Expanding the value of CRP for Monarch Recovery

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Research and Restoration

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CRP Research at UNI-TPC

- 2015-2025 Comparison of CP25, CP43 and CP42
  - 3 seed mixes x 1st yr mowing x planting time
  - Weed resistance, erosion control, pollinator habitat
- 2017-2019 Pollinator CP-42
  - Seed mix, vegetation and bees in year 3 (46 sites)
- **2020-2024**
  - **Forb enhancement for monarch recovery**
- 2023-2025
  - Supply and demand influences on cost and availability of native seed and seed mixes

Partners and Funders

Total Area Occupied by Monarch Colonies at Overwintering Sites in Mexico

Hectares (ha)

Winter Season	Hectares (ha)
94-95	7.81
95-96	12.61
96-97	18.19
97-98	5.77
98-99	5.56
99-00	9.05
00-01	2.83
01-02	9.35
02-03	7.54
03-04	11.12*
04-05	2.19
05-06	5.92
06-07	6.87
07-08	4.61
08-09	5.06
09-10	1.92
10-11	4.02
11-12	2.89
12-13	1.19
13-14	0.67
14-15	1.13
15-16	4.01
16-17	2.91
17-18	2.48
18-19	6.05
19-20	2.83
20-21	2.10
21-22	2.84
22-23	2.21
23-24	0.90

The Iowa Monarch Conservation Strategy (IMCS):

"…purposeful, coordinated voluntary conservation measures based on the best available scientific information. Implementation of the Iowa strategy will contribute to the long-term conservation of the monarch butterfly (*Danaus plexippus*), while maintaining agricultural productivity.

www.iowamonarchs.info

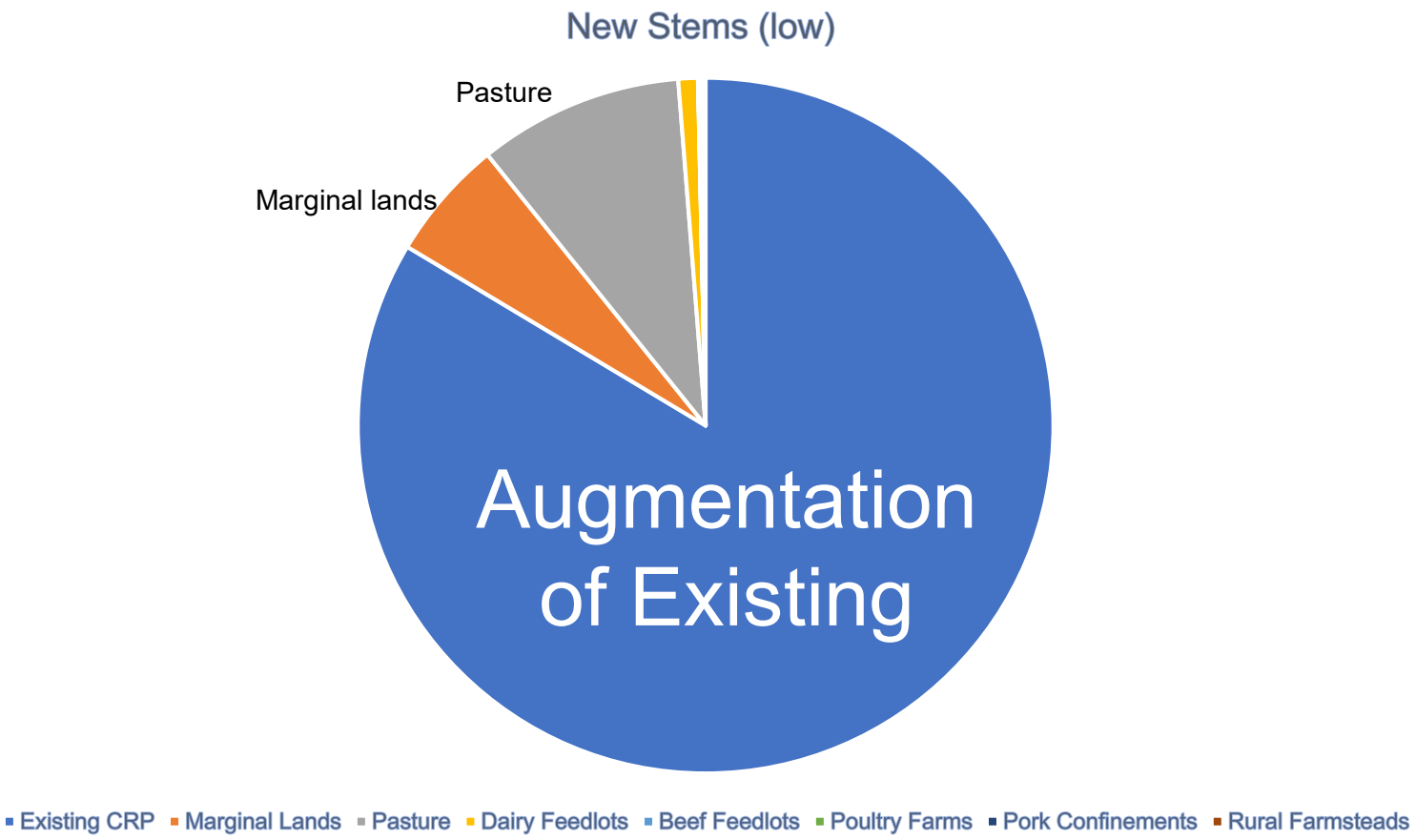
The IMCS depends on Agriculture sector ***providing 45% of "new" acres and 65% of new milkweed stems from 2015 to 2038***

Acres	Range		Stems*	Range	
Urban/Suburban	39,774	198,870	Urban/Suburban	1,300,000	5,600,000
Public†	144,041	156,674	Public†	28,527,789	31,030,041
Other†	62,749	67,049	Other†	12,549,800	13,409,800
Road Rights-of-Ways	19,000	21,000	Road Rights-of-Ways	6,156,000	6,804,000
Agricultural	214,000	387,000	Agricultural	78,000,000	131,000,000
Total	**479,564**	**830,593**	**Total**	**126,533,589**	**187,843,841**

** New stems include stems derived from new seeding and subsequent propagation. Biologically reasonable stem densities of 10 to 50, 197 to 199, 200, 200 to 324, and 150 to 600 stems/acre were assumed for Urban/Suburban; Public Lands; Other; Road Rights-of-Ways and Agriculture, respectively.*

† These sectors include stems planted since 2015 through US Fish and Wildlife Service and other public programs.

Estimated agricultural sector contributions to new milkweed stems



40 million new stems from inter-seeding existing CRP

- “Currently 512,000 acres are enrolled in CP-25, CP-38 and CP42. Arguably, these existing CRP practices may be most readily augmented by inter-seeding with a monarch habitat seed mix.
- Assumes that federal funding to support establishment and maintenance of monarch habitat, especially funds appropriated to farm bill programs, are maintained at or above fiscal year 2017 levels

Our goals for this project

1. *Estimate baseline monarch habitat value of common CRP practices.*
   - *Focused on CP-25 at re-enrollment*
2. *Assess approved methods for enhancing CRP*
   - *Mid-contract or re-enrollment*
   - *On farm and experimentally*
3. *Improve the long-term performance of new CRP enrollments for monarch habitat*

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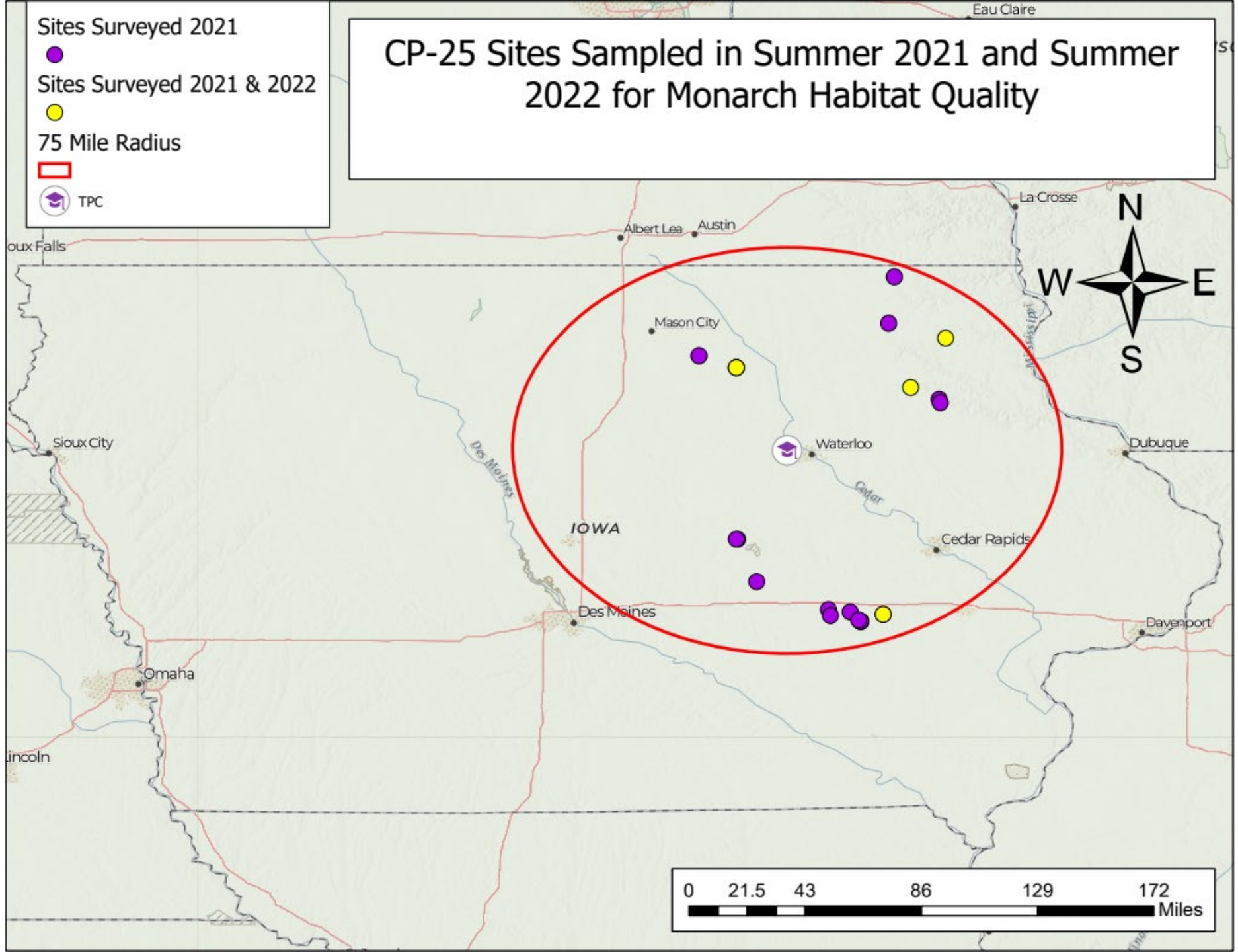

Sites Surveyed 2021
Sites Surveyed 2021 & 2022
75 Mile Radius
TPC
CP-25 Sites Sampled in Summer 2021 and Summer 2022 for Monarch Habitat Quality
N
W
E
S
Eau Claire
La Crosse
Albert Lea
Austin
oux Falls
Mason City
Sioux City
Waterloo
Dubuque
Des Moines
IOWA
Cedar Rapids
Davenport
Omaha
incoln
0 21.5 43 86 129 172
Miles

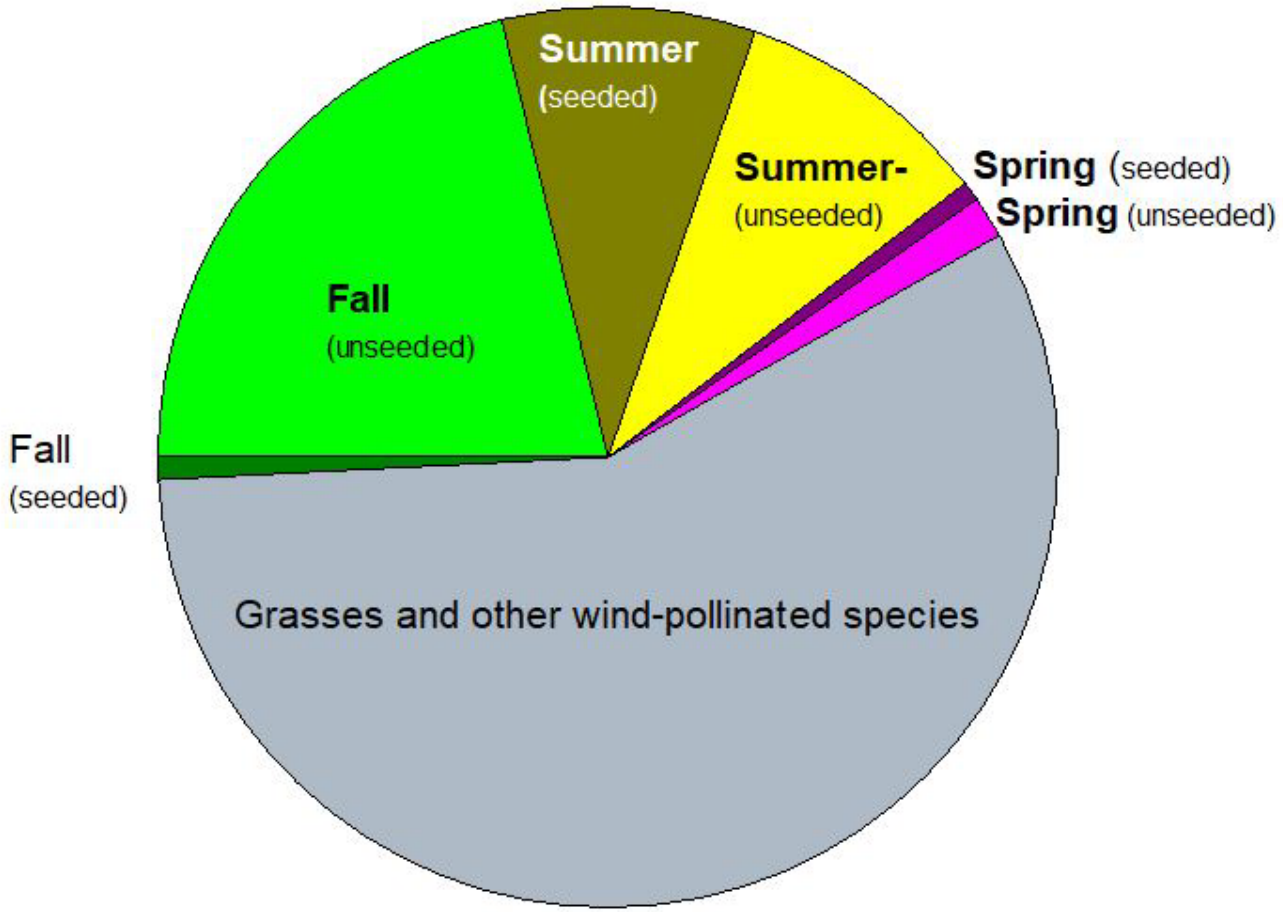
Methods

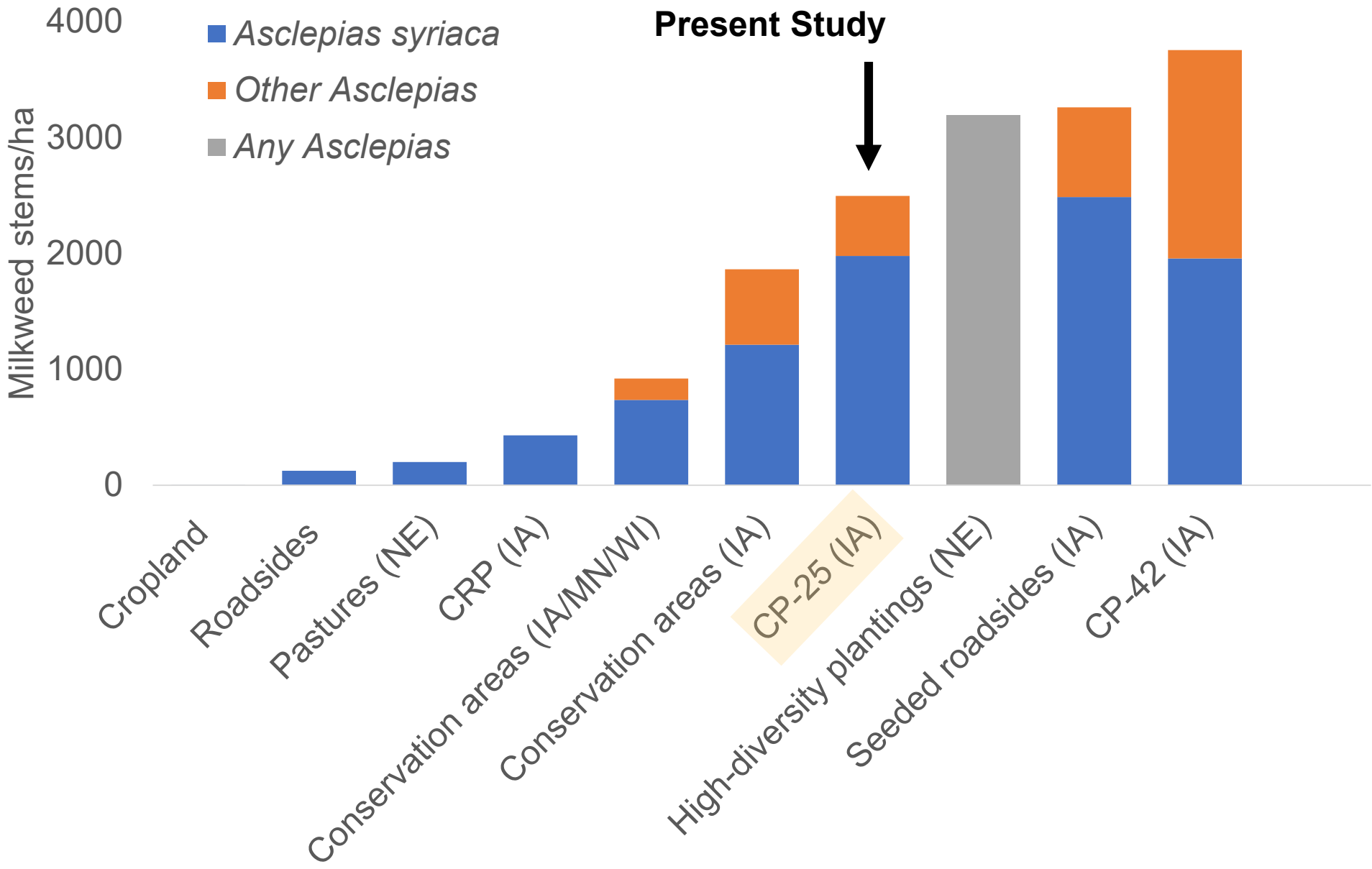
Observational Study

Data Collection

- Randomly positioned transects (100 1m^2 quadrats)
- Milkweed stem density
- Canopy cover/presence of all other species

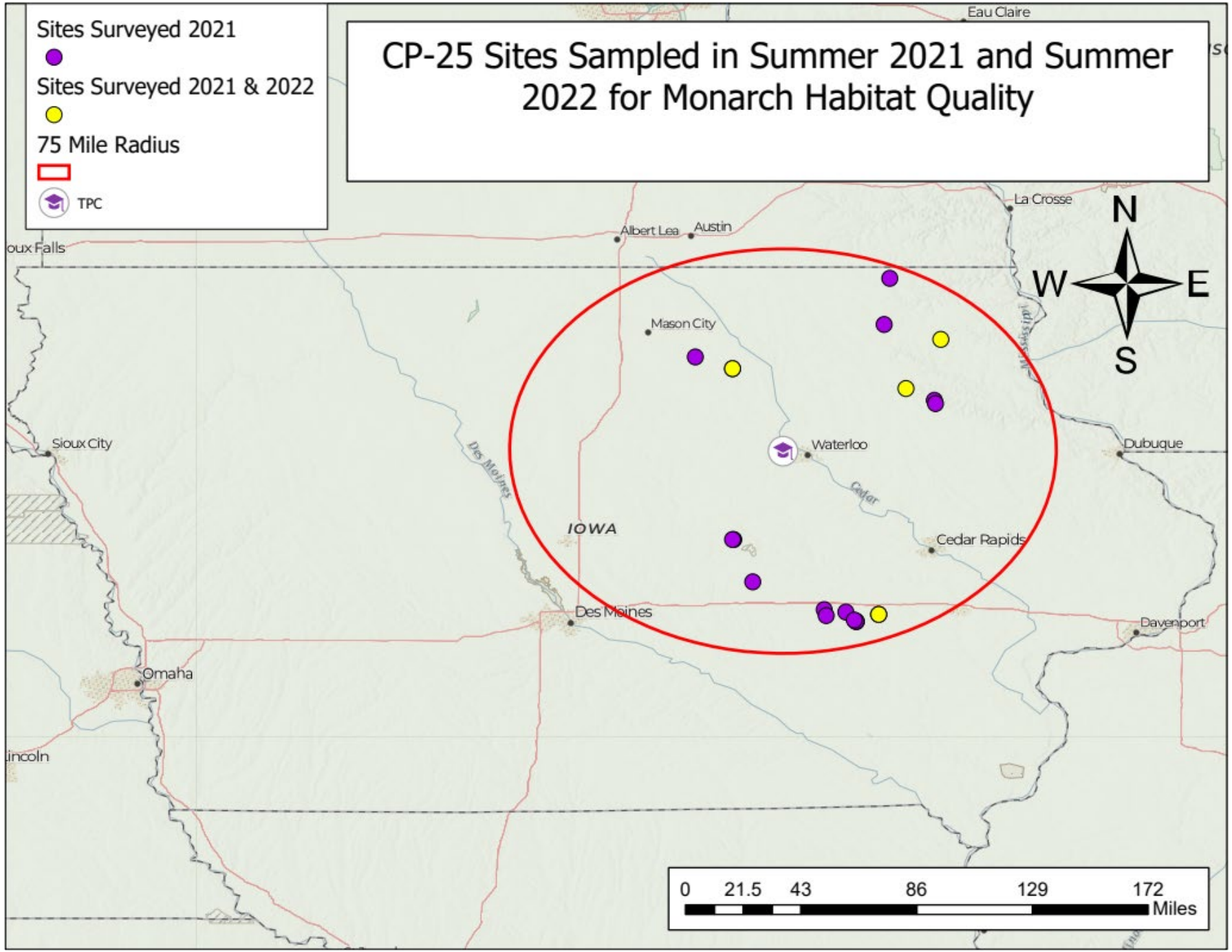
Flowering time & likely source of nectar plants in expiring CP-25 fields




Present Study
Asclepias syriaca
Other Asclepias
Any Asclepias
Milkweed stems/ha
4000
3000
2000
1000
0
Cropland
Roadsides
Pastures (NE)
CRP (IA)
Conservation areas (IA/MN/WI)
Conservation areas (IA)
CP-25 (IA)
High-diversity plantings (NE)
Seeded roadsides (IA)
CP-42 (IA)

Baseline habitat: Take-aways

- Many expiring CRP plantings already provide high quality monarch habitat
- Milkweed density was fairly high
- Over half of nectar plants and virtually all milkweeds established naturally
- Most of the vegetation comprising CP-25 sites is grass. Enhancement with forbs and milkweeds would produce substantial gains in monarch habitat quality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Mason City
Sioux City
Waterloo
Dubuque
Des Moines
IOWA
Cedar Rapids
Des Moines
Davenport
Omaha
incoln
0
21.5
43
86
129
172
Miles

Enhancing CRP at re-enrollment

Site	Site Preparation Treatment (2021/22)	County
J	Spring burn	Iowa
T-1	Spring burn	Winneshiek
T-2	Fall tillage, spring tillage	Winneshiek
K-1	Fall herbicide, fall tillage	Floyd
K-2	Fall herbicide, fall tillage, spring herbicide	Floyd
N	Fall herbicide, spring herbicide	Fayette

Comparison of vegetation in sites that did (n=4) and did not (n= 13) require enhancement

Vegetation category	P value
Warm-season grass cover	.77
Forb cover	.36
Non-native grass cover	.13
Milkweed stem density	.50

Did enhancement affect vegetation cover?

Vegetation category	Change?
Warm-season grass cover	Reduced 20%
Forb cover	No change
Non-native grass cover	No change
Milkweed stem density	No change
Bare ground	Increased ~60%
New seedlings of native forbs	8 seedlings/m^2

Forb enhancement: Take-aways

- Enhancement did not target lowest quality vegetation
- Treatments reduced warm-season grass cover in first year
- New forb seedlings require 2nd year of data
- Perils of on-farm study: five enhancement methods at six sites → no conclusions possible

Staff, students and AmeriCorps Summer 2024

Sources

Glidden, A. J., M. E. Sherrard, J. C. Meissen, M. C. Myers, K. J. Elgersma, L. L. Jackson. *In review.* Planting time, first-year mowing, and seed mix design influence ecological outcomes in agroecosystem revegetation projects. *Restoration Ecology.*

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Wen, A., K. J. Elgersma, M. E. Sherrard, L. L. Jackson, J. Meissen, and M. C. Myers 2022. Wild bee visitors and their association with sown and unsown floral resources in reconstructed pollinator habitats within an agriculture landscape. *Insect Conservation and Diversity* 15(1): 102-113. https://doi.org/10.1111/icad.12539

Roadmap

1. *Estimate baseline monarch habitat value of common CRP practices.*
   - *Focused on CP-25 at re-enrollment*
2. *Assess approved methods for enhancing CRP*
   - *Mid-contract or re-enrollment*
3. *Improve the long-term performance of new CRP enrollments for monarch habitat*

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Grass-selective herbicide MCM for monarch habitat

Background

- Many CRP plantings become grass dominated, lose forb abundance
- MCM could prevent grass dominance, improve nectar plant/ milkweed abundance

Objectives

- Evaluate grass-selective herbicide application MCM (clethodim) in different CRP practices for monarch habitat enhancement

Grass-selective herbicide MCM for monarch habitat

Methods

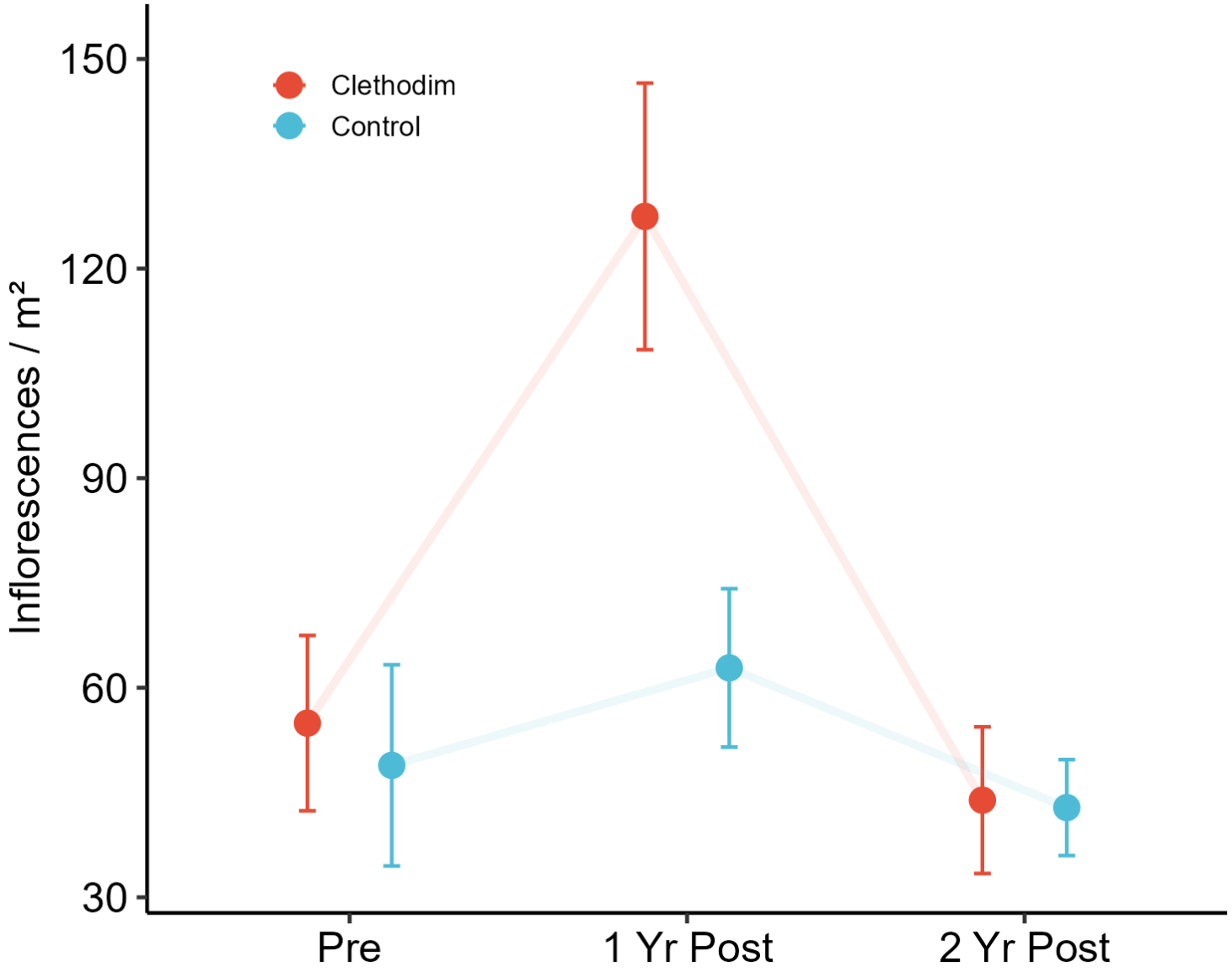
Experimental Design

Apply clethodim to established prairie (6 yr old) with varying CRP seed mixes

- Clethodim (0.56 kg/ha) /control
- Economy Mix: 3:1 grass dom., Diversity Mix: 1:1 grass:forb balanced, Pollinator Mix: 1:3 forb dom.

Grass-selective herbicide MCM for monarch habitat

Results

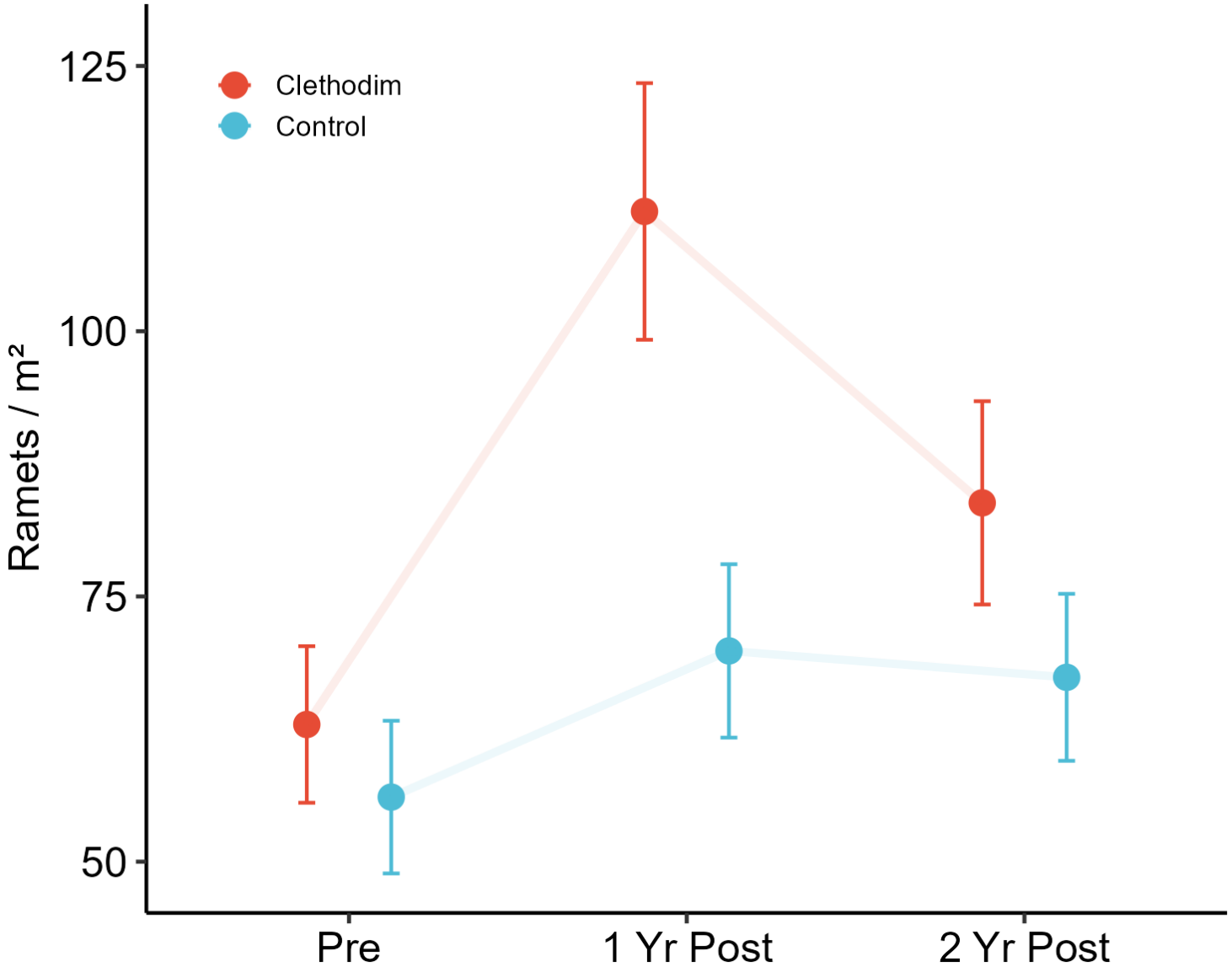


Clethodim increased flowering

- Overall effect statistically significant
- Marginally significant in economy, diversity mix

Grass-selective herbicide MCM for monarch habitat

Results



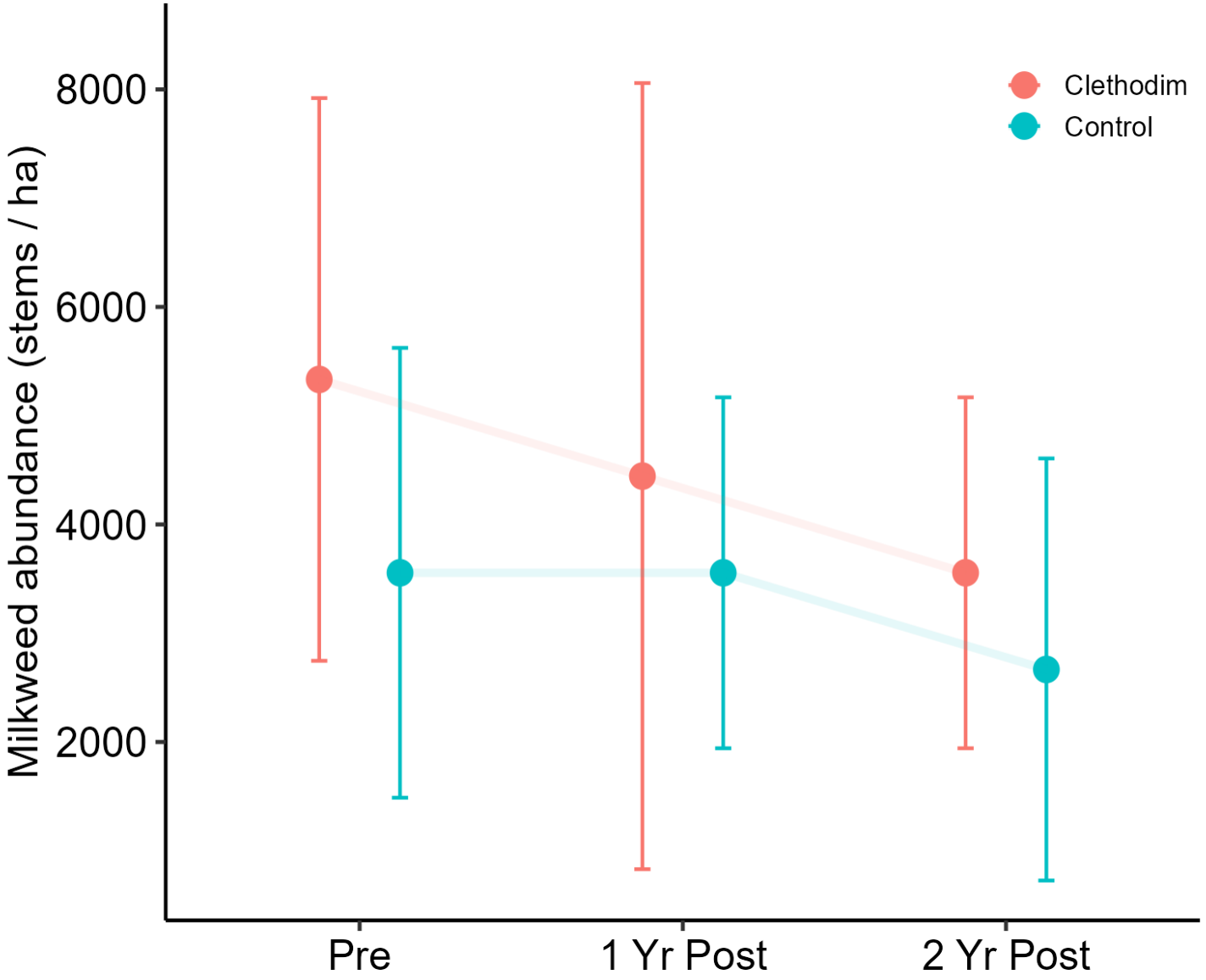
Clethodim increased forb abundance

- Overall effect statistically significant
- Significant in economy mix

No effect on grass abundance

Grass-selective herbicide MCM for monarch habitat

Results



No effect on milkweed abundance

Grass-selective herbicide MCM for monarch habitat

Results

Summary

Grass-selective herbicide application:

- Increased flower and forb abundance
- More impactful in grassier mixes
- No change in milkweed or grass abundance
- Effects temporary (no differences 2yr post treatment)

Grass-selective herbicide MCM for monarch habitat

Conclusions

Take-aways

- Clethodim useful for improving monarch habitat in grassy practices (e.g. CP25 and similar)
- Restrict use in CP42
  - Burn instead
- Multiple applications likely needed
  - Existing approach won’t increase monarch habitat much
  - Adding seeds unlikely to be successful given quick regrowth

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Converting cool season grass stands to monarch habitat

Background

- Plans for monarch recovery rely on upgrading low-quality CRP to higher quality practices
- Upgrading existing vegetation requires some degree of stand disturbance

Objectives

- Evaluate site-prep methods (herbicide frequency) to increase monarch habitat in cool-season grasslands (CSG)

Converting cool season grass stands to monarch habitat

Methods

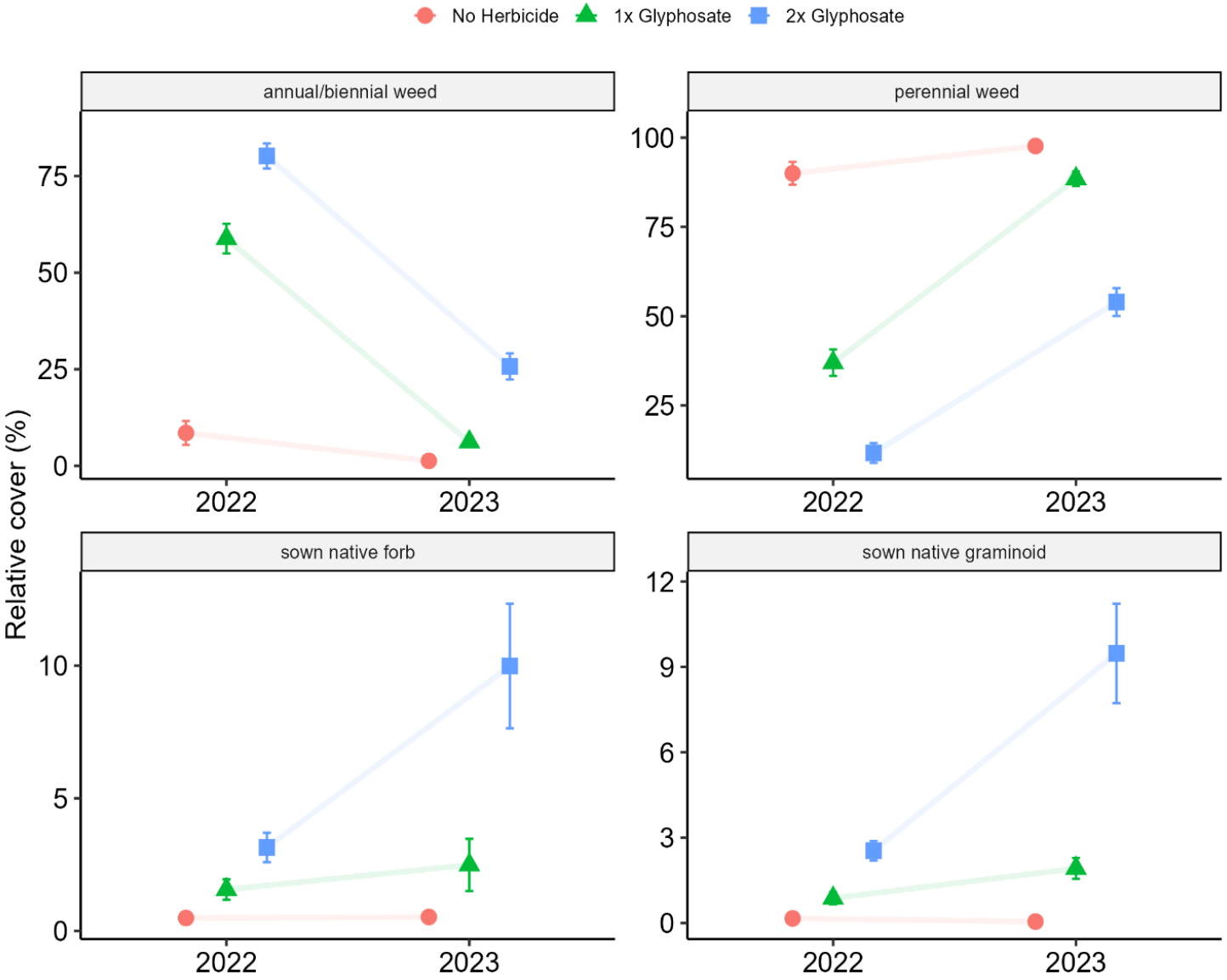
Experimental Design

Apply varying frequencies of herbicide to typical cool season grasslands prior to seeding monarch habitat

- 1x glyphosate application, 2x glyphosate application, control
- Diversity Mix*

Converting cool season grass stands to monarch habitat

Results



CSG quickly recolonized

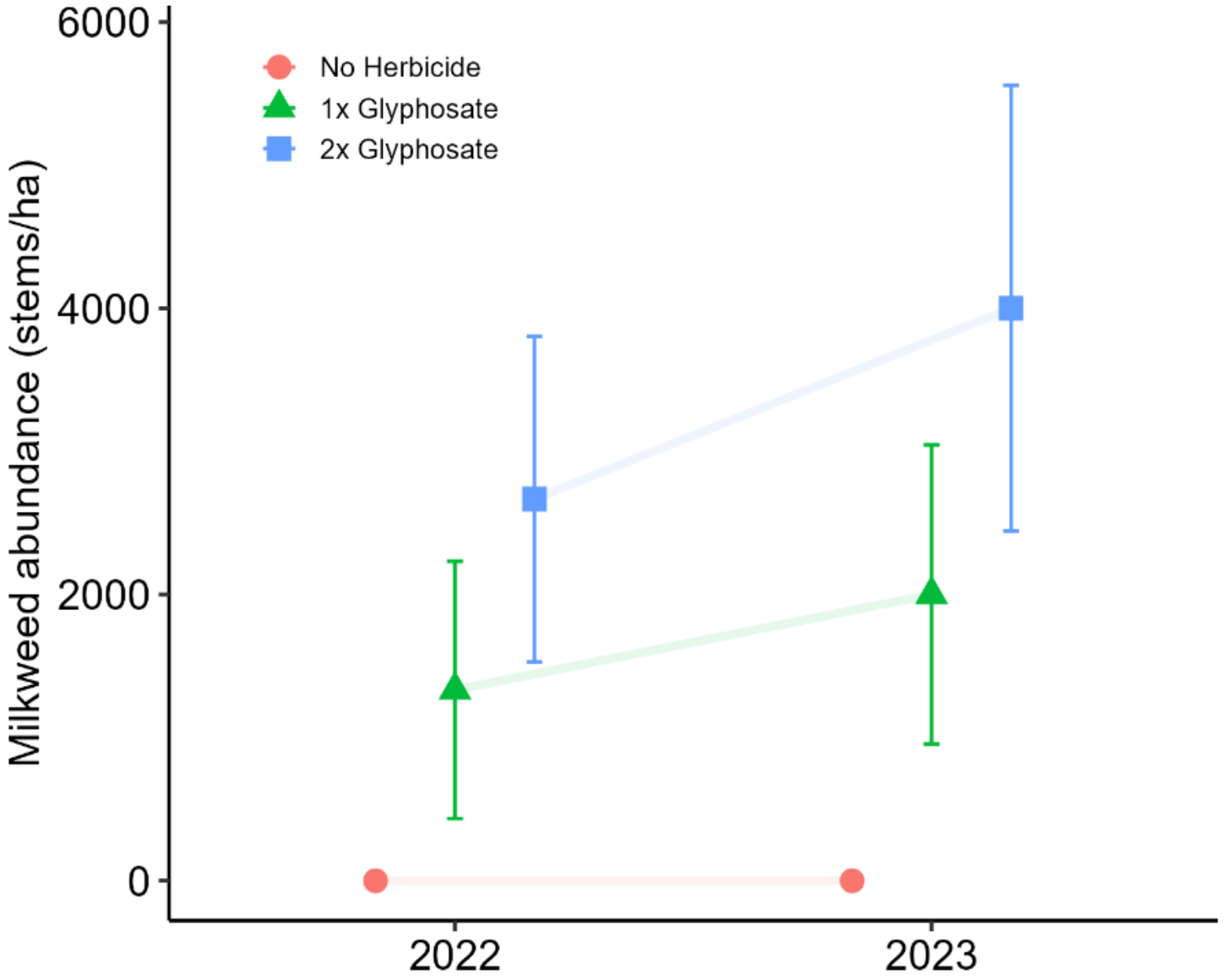
- >75% in control, 1x spray
- ~50% in 2x spray

Native species established only in 2x spray

- ~4x more native cover from 1x to 2x

Converting cool season grass stands to monarch habitat

Results

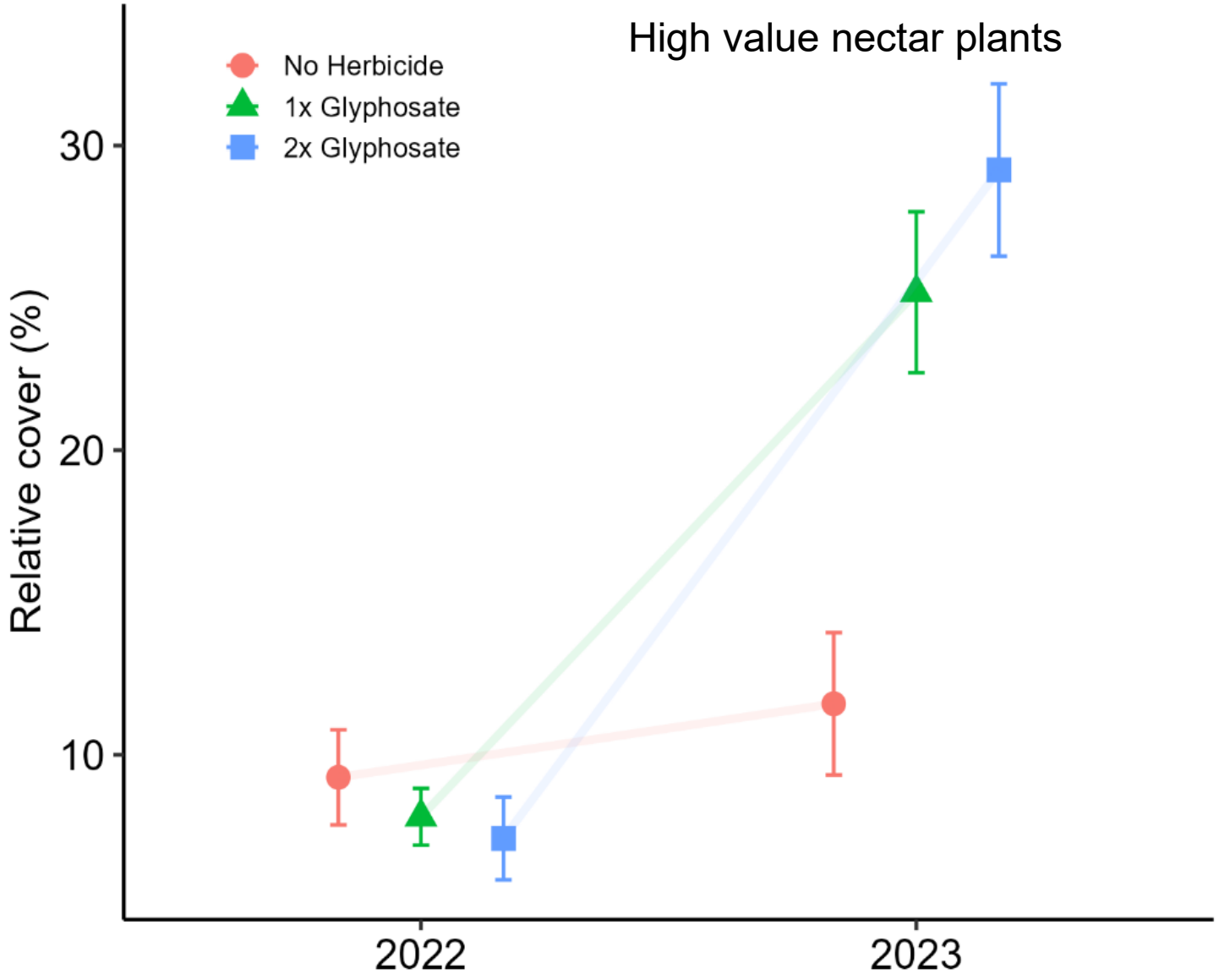


Milkweed only established with spraying

High variability, no statistical difference

Converting cool season grass stands to monarch habitat

Results



Similar high value nectar plants in 1x* and 2x sprayed plots*

- *Seed bank alsike clover in 1x*
- Seeded natives in 2x

Converting cool season grass stands to monarch habitat

Results

Summary

- Intense site preparation required to enhance monarch habitat in CSG (eg CP1)
  - Stand failures in all but 2x sprayed plots
  - CSG cover recolonizes rapidly after disturbance
  - Milkweed established with any herbicide frequency
  - High value native nectar plants highest in 2x sprayed

Converting cool season grass stands to monarch habitat

Conclusions

Take-aways

- 3x (or more) applications necessary to convert to fully native dominated stands
- CSG recolonization fast, extensive
- Follow up research needed to understand how to improve mixed stands, higher herbicide frequency for site prep

Roadmap

1. *Estimate baseline monarch habitat value of common CRP practices.*
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Seeding time and first year management for monarch habitat

Background

Background

- Post-crop acres for monarch habitat have the most potential for quality
- Maximizing the monarch habitat value of these plantings is essential

Objectives

- Investigate how first year mowing, season of planting affect monarch habitat

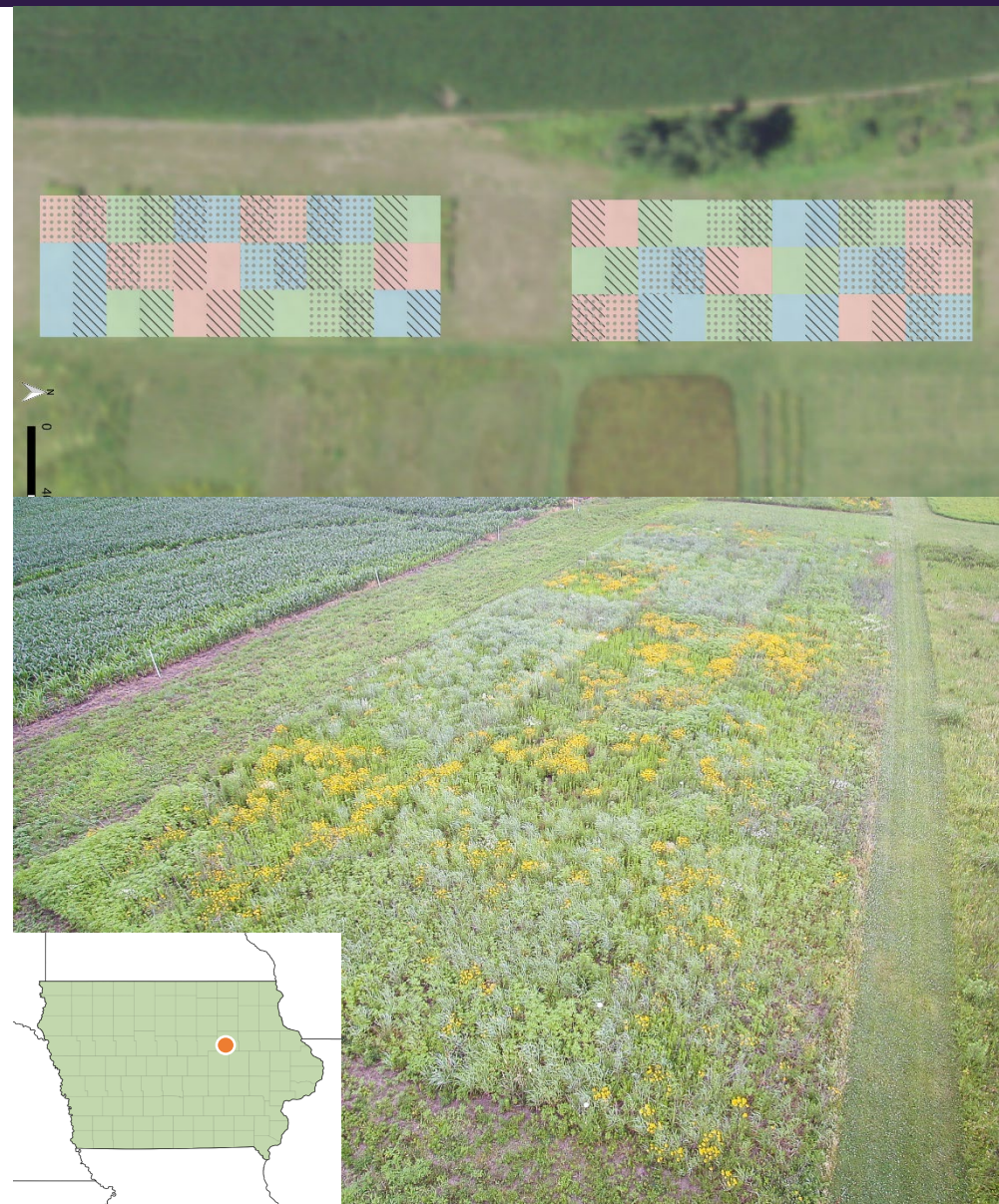
Seeding time and first year management for monarch habitat

Methods

Experimental Design

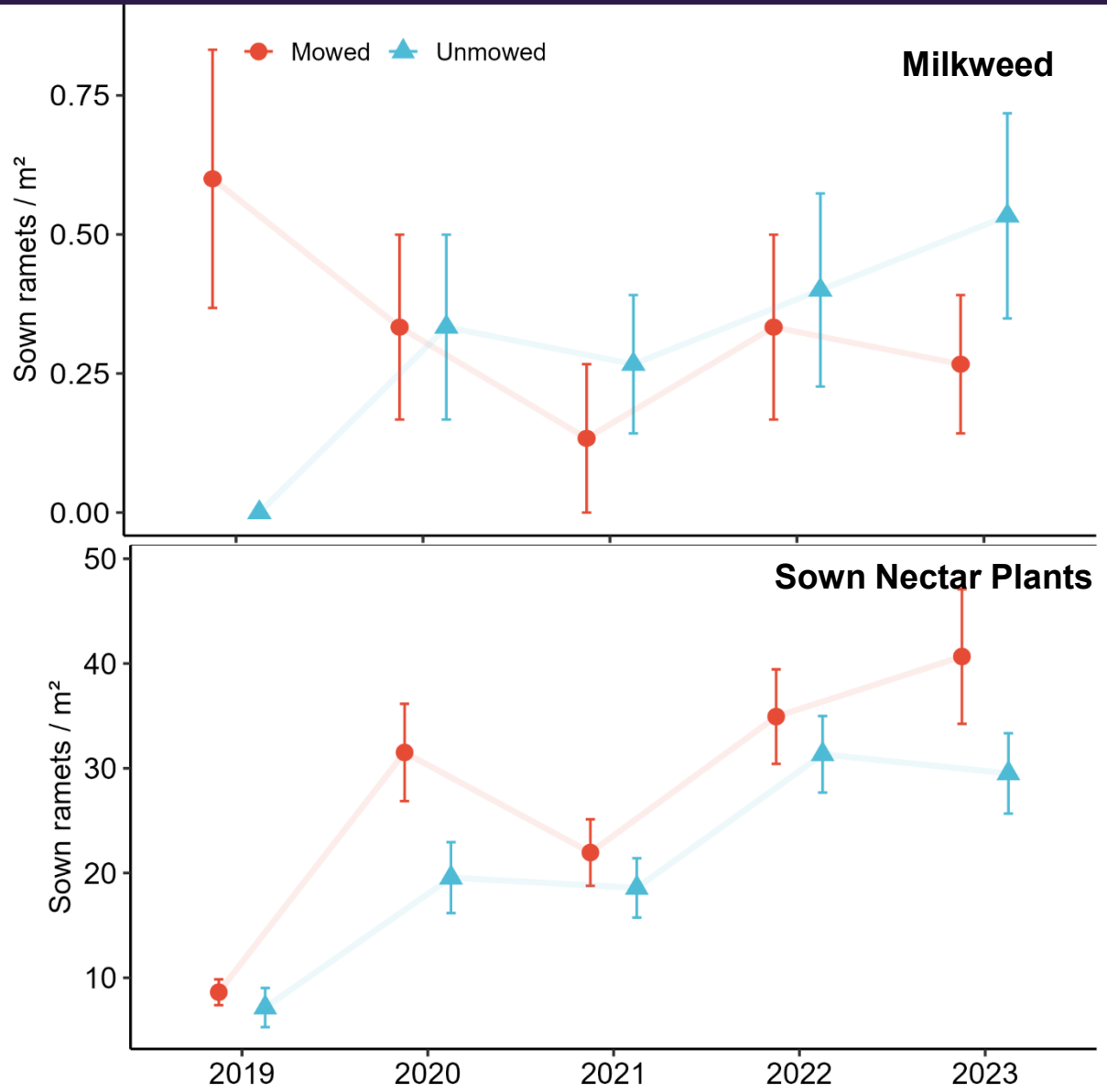
Evaluate how early contract management decisions impact monarch habitat (prairie CRP)

- Mow/no-mow, dormant/spring planting
- Economy, Diversity, Pollinator mixes
- Assess first half of contract (MCM burn at year 5)



Seeding time and first year management for monarch habitat

Results



Mowing

No effect of mowing on milkweed

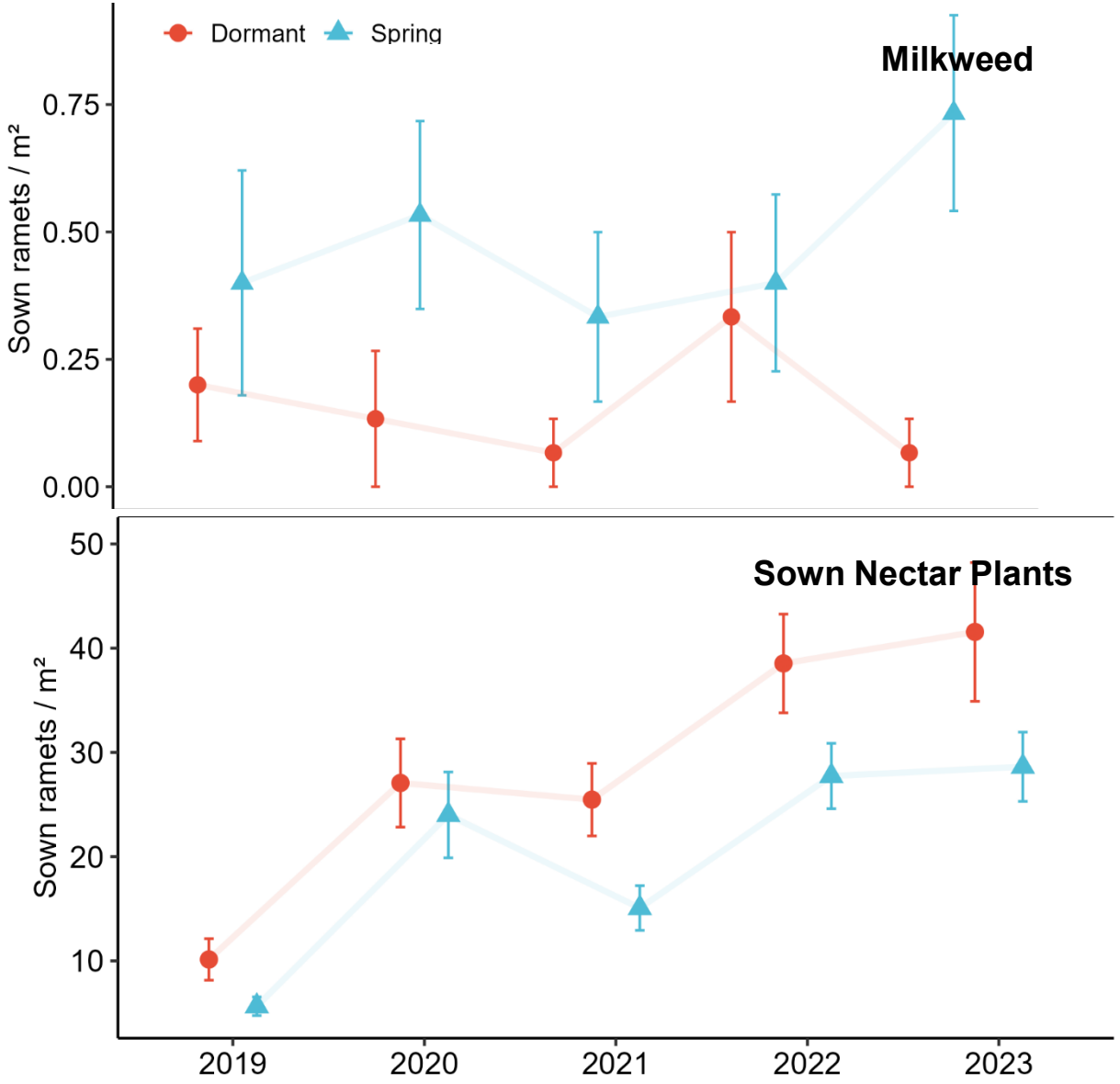
- Based on very limited data, interpret with caution

Mowing increases nectar plant abundance

- Effect strength varies over time
- Driven by pollinator mixes

Seeding time and first year management for monarch habitat

Results



Planting Season

Milkweed established better in spring plantings

- Mostly butterfly milkweed
- Opposite finding at other sites

Nectar plants established better in dormant plantings

- Especially in important fall flowering spp.

Seeding time and first year management for monarch habitat

Results

Summary

- First year mowing improves monarch habitat in CRP plantings
- Dormant season planting increases nectar plants but impact on milkweed needs more research

Seeding time and first year management for monarch habitat

Conclusions

Take-aways

- Keep encouraging first year mowing
- Encourage more dormant seeding to increase monarch nectar plants
- Milkweed response to planting season needs more research (butterfly milkweed replacement for dormant seedings?)

Emerging Research Gaps

- Remedies for failed plantings/upgrades
- Role of repeat grass selective herbicide application
- Dialing in necessary effort for cool-season upgrades

Overall Summary

- Existing plantings provide more monarch habitat than assumed
- Enhancement decisions out of sync with optimizing monarch habitat
- MCM a very temporary boost to habitat
- Upgrading sites may be harder than expected
- Mowing, dormant seeding can make the best of new plantings for monarchs

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