved February 7, 2021, from <https://www.aspetucklandtrust.org/sasqua-wildflower-preserve>
  - <sup>4</sup> *Stratford town parks and playgrounds*. (n.d.). Town of Stratford. Retrieved February 7, 2021, from <http://www.townofstratford.com/parks>
  - <sup>5</sup> Wilson, J., & Carril, O. (2016). *The Bees in Your Backyard: A Guide to North America's Bees*. Princeton; Oxford: Princeton University Press. doi:10.2307/j.ctt15hvxqg
- ★ Harper's Sasqua Preserve blog: <https://wildflowerpreservesouthport.blogspot.com/>

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