



Idaho Roadside Pollinator Research Project

Idaho Transportation Dept. Grant 4W8635

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Dr. Diane Debinski & Dr. Laura Burkle

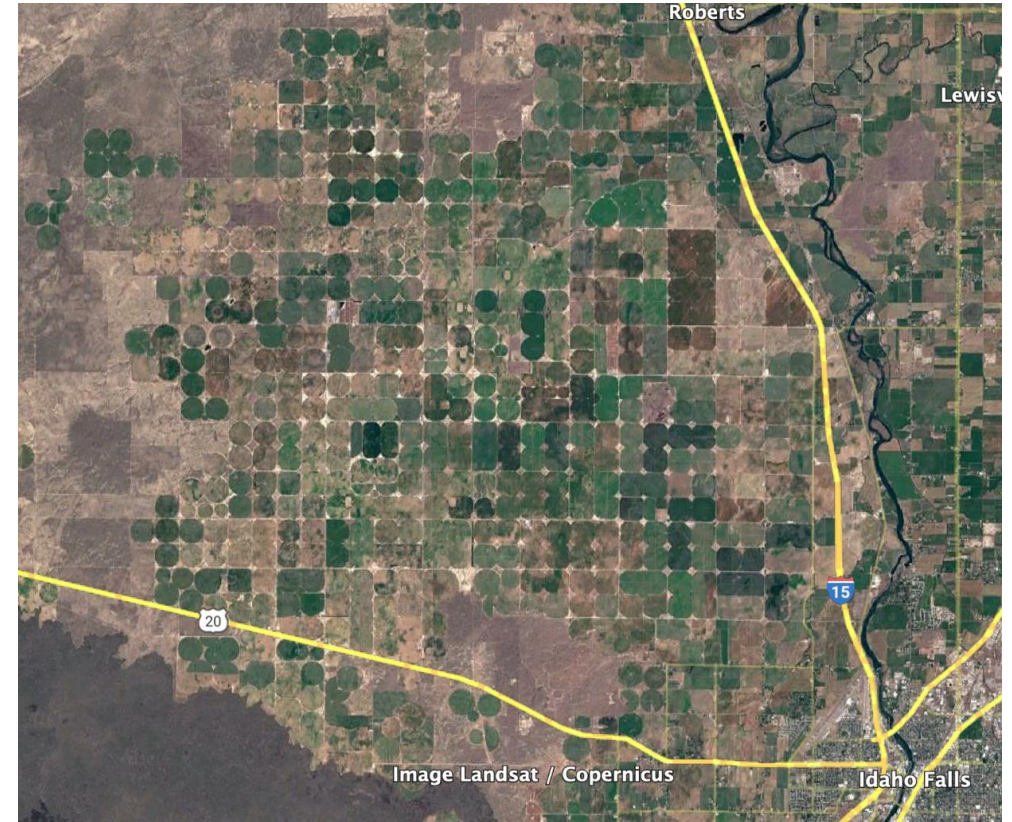
Montana State University

with Rob Ament

Western Transportation Institute

Why is this research important?

- Pollinators play a critical role →
- Insects are declining globally →
- Pollinator habitat is increasingly rare



- Roadsides can provide needed pollinator habitat – **if managed effectively**

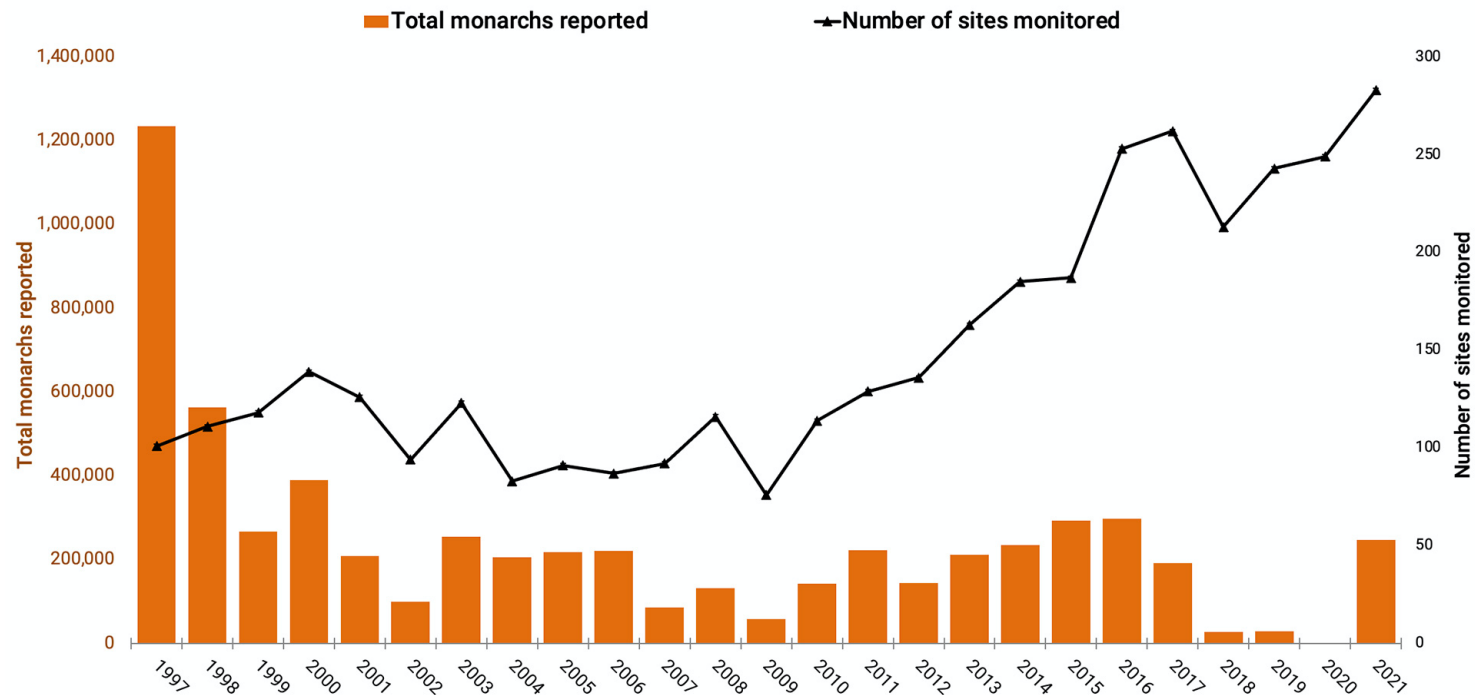
Tylianakis (2013)
Zattara & Aizen (2021)
Cariveau (2019)

Monarch Conservation

- Monarch butterfly populations have plummeted since the 1980's
 - 80% reduction East of the Rockies
 - 95 to 99.9% reduction West of the Rockies (<2000 remaining in 2020)
- Monarch designated as “warranted but precluded” for listing under the Endangered Species Act in December 2020

Western Monarch Thanksgiving Count: 1997-2021

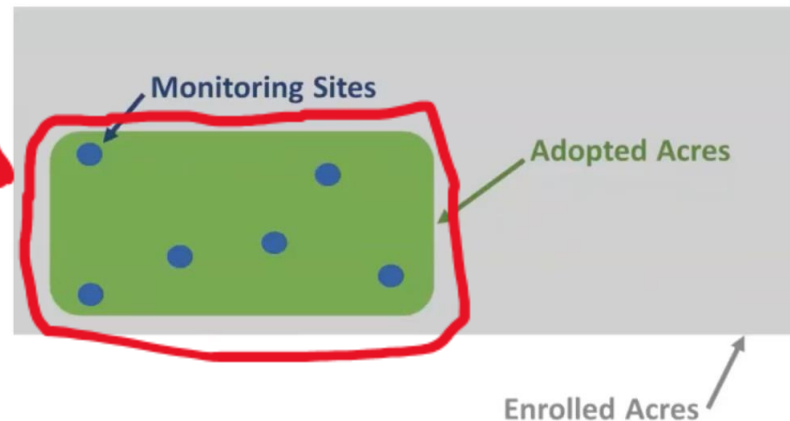
Data: © The Xerces Society for Invertebrate Conservation 2022 (www.westernmonarchcount.org)



Candidate Conservation Agreement with Assurances

Enrolling Lands

- Utility or DOT enrolls either all or a portion of its system
- Implement conservation measures on managed lands
 - 5 – 8% for DOTs
 - 9% for electric generation sites
 - 18% for gas/electric transmission
 - 1% for gas/electric distribution
 - 5% for railroads



ARCADIS

UIC ENGINEERING

- Which 5-8% is it best to protect?
- How much milkweed is out there, and where?

Source: Slide from Monarch CCAA Webinar, Arcadis/USFWS, May 2021

Candidate Conservation Agreement with Assurances

Conservation Commitment:

- 8% of Highway ROW
- 5% of State Route ROW

Conservation Actions:

- Seeding, planting
- Brush removal
- Conservation mowing
- Targeted herbicide
- Invasive removal
- Promote conservation efforts



- Which 5-8% is it best to protect?
- How much milkweed is out there, and where?

Research Questions

- What qualities make Idaho roadsides good pollinator habitat?
 - How does road class (highway type) relate to pollinator abundance and diversity?
 - What other factors explain roadside pollinator distribution?
-
- What conditions predict monarch and milkweed habitat suitability along roadsides? How can roadsides support threatened monarch populations?
- **Management Goals:**
 - **Recommend roadside management practices that benefit pollinators**
 - **Direct limited agency funds for conservation toward most critical roadside pollinator habitat.**

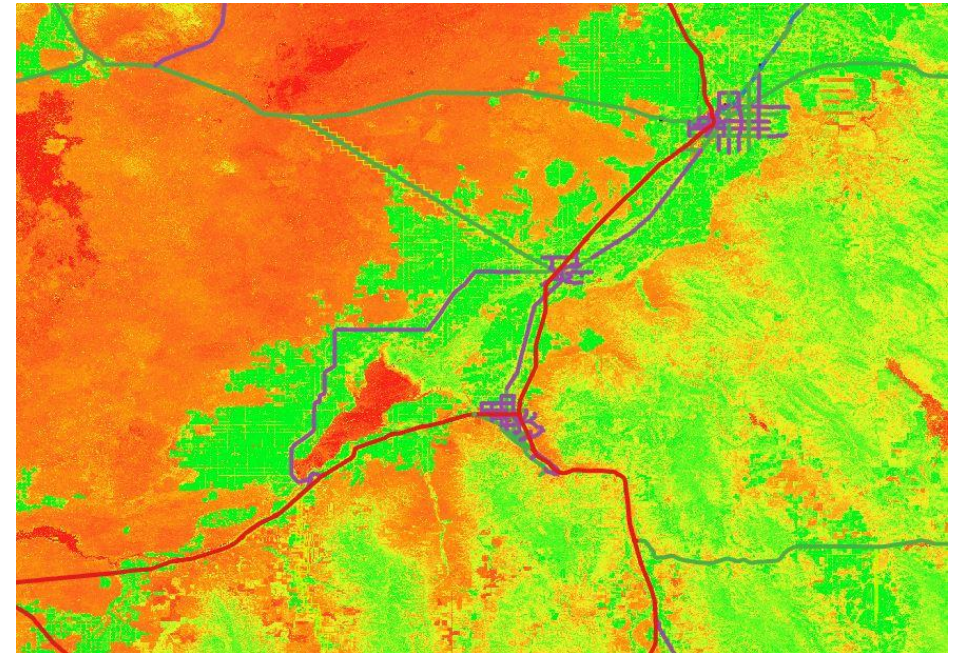
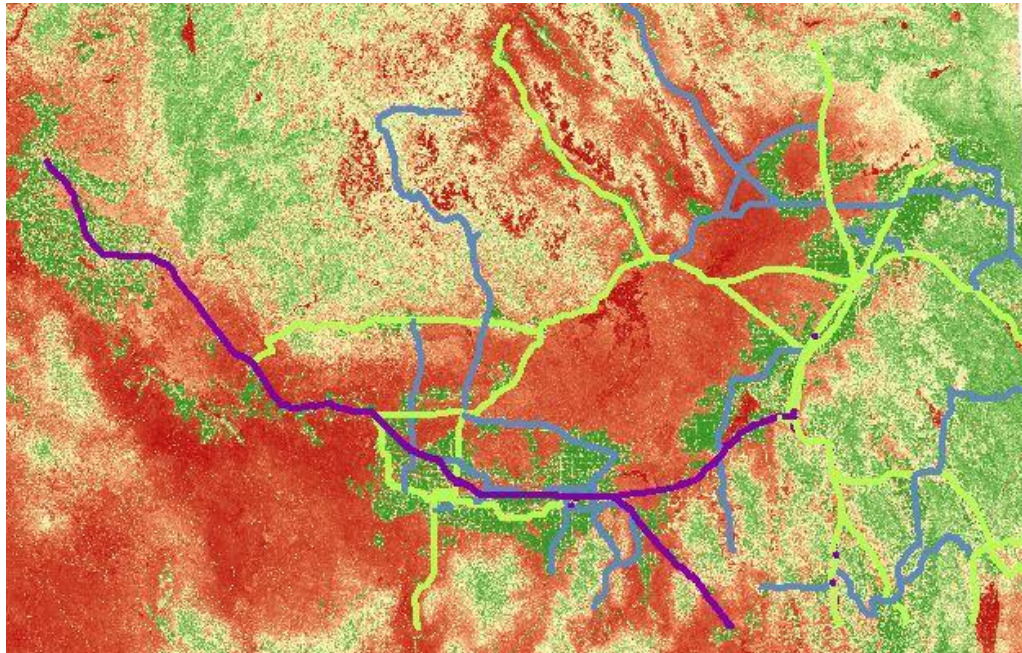
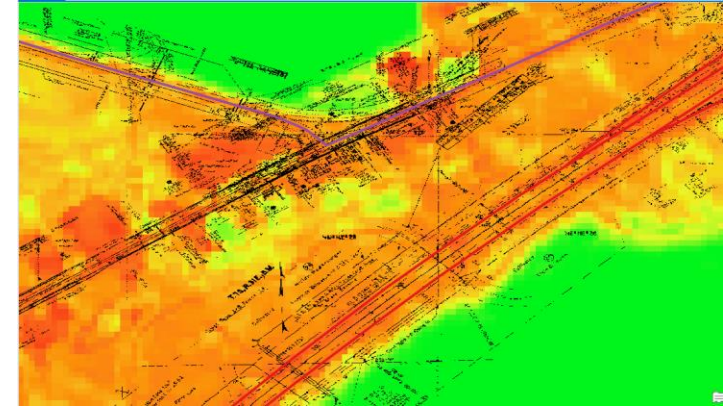
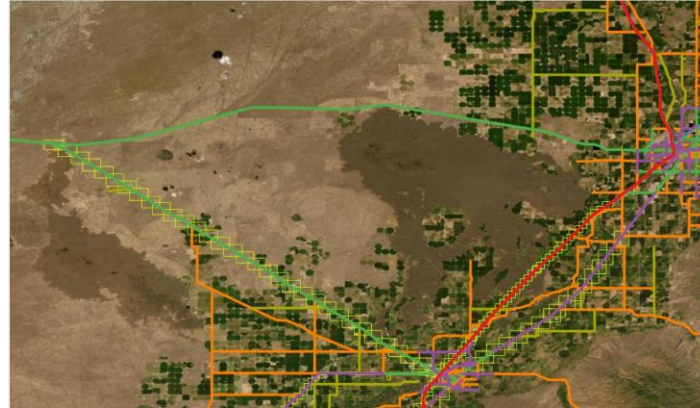


Study Overview: Stratification by NDVI



StreetSmart

Google Earth Engine



Study Overview

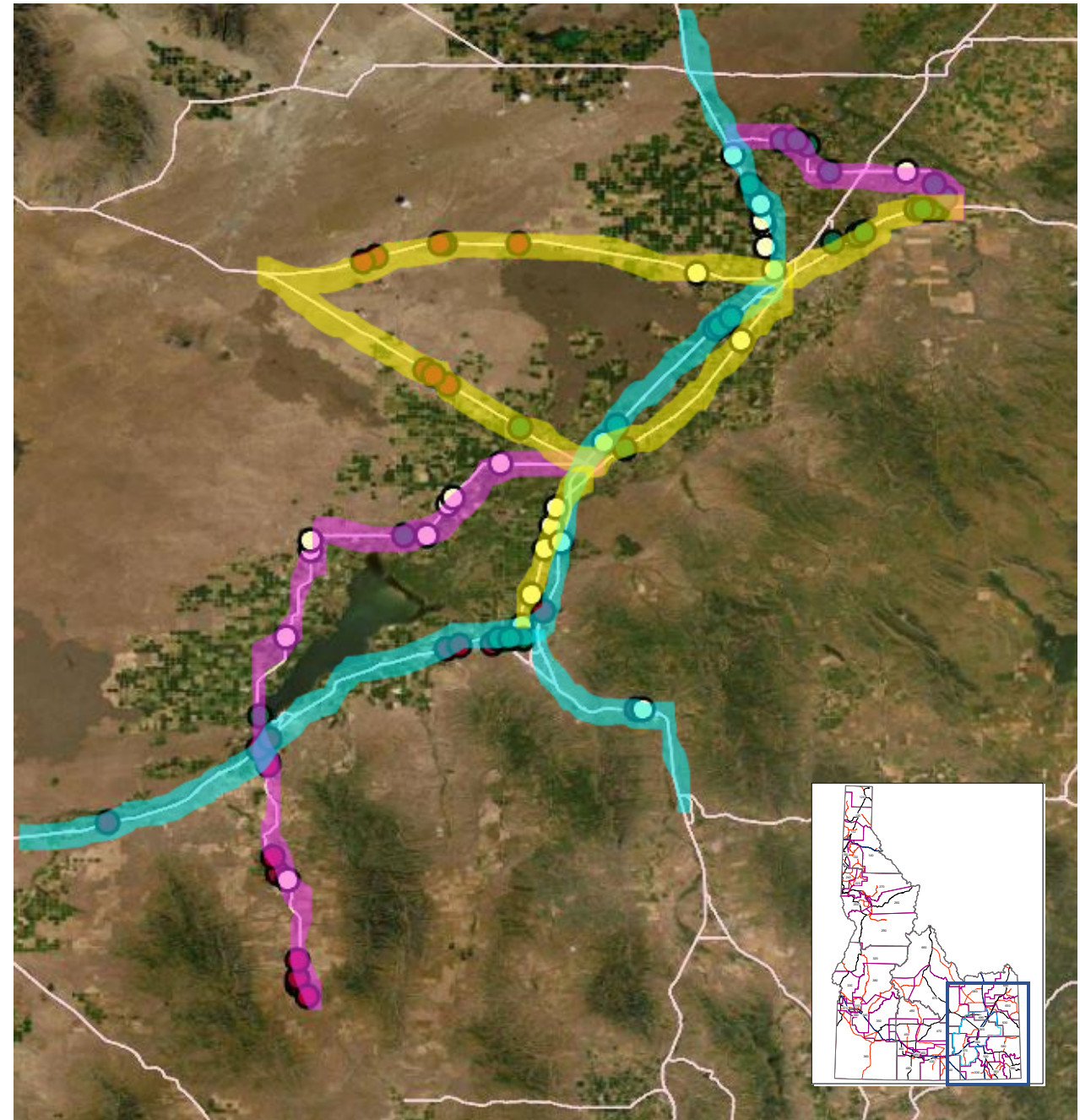
- 63 plots in SE Idaho

- Low NDVI
- Med NDVI
- High NDVI

Interstates

U.S. Highways

State Highways



Stratified Plot Surveys

- Early-mid June
- Early July
- Mid-late August (subset)

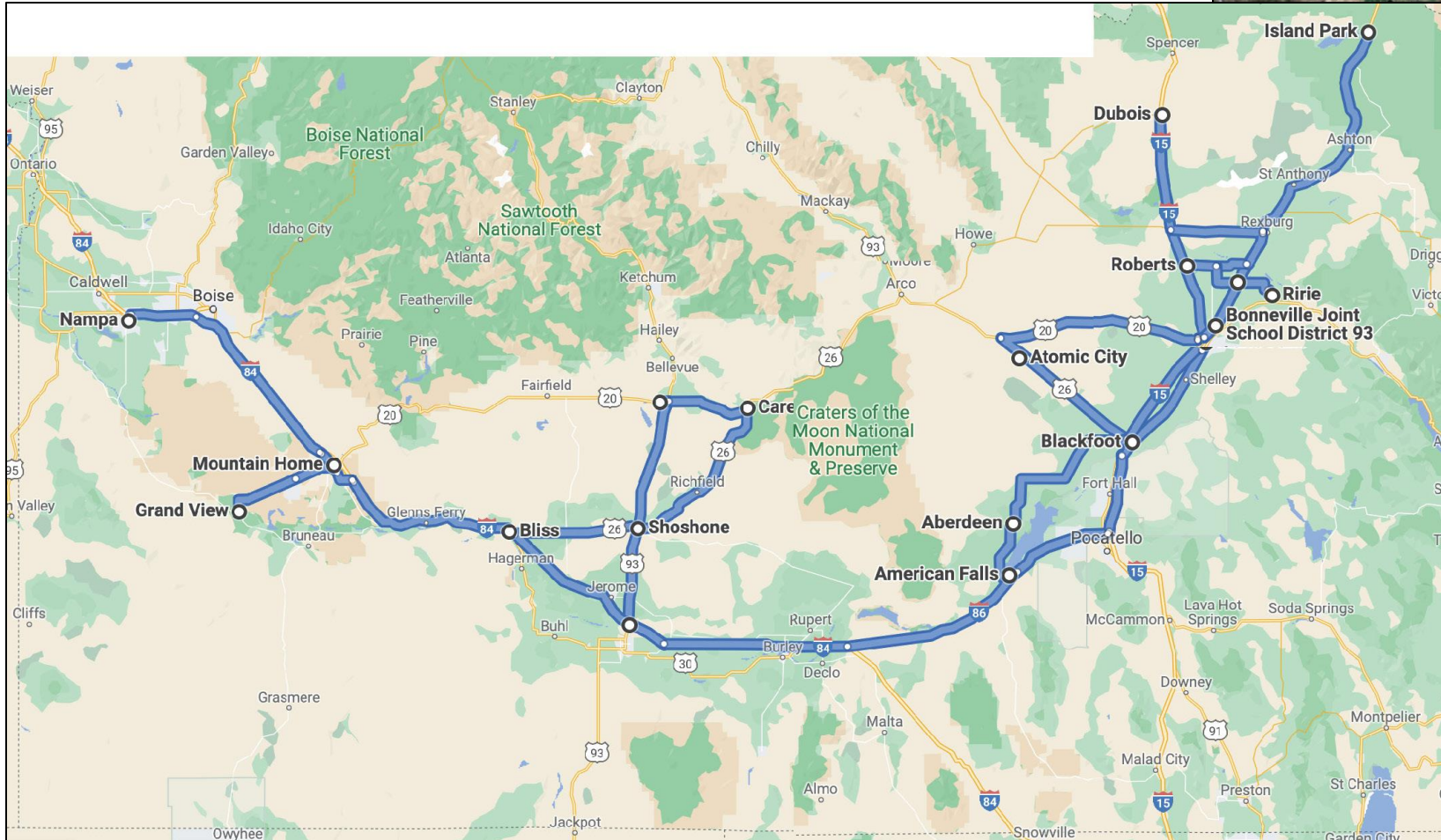
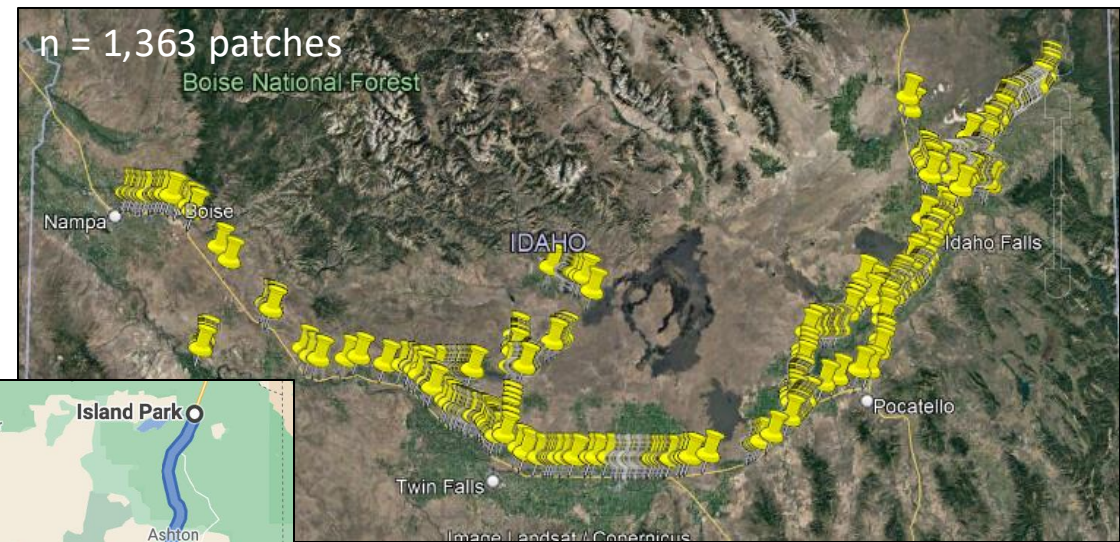
- 100 m transects
- Butterflies + plants
- Pan-trapping for bees (2021 only)



Pan-Trapping



Milkweed Rapid Assessment



following Waterbury et al. 2019

What kind of data are we collecting?

Stratified Plot Surveys

At 63 transects:

- Butterfly species & number
- Flowering plant spp. & floret number
- Adjacent land use
- Dominant species in right-of-way
- Presence of milkweed in ROW

At 27 (of 63) transects:

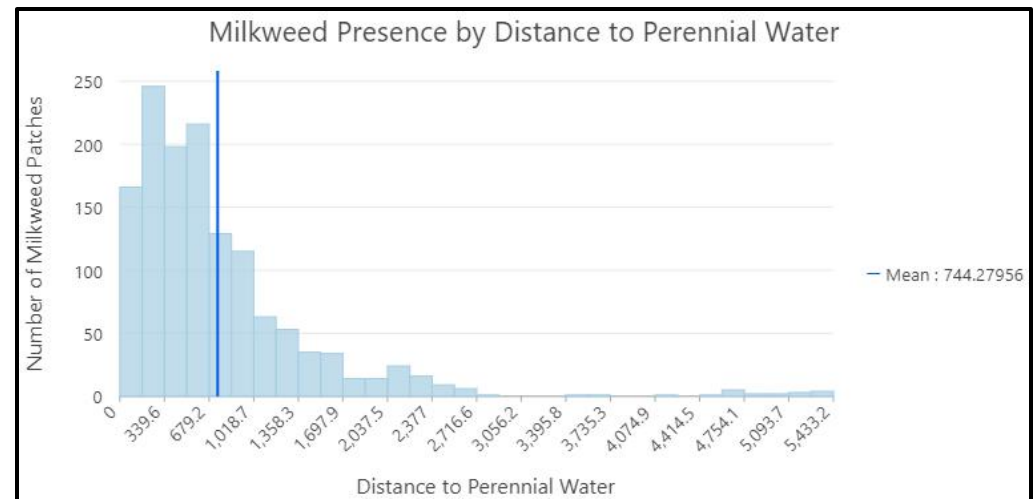
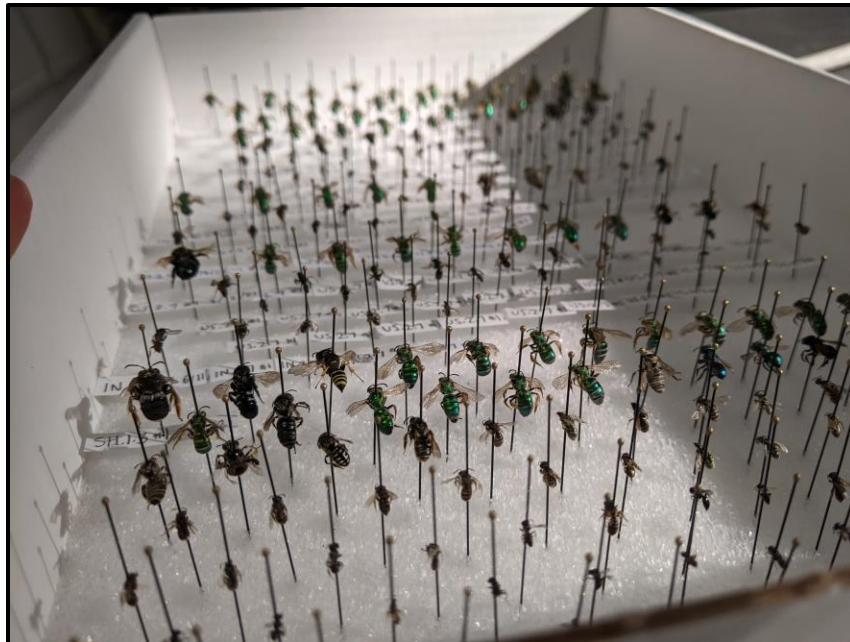
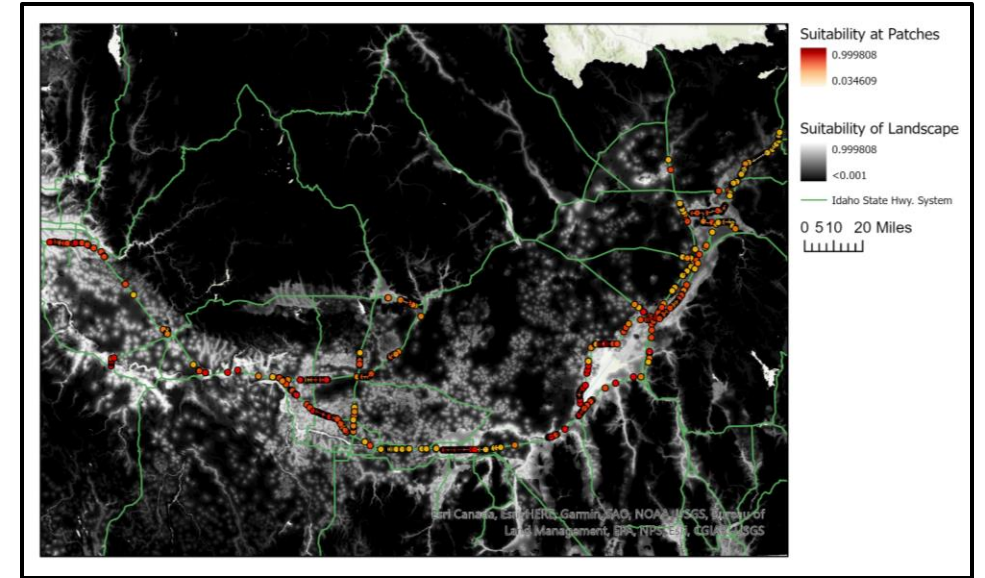
- Bee specimens (species and number)
from 6 pan traps

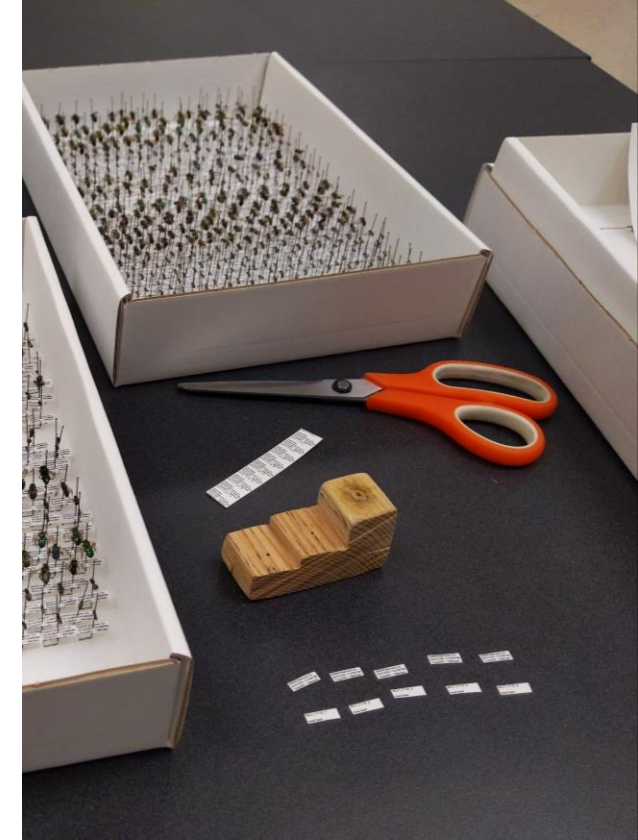
Milkweed Rapid Assessment

Along 600+ miles of highway:

- All milkweed observed in right-of-ways (1,363 patches)
- For milkweed patches larger than 50 stems:
 - Size and density of milkweed patch
 - Other floral resources
 - Adjacent land use
 - Dominant species in right-of-way

Current Work

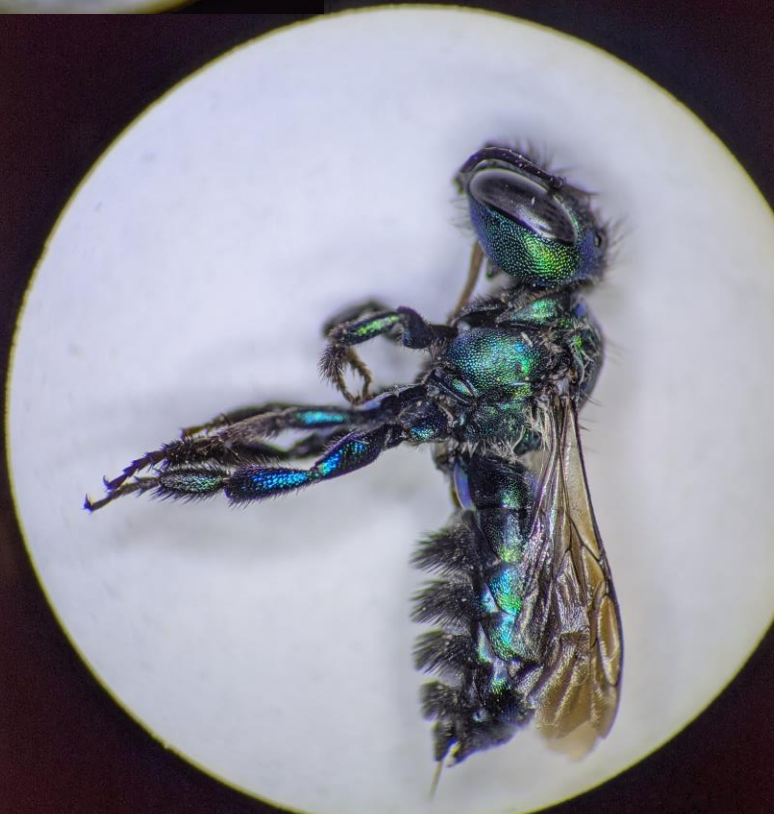
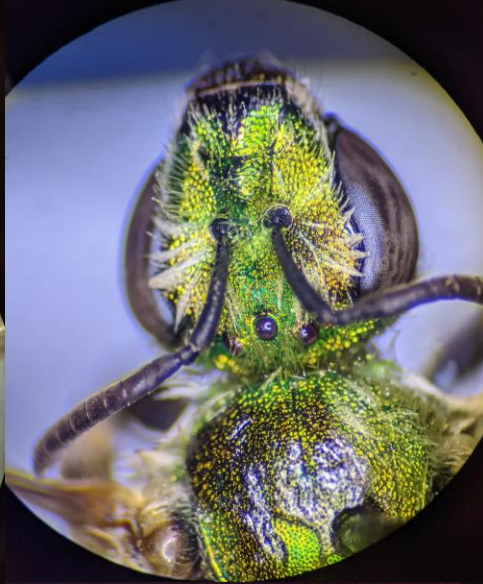




Bee Pinning

- 1,699 bees collected (far more than we expected)
- Each bee must be dried, fluffed, pinned, and labeled.
- Specimens will be ID'd by experts at the Logan Bee Lab.

Likely >48 morphospecies!



Bee Diversity in Plots

Trends and Patterns: BUTTERFLIES

General Trends and Observations: Seasonality

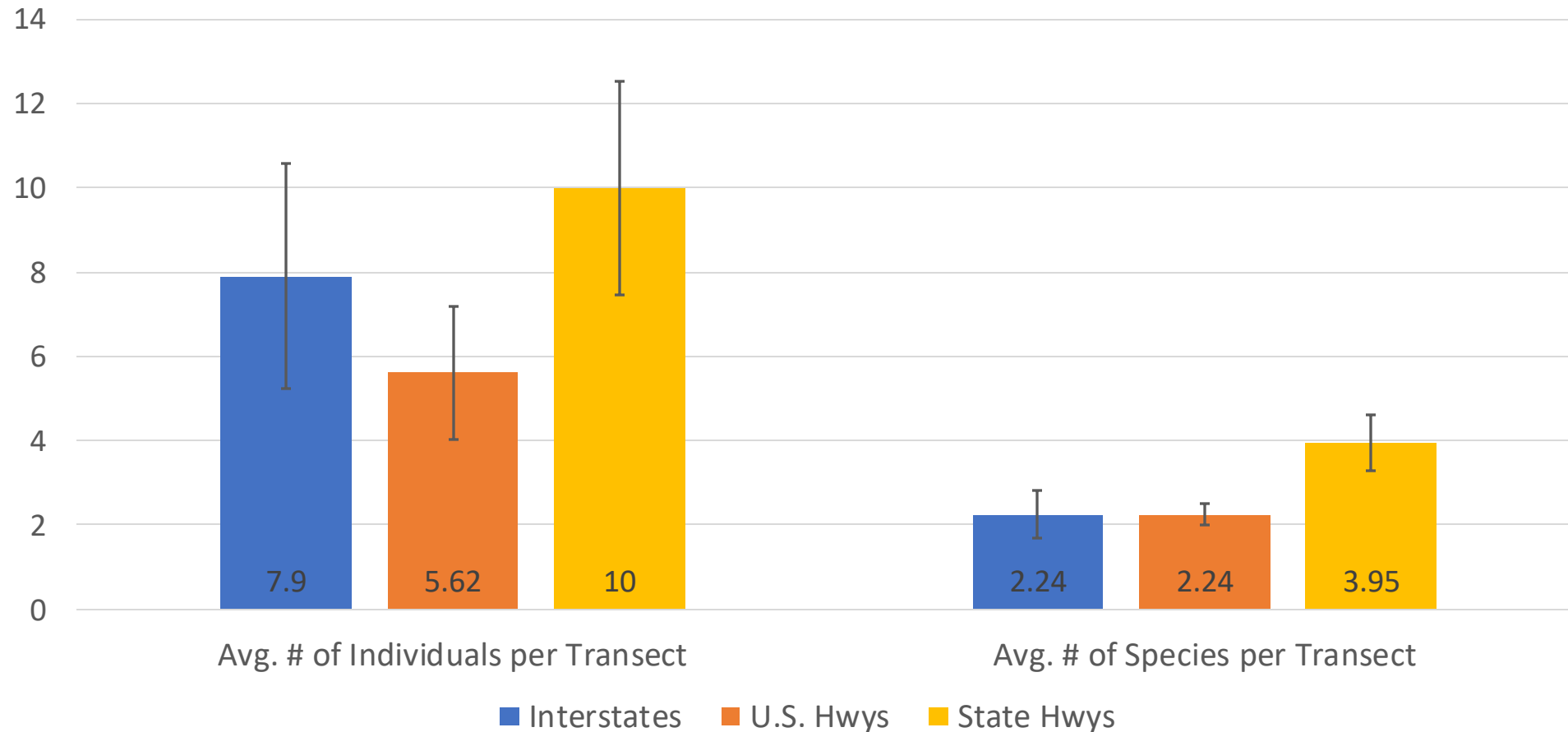
- Higher overall butterfly diversity and numbers in July than in June
- Significant numbers throughout the summer (June-August), likely beyond
- Considerable variation between months at some sites

2021 Butterfly Data	June Species Richness	July Species Richness	June Abundance	July Abundance
AVERAGE per Transect:	1.30	1.84	2.41	5.43
TOTALS:			152	342

General Trends: Highway Type

Average Butterfly Abundance and Species Richness per Transect by Highway Class

based on June and July 2021 combined data

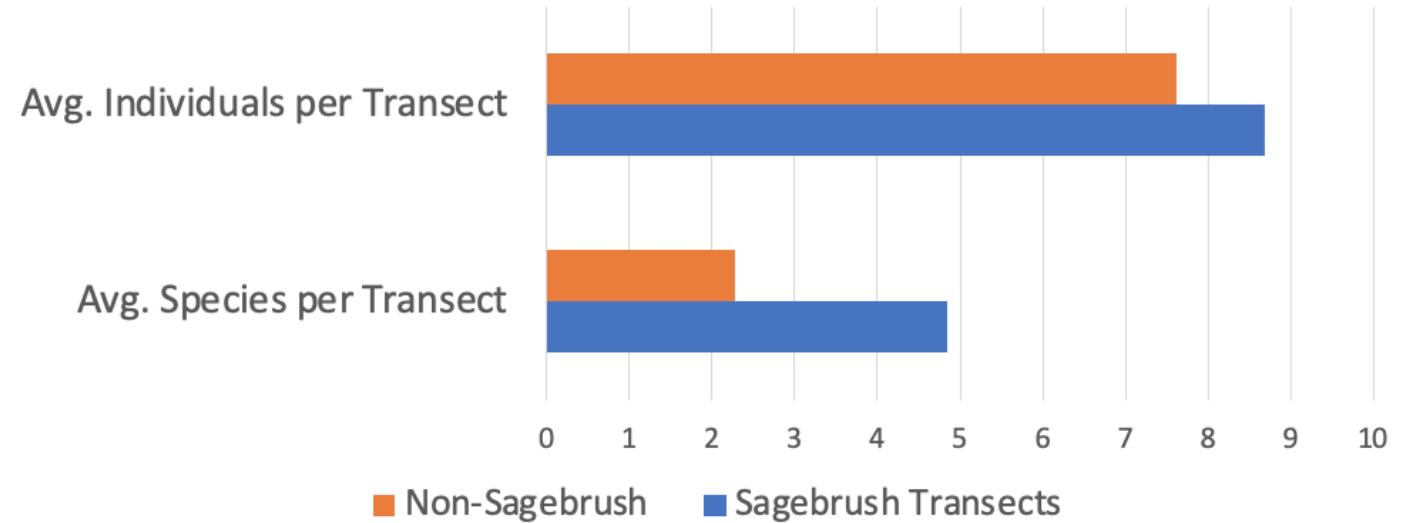


General Trends: Habitat

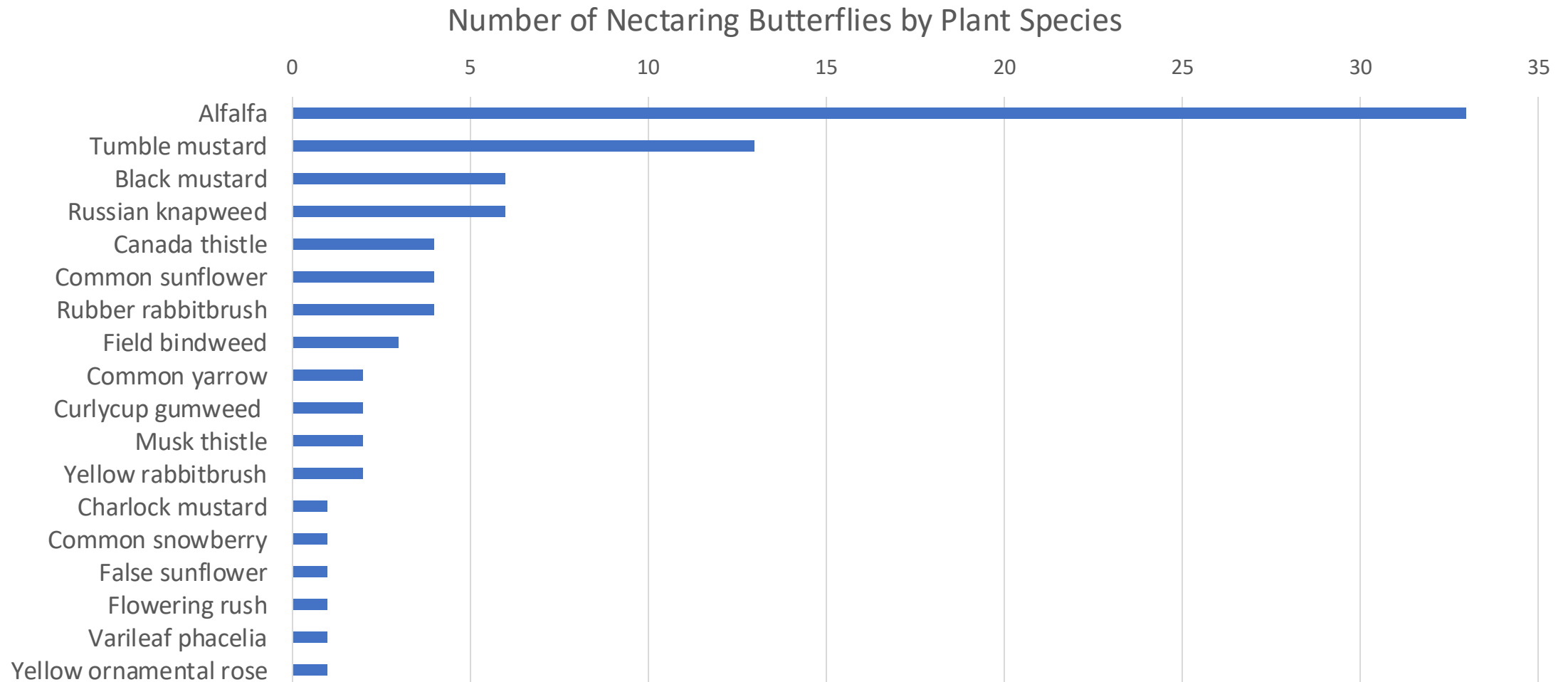
- Higher bee and butterfly species richness associated with sagebrush environments
- High bee numbers and diversity even in areas with relatively few flowers
- Much more data still to analyze here!

Sagebrush vs. All Other Transects

based on June/July 2021 combined data



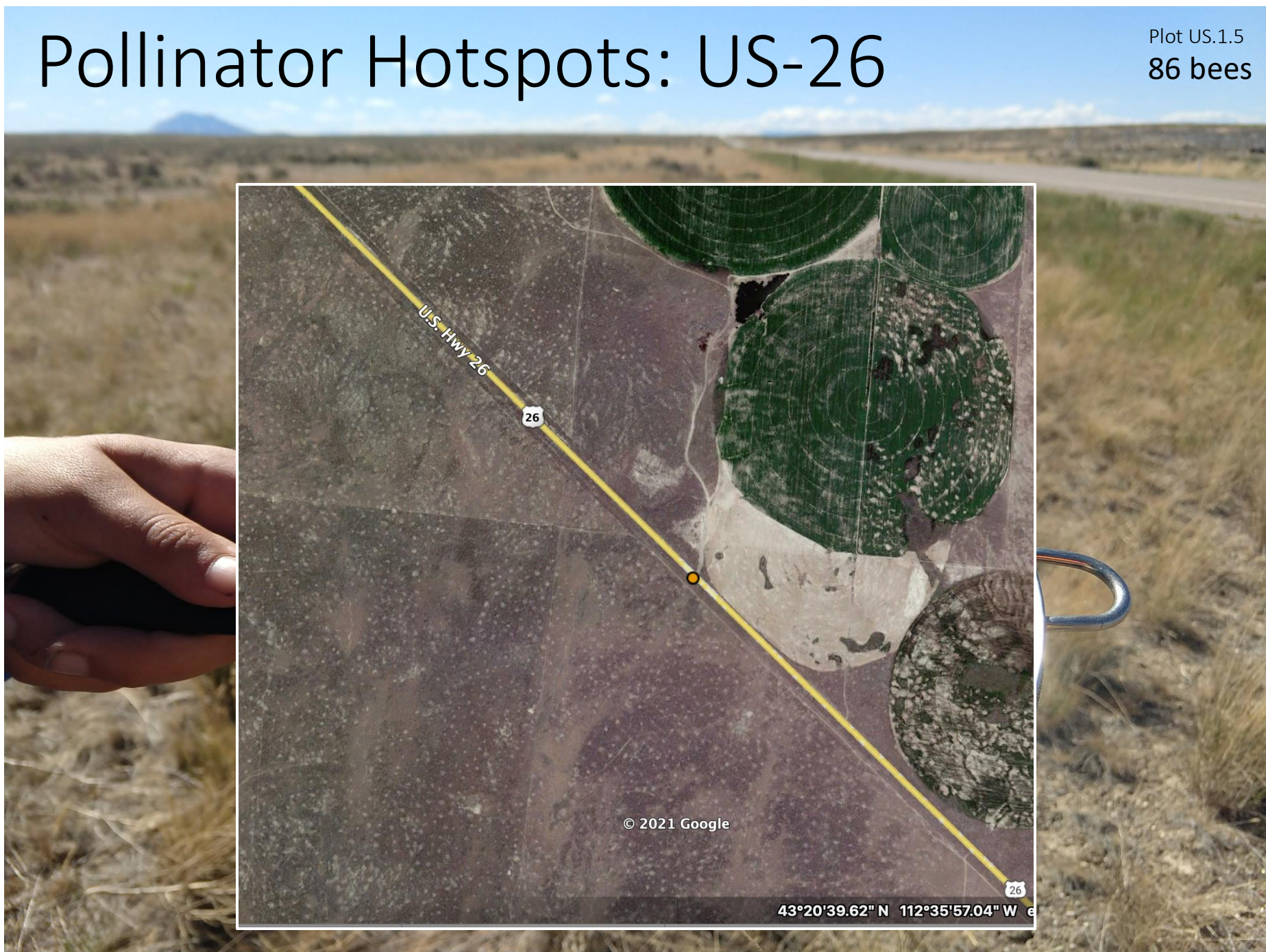
What are butterflies feeding on in Idaho roadsides?



Pollinator HOTSPOTS

Pollinator Hotspots: US-26

Plot US.1.5
86 bees



Pollinator Hotspots: SH-37

29 butterflies of 14 species

Plot SH.1.8

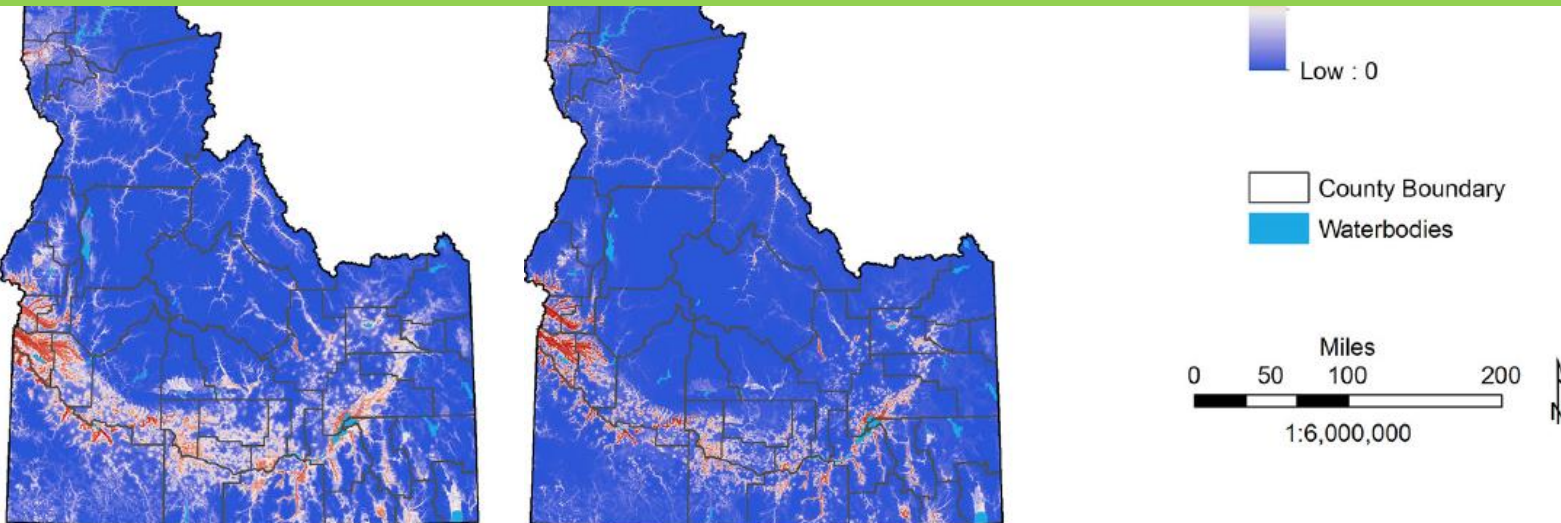


Modeling Current and Future Potential Distributions of Milkweeds and the Monarch Butterfly in Idaho

Leona K. Svancara^{1*}, John T. Abatzoglou² and Beth Waterbury³

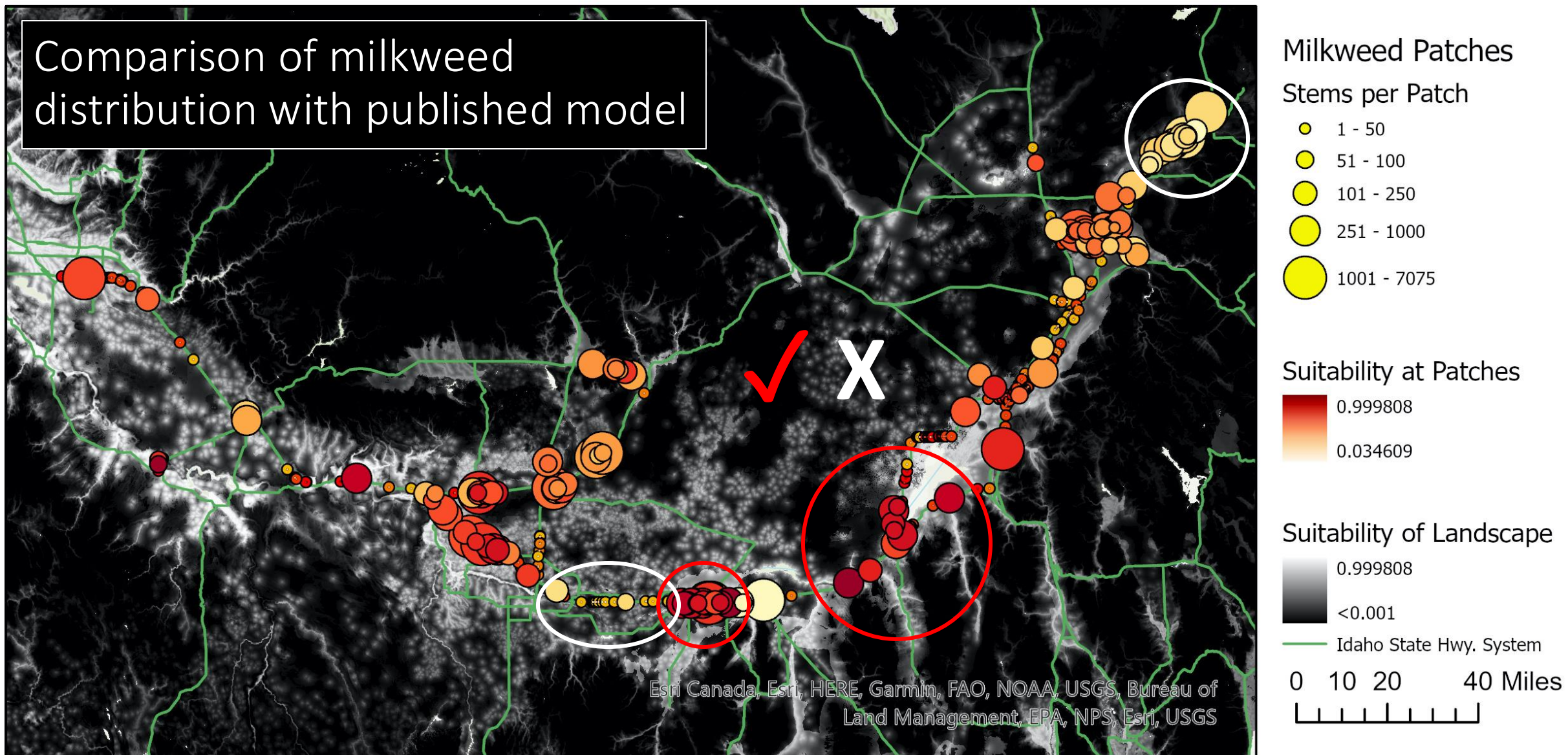
¹ Idaho Department of Fish and Game, Moscow, ID, United States, ² Department of Geography, University of Idaho, Moscow, ID, United States, ³ Idaho Department of Fish and Game, Salmon, ID, United States

Does Svancara's model accurately predict milkweed patch size and distribution along roadsides?



Top Five Factors:

- Elevation
- Soil depth
- Mean precipitation of wettest month
- Distance to perennial water



Mean suitability value of roadside milkweed patches: **0.53**

Showy milkweed suitability model *from Svancara et al. 2019*

What determines where pollinators live?

- Flower availability
- Native habitat on adjacent land
- Host plant presence (butterflies)
- Nesting habitat (bees)
- Safety from threats:
 - mowing/spraying of forbs
 - collisions with traffic
- Sources of water and mineral nutrients



Managing ROWs for Pollinators: Threats

Beyond ROWs:

- Agriculture: plowing, tilling, planting, herbicide application
- Grazing
- Development
- Invasive Species

In ROWs:

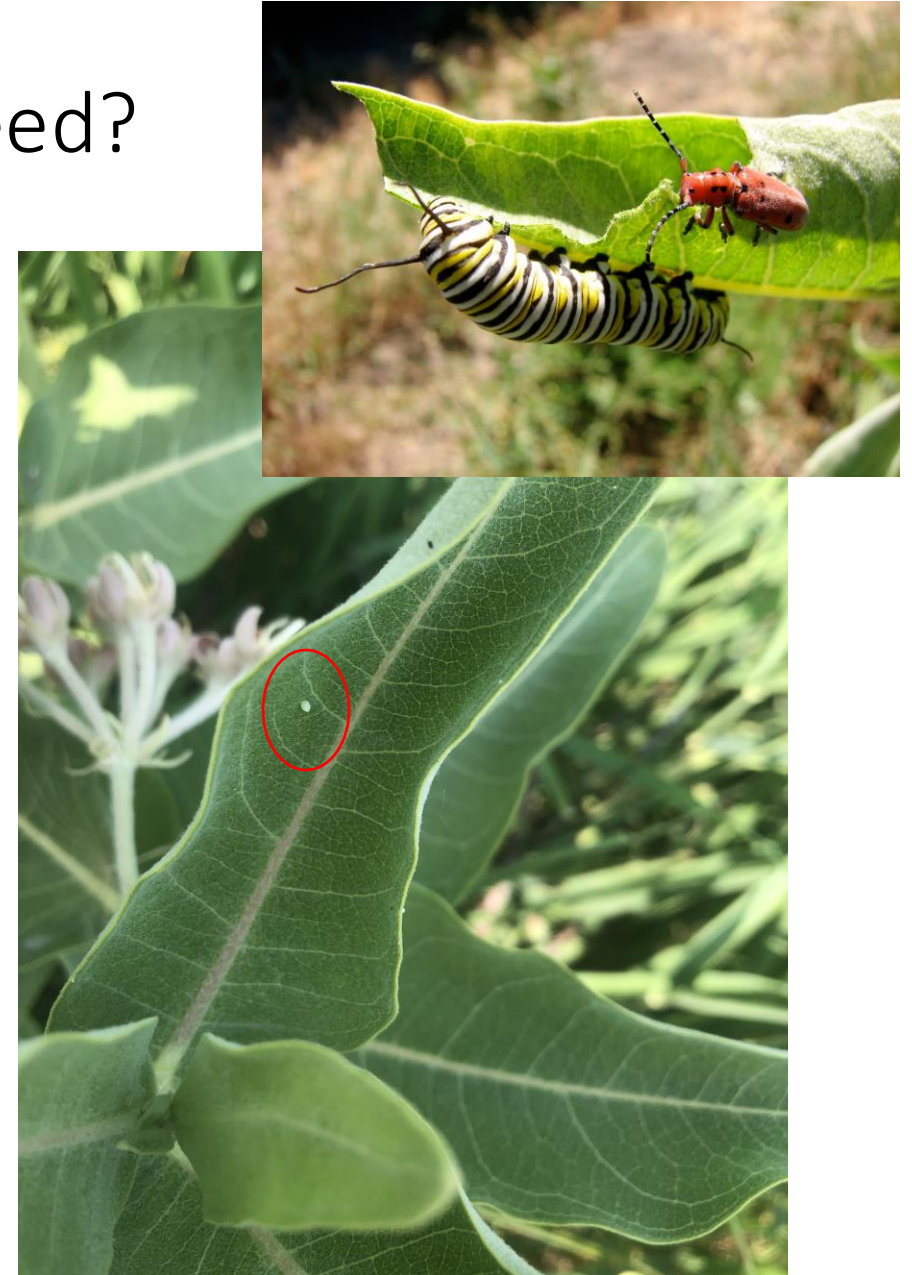
- Grading + Road Construction
- Mowing
- Herbicide Application
- Invasive Species
- Collision with Vehicles



Managing ROWs for Pollinators: Recommendations

- Avoid mowing to fenceline (2-3 m clear zone only)
- When necessary, mow early or late in season
- Spot-treat weeds early or very late in season; especially avoid spraying flowering plants
 - *Herbicides can kill pollinators!*
- Prioritize plantings in areas farthest from road, in wider ROWs, and/or along less-trafficked roads
 - *Not in medians!*
- Whenever possible, seed with native forbs and bunchgrasses rather than non-natives (e.g. crested, intermediate wheatgrasses)

Why avoid mowing or spraying milkweed?



A group of six people, three men and three women, are standing in a grassy field next to a small pond. They are all wearing high-visibility safety vests (yellow and orange) and hard hats (white and orange). One woman is wearing a wide-brimmed hat. They appear to be engaged in a discussion or a field inspection. The background shows a clear blue sky, some trees, and a house in the distance.

Plans for 2022

- **Field Work: June – August 2022**
 - Replicate surveys of all plots (63) in June and July; late-season sites (18) in August
- **Bee Data Processing & Identification**
- **Data Entry & Analysis**
- **Mapping & Developing Recommendations**

Literature Cited

- Cariveau, A.B. *et al.* (2019) Rapid assessment of roadsides as potential habitat for monarchs and other pollinators. *Front. Ecol. Evol.* 7, 386
- Hopwood, J. *et al.* (2015) Literature Review: Pollinator Habitat Enhancement and Best Management Practices in Highway Rights-of-way. *Fed. Highw. Adm.*
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- Turner, M.G., R.H. Gardner. (2015) *Landscape Ecology in Theory and Practice: Pattern and Process*. Springer Verlag, New York.
- Tylianakis, J.M. (2013) The global plight of pollinators. *Science* (80-.). 339, 1532–1533
- Waterbury, B., Potter, A., & Svancara, L. K. (2019) Monarch butterfly distribution and breeding ecology in Idaho and Washington. *Frontiers in Ecology and Evolution*, 7, 172.
- Zattara, E.E. and Aizen, M.A. (2021) Worldwide occurrence records suggest a global decline in bee species richness. *One Earth* 4, 114–123

Research Progress

Idaho Study of Roadside Habitats for Monarch Butterflies and Other Pollinators							
TASK	2020		2021				
	3rd Quarter	4th Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	1st Quarter
1. Project Coordination	5%	15%	25%	50%	55%	60%	
2. Incorporate Existing Relevant ID Pollinator Data Into Study			20%	40%		45%	
3. Field Study Design	15%	15%	25%	100%			
4. Data Collection				50%	55%	55%	
5. Data Analysis and Mapping				10%	15%	40%	
6. Recommendations for ROW Management						12%	
7. Final Reporting							
*percentages are total work for task completed <i>so far</i> (do not sum across rows)							

- First year of plot surveys complete
- Milkweed rapid assessment complete
- Bee specimens processed and pinned for 2021
- Data analysis and mapping begun

Updates Relative to Plan for Project Completion

- Given that we planned for 2 field seasons, we assumed that this 2 year grant would take 2.5 years to complete (substantial analysis and writing will necessarily occur after the 2nd field season).
- Thomas is supported this semester by an MSU Ecology Teaching Assistantship, which pays his salary and tuition (but not his fees) and will allow us to extend the project by 6 months.
- Thomas collected much larger numbers of bees during the 2021 field season than we expected. As such, we feel we have adequate bee data and propose to collect no additional bees in 2022.

Budgeting for Project Completion

- We will underspend on travel due to obtaining a small grant last summer that could pay those expenses and frugal approaches to travel.
- We will underspend relative to the hours charged for Rob's work.
- We will overspend on salary, tuition, and fees due to the addition of one more semester to the project timeline (which we had expected), as well as the increase in each of these expenses relative to what we had originally projected.
- We will overspend on the cost of bee ID because we underestimated the total number of bees that would be collected in the 2021 field season.

Proposed Adjustments for Project Completion

- Request a no-cost extension to extend the project deadline from 2/28/23 to 8/31/23.
- Request no additional funding, but modify spending within budgetary categories. Does this require a formal budget modification?
- Collect no additional bees during 2022 field season, given that we have adequate data.