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Bioretention Cells as Reproductive Habitat for Monarch Butterflies in Urban Areas

Cade Capper

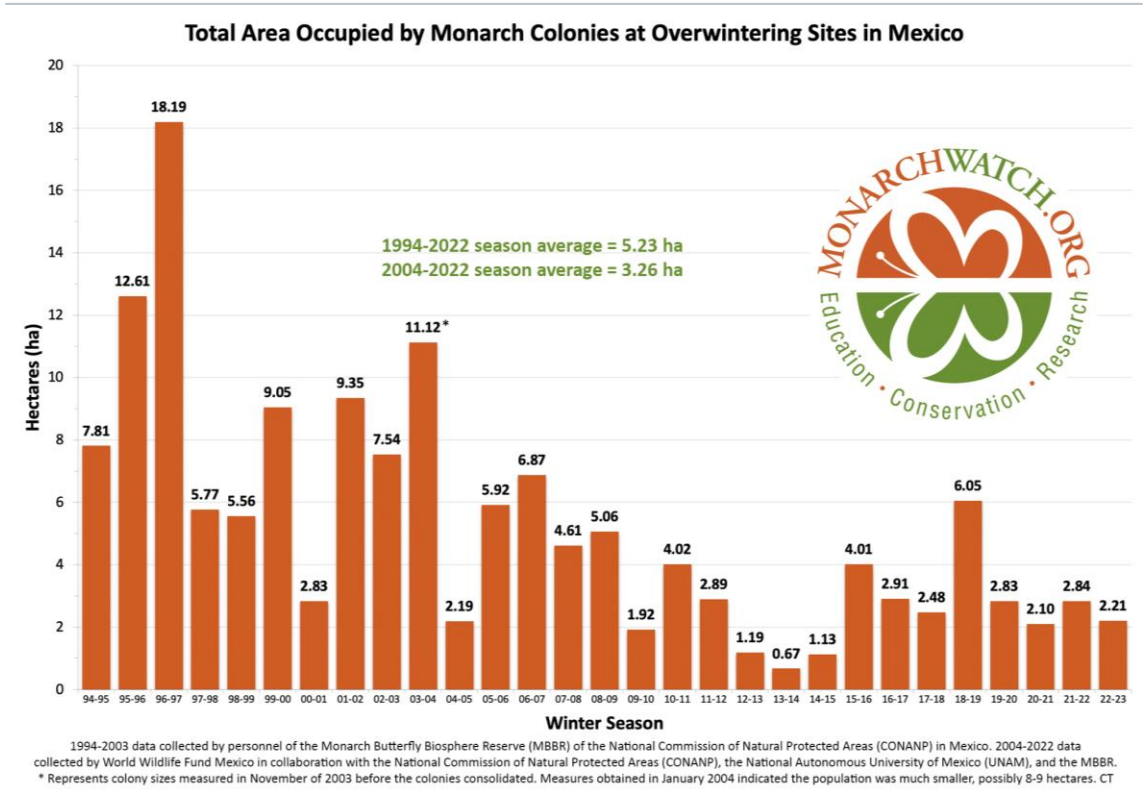
THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

Background

Why monarchs?

- Pollinators
- Cultural significance
- Rapidly declining populations

Background



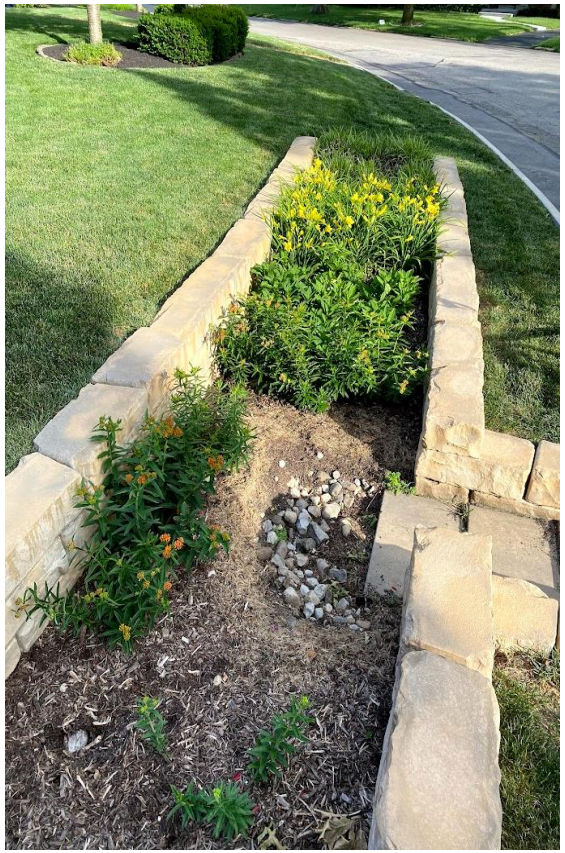
- Monarch butterfly populations have declined by almost 90% in the last 30 years
- Primary cause is milkweed habitat loss due to urbanization and agricultural expansion
- Restoration of milkweed habitat is crucial to help the monarchs recover

Overarching question:

How can we restore monarch habitat while still allowing urban and agricultural growth?

Background

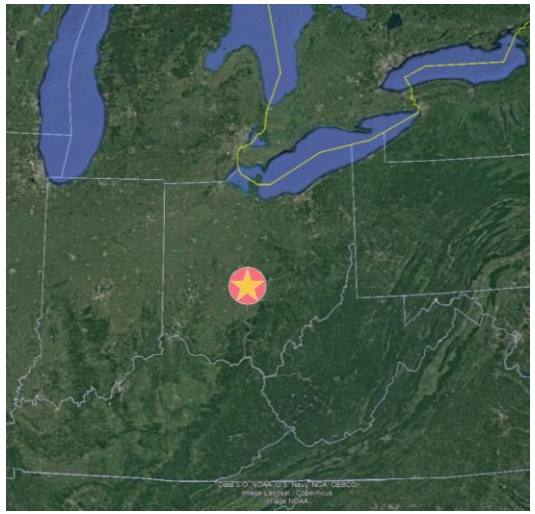
- Bioretention cells engineered for stormwater management can also grow milkweed
- Can be used as multifunctional ecosystems
- My research investigates monarch oviposition rates in bioretention cells



Study sites

- 14 Bioretention cells, four reference sites
- Each site had common milkweed, butterfly milkweed, swamp milkweed or a combination
- Milkweed may be potted, planted, or both


Study site locations
Site type
Experimental
Reference
0 100 200 300 400 m
Satellite imagery from Google

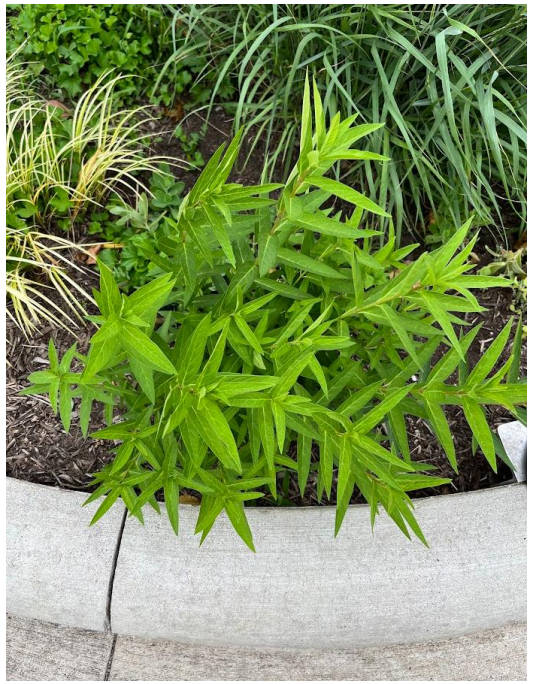


Study sites

Common milkweed (*Asclepias syriaca*)

Butterfly milkweed (*A. tuberosa*)

Swamp milkweed (*A. incarnata*)



Hypotheses

- Monarchs will lay eggs at similar rates in bioretention cells as they do in natural milkweed patches
- Monarchs will lay more eggs on common milkweed and milkweed that is planted

Methods

Data collection

- Sites were surveyed once a week from June to September of 2021 and 2022
- Collected data:
  - Number of eggs
  - Species of milkweed eggs were laid on
  - Whether milkweed with eggs was potted or planted
  - Number of plants checked
  - Instar (stage) of larvae if found
- Number of eggs was normalized according to number of plants checked

Methods

Data analysis

Factors examined:

- Bioretention cells vs natural (reference) sites
- Milkweed species
- Potted vs planted milkweed

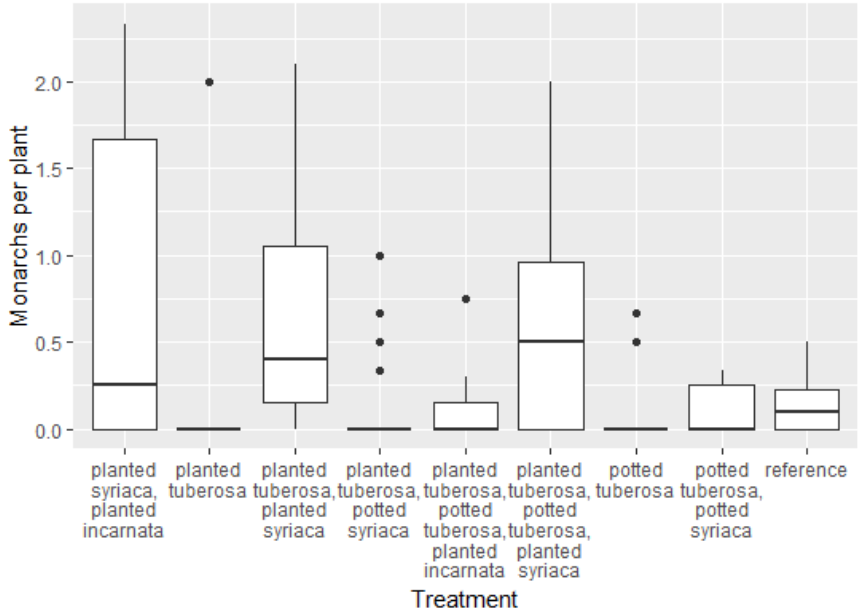
Results

Difference in average number of eggs found per plant according to site treatment

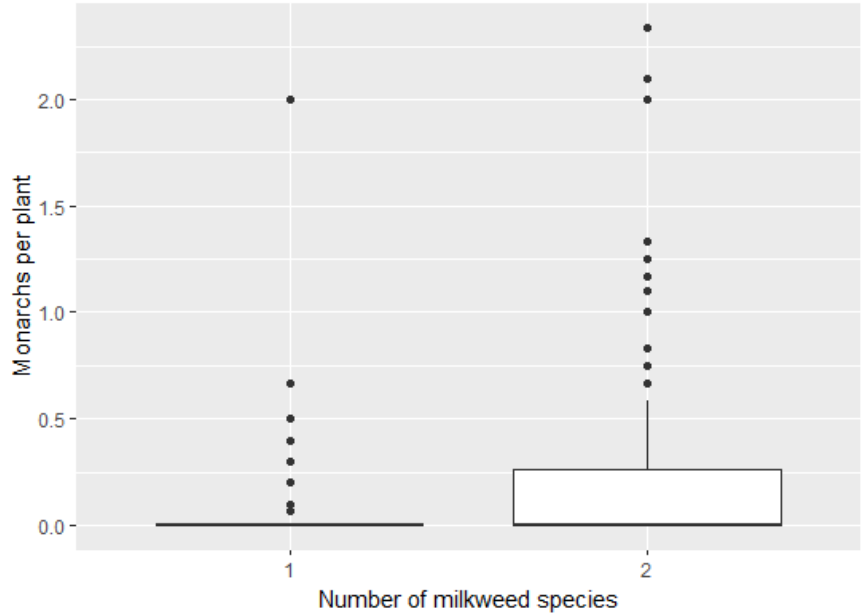
Treatment type A	Treatment type B	Difference (A—B)	p-value
Planted *A. syriaca* and planted *A. incarnata*	Potted *A. tuberosa*	0.78	0.005
Planted *A. syriaca* and planted *A. incarnata*	Planted *A. tuberosa*	0.75	0.008
Planted *A. syriaca* and planted *A. incarnata*	Planted *A. tuberosa* and potted *A. syriaca*	0.72	0.013
Planted *A. syriaca* and planted *A. incarnata*	Reference (planted *A. syriaca*)	0.69	0.041
Planted *A. syriaca* and planted *A. tuberosa*	Potted *A. tuberosa*	0.64	0.048

Results

Average number of monarchs found per plant according to site treatment



Average number of monarchs found per plant according to milkweed diversity



Key takeaways

There was no significant difference between the average number of eggs laid per plant in bioretention cells compared to the number laid at reference sites.

For sites where there was a significant difference in number of eggs laid per plant:

- Sites with planted milkweed had more eggs per plant than sites with potted milkweed
- Sites with *A. syriaca* and *A. incarnata* had more eggs per plant than sites with only *A. tuberosa*
- Only one comparison between reference and treatment sites showed a significant difference in eggs laid per plant

Interpretation

Why do monarchs lay more eggs at sites with higher milkweed diversity?

- Larvae exhibit host plant species fidelity
  - Eggs laid on one species will only feed on that species
- This may carry over into adulthood as butterflies
- More research is needed

Interpretation

Other potential influencing factors

- Milkweed visibility
  - Common milkweed is much larger and has broader leaves than butterfly milkweed
- Milkweed density
- Surrounding plant communities

Management implications

- Cities interested in implementing their own bioretention cell projects for stormwater management can plant milkweed in the cells to create monarch habitat
- Cities may be able to improve these habitats by planting more than one species of milkweed
- Turning bioretention cells into multifunctional ecosystems may help increase public support and garner more funding

Study limitations

- Only one site had both common milkweed and swamp milkweed
- Each site had a different number of milkweed plants
  - Normalizing the number of eggs found according to plants checked is good, but overinflates significance of sites where no eggs were found and only a few plants were checked
- Impossible to control for all variables

Further research

- Isolate and investigate factors such as milkweed diversity, species, density, and visibility
- Larval survival rates

Conclusion

- Bioretention cells can be used to help mitigate the loss of monarch habitat and help restore their populations
- This provides an opportunity to integrate monarch habitat into human infrastructure

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Find my research on Instagram!

SCAN ME

@CADE.AND.HIS.MONARCHS

Cade Capper
capper.15@osu.edu