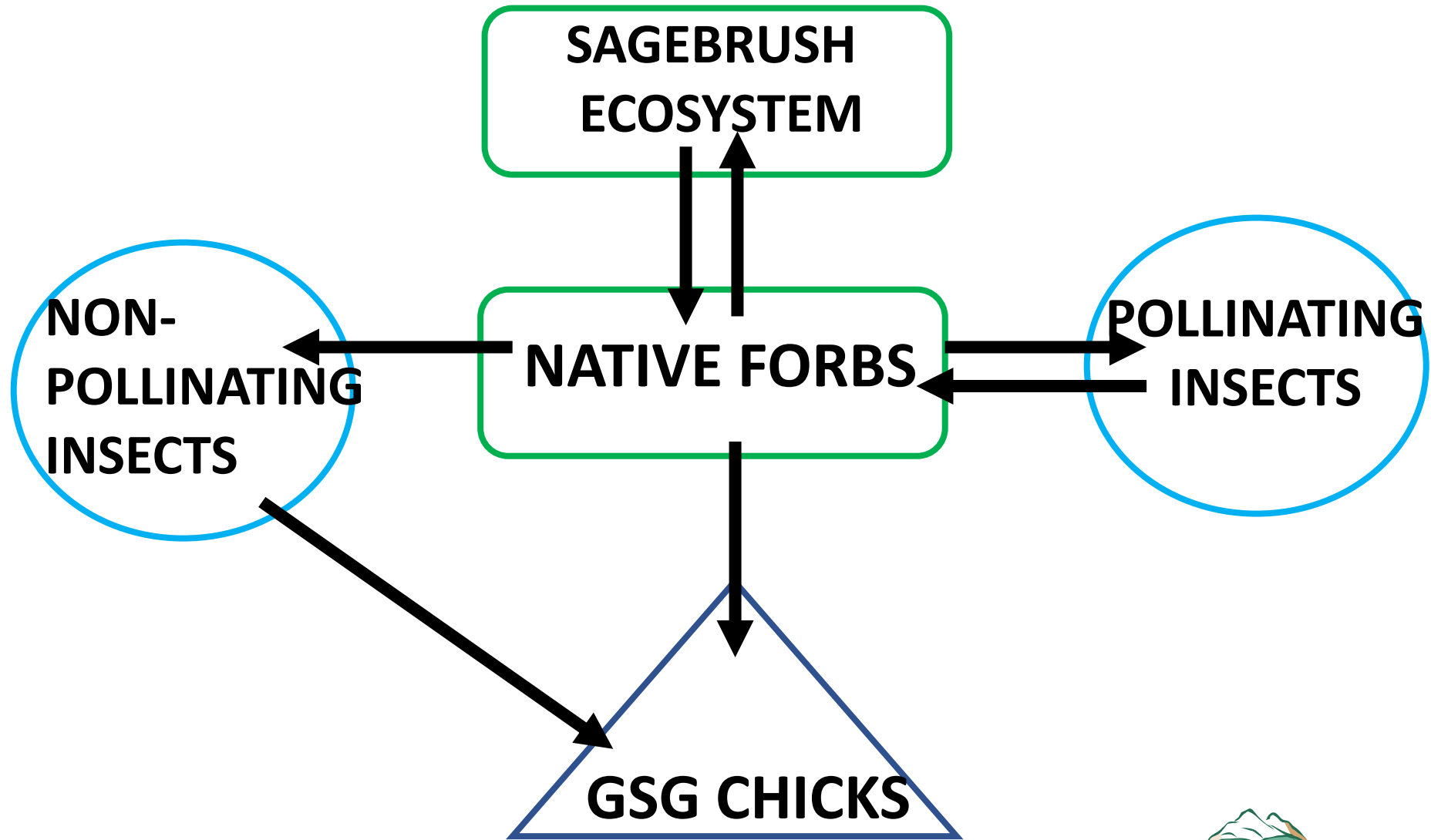


A Novel, Landscape Approach to Constructing Plant-Pollinator Networks Important for Greater Sage Grouse Conservation and Habitat Restoration

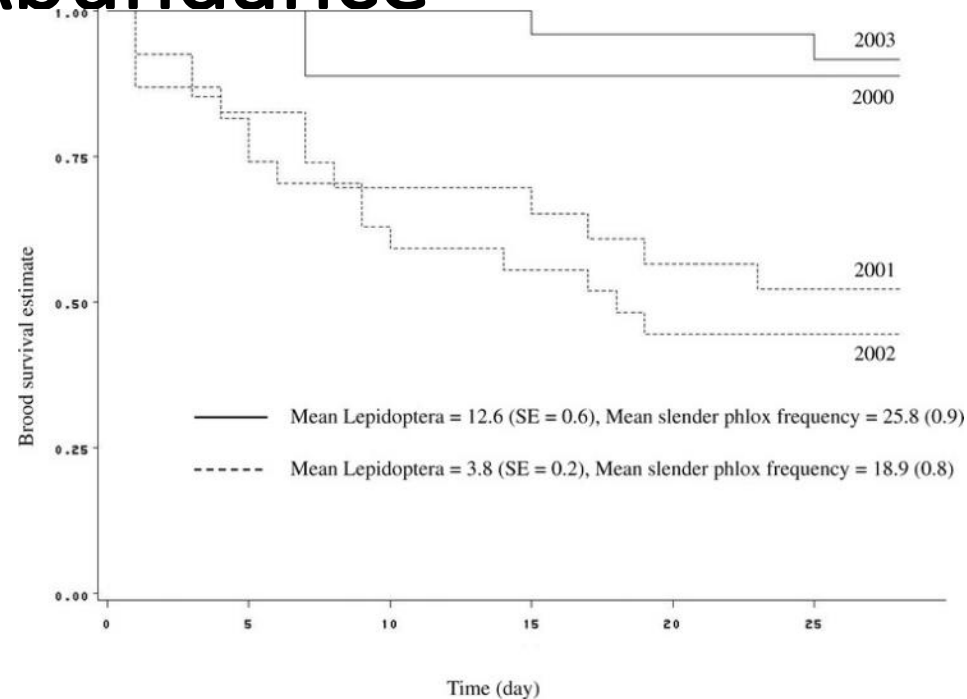
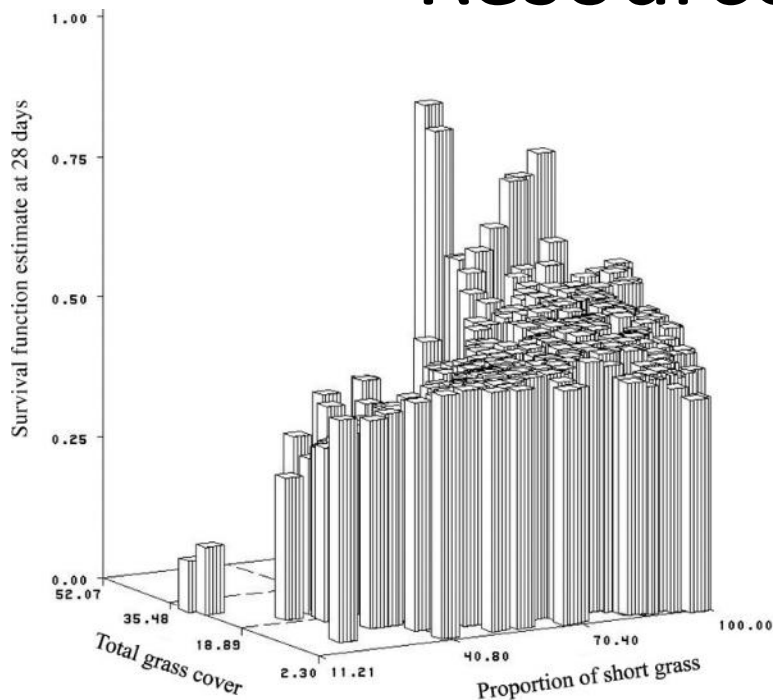
Sarah Barlow and Bruce Pavlik

Conservation Department
Red Butte Garden and Arboretum
Salt Lake City, Utah 84105





Chick Survivorship Linked to Vegetation Structure and Food Resource Abundance



Gregg and Crawford 2009 J. Wildlife Man. 73:904-913

Non-Pollinating Insects – GSG Chick Food



Hemileuca hera (Lepidoptera)
Strawberry Reservoir, Wasatch County, UT

Copyright © 2009 [Glassman](#)



Eleodes (Tenebrionidae)
Florida Canyon, Pima Co., AZ

Copyright © 2012 [Mark H Brown](#)



Polyphylla (Scarabaeidae)
Oldtown, Bonner County, ID

Copyright © 2013 [Suzanne Endres](#)



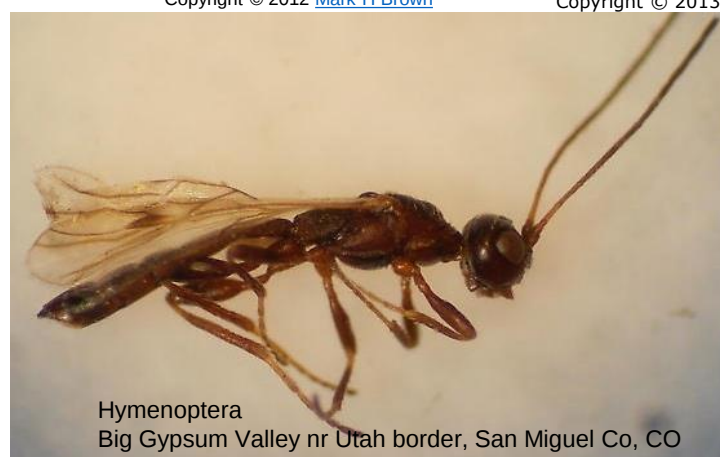
Chrysomela (Chrysomelidae)
Lyons, Boulder County, CO

Copyright © 2015 [Lynn Monroe](#)



Anabrus simplex (Orthoptera)
Austin, Lander County, NV

Copyright © 2013 [Sam McNally](#)



Hymenoptera
Big Gypsum Valley nr Utah border, San Miguel Co, CO

Copyright © 2012 [Derek Uhey](#)



Pogonomyrmex (Hymenoptera)
Boulder, Boulder County, CO

Copyright © 2015 [Lynn Monroe](#)

Native Forbs – Esp. Asteraceae and Fabaceae – GSG Chick Food



Microsteris_gracilis_1776.JPG



Astragalus geyeri



Agoseris heterophylla



Achillea millefolium

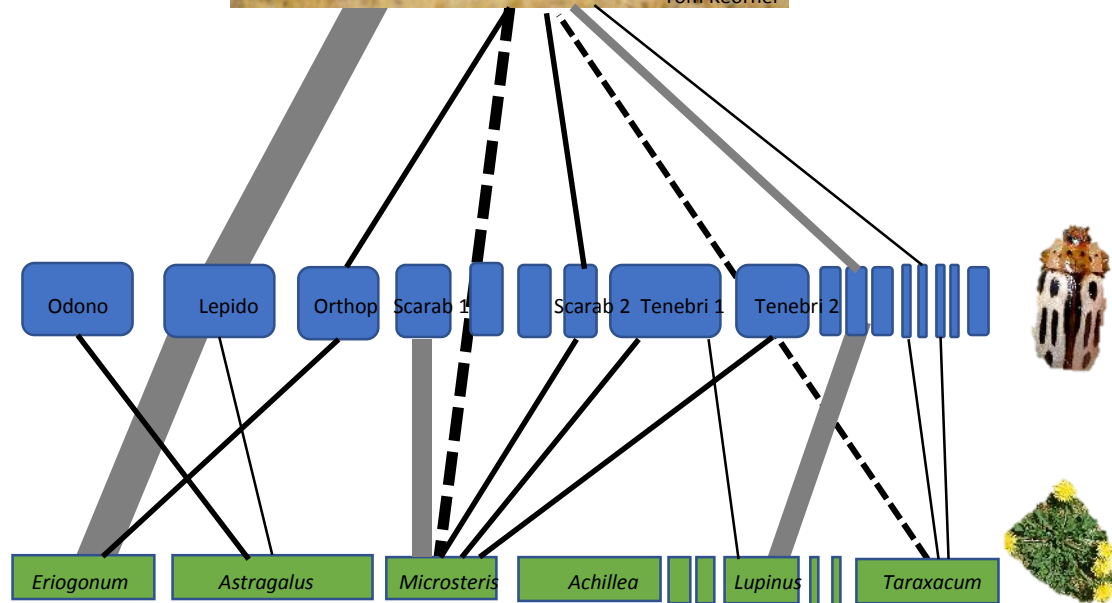
<http://www.americansouthwest.net/>



Taraxacum officinale

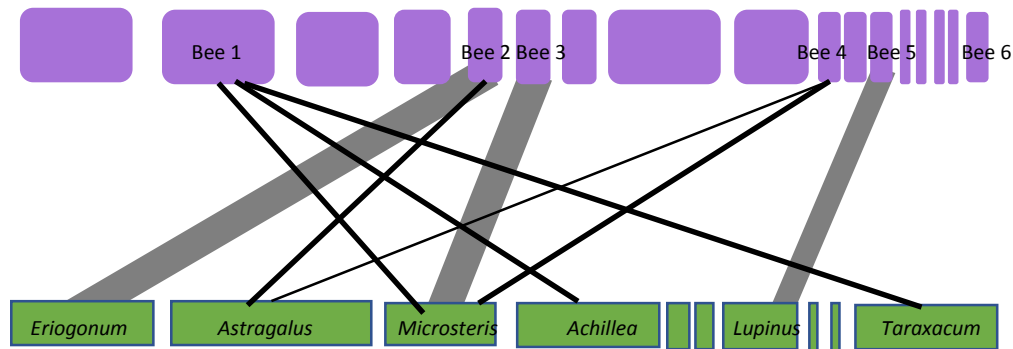
Bransford, W.D. & Dophia

Tri-Trophic Networks



Chick
diet

Plant-Pollinator Network



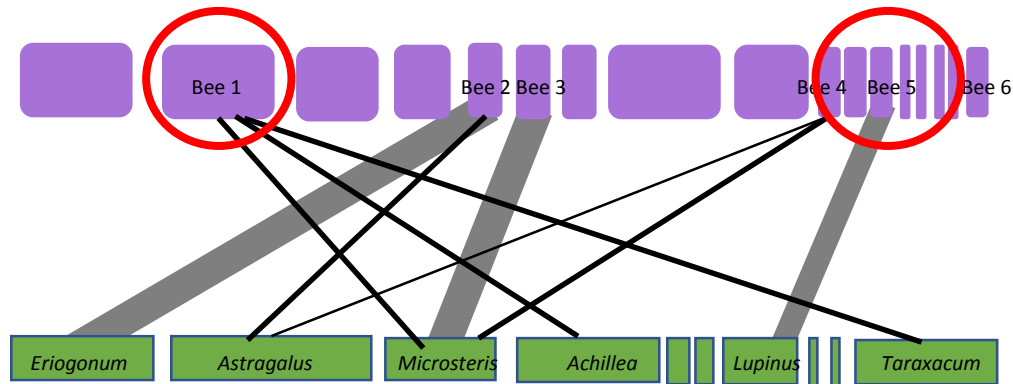
Forb
fecundity

Plant-Pollinator Network



Keystone Bee

Specialist Bee



Forb
fecundity

What are the vegetation characteristics associated w/ forb diversity and abundance in N. Utah?

Shrub/grass dominants – height, cover

GSG forbs – phenoseason variation

Landscape-level variation

What pollinators support GSG forb species critical to brood survivorship?

Apoidea/Diptera/Lepidoptera diversity

Visitation rates to GSG forb species

Landscape-level variation

What are the relationships between non-pollinating insects, forb diversity and vegetation characteristics?

How do pollinator identity and visitation rate affect forb fecundity?

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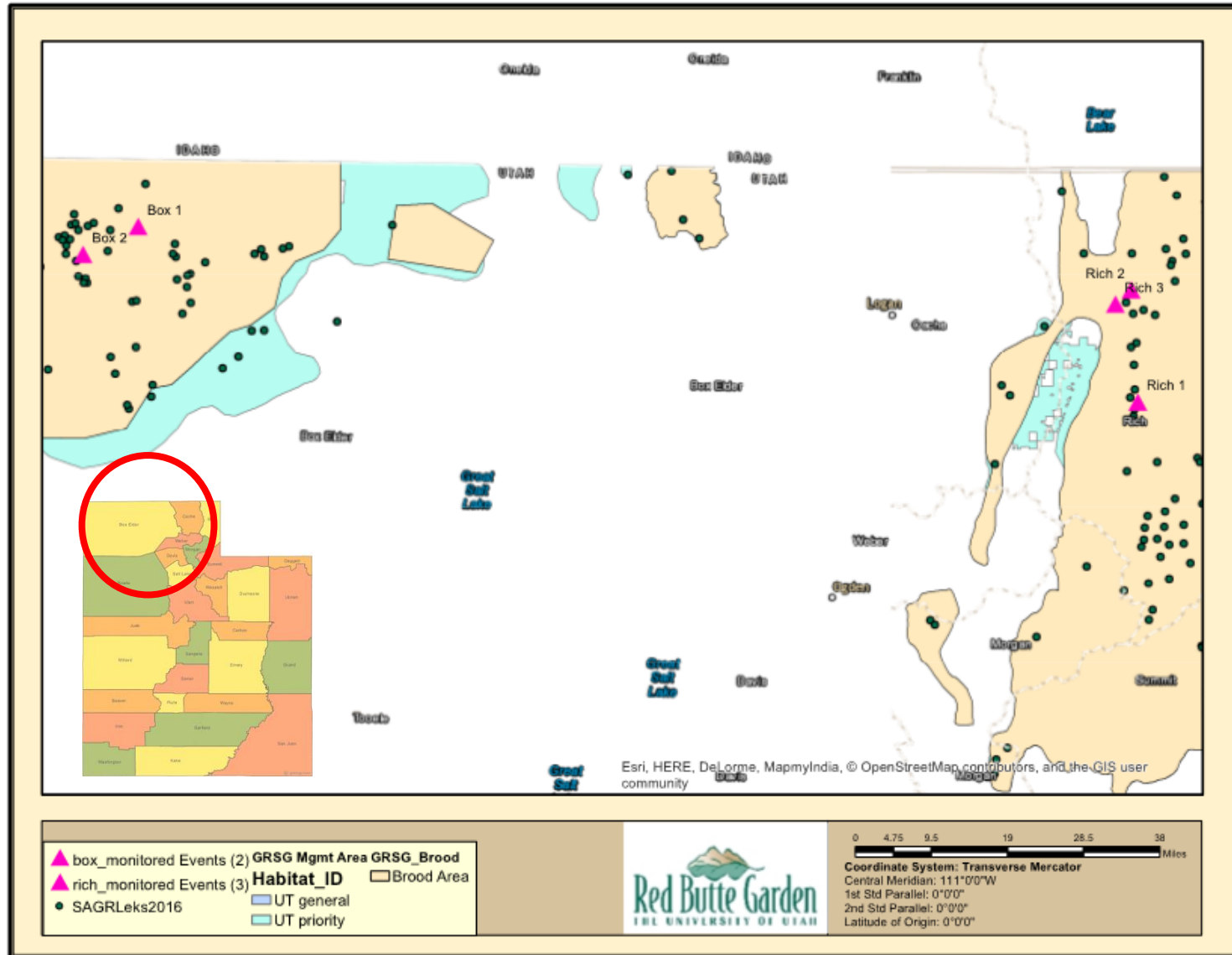
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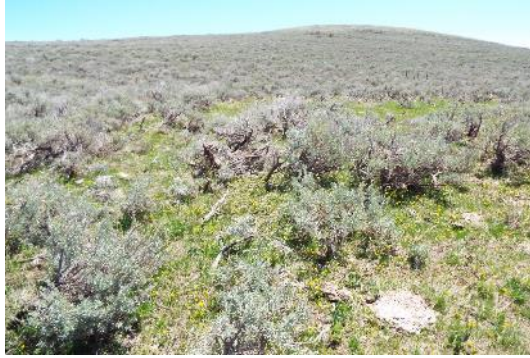
Take-Homes (in progress)

- 3 distinct *Artemesia* communities w 4/forb assemblages
- *A. tridentata* most homogeneous, low forb diversity, low V_R
- *A. nova* most heterogenous, high forb diversity
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- The same forb species attract different pollinators at different rates across the landscape

Study Sites



Study Sites



BOX1



BOX2



RICH1

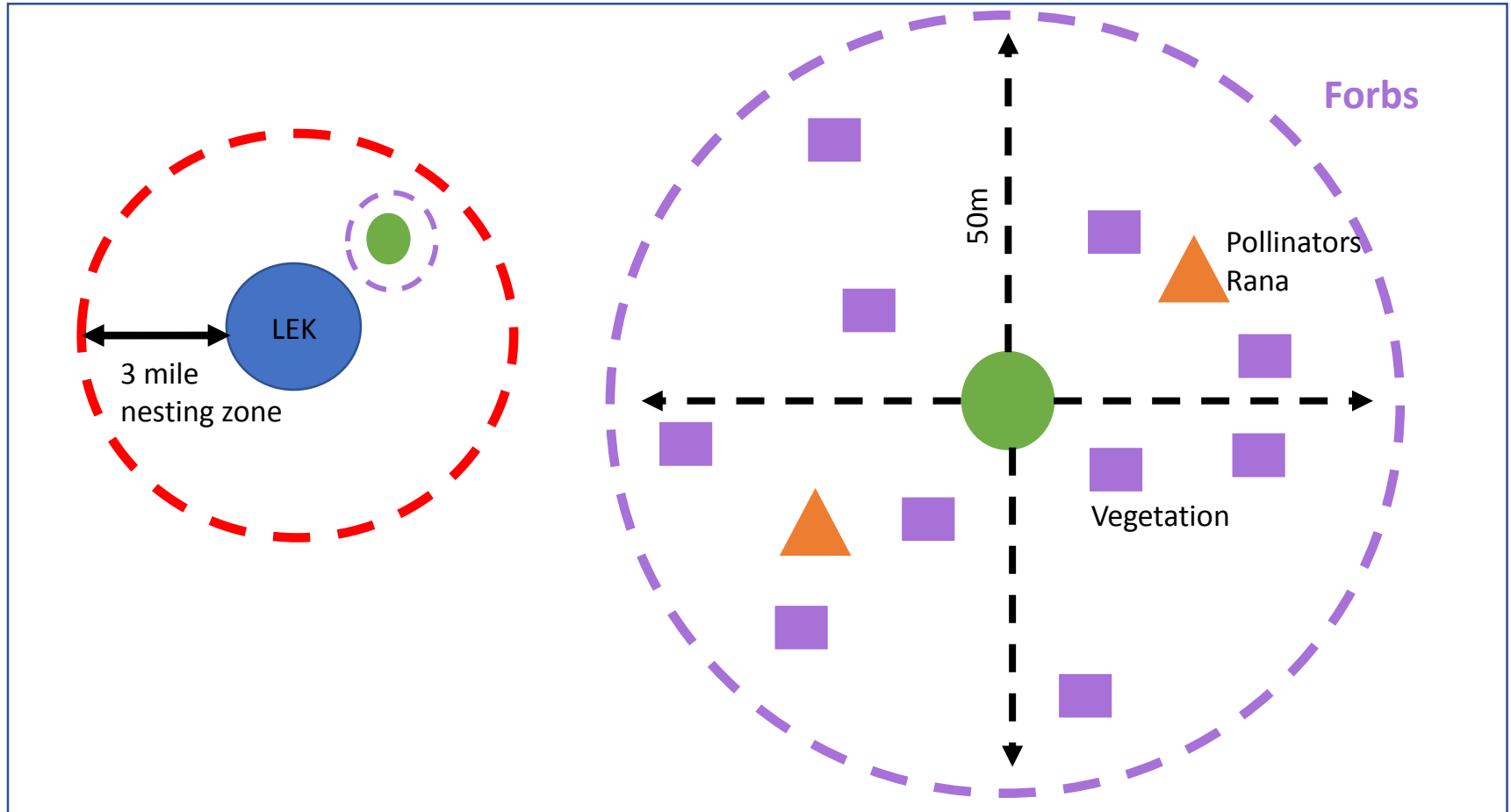


RICH2



RICH3 (VEG)

Monitoring Sites



1. Vegetation Description

- Linear cover (grasses and shrubs), *Artemisia* sp. height, and forb abundance and cover (x3 pheno)



Achillea millefolium



Microsteris gracilis (*Phacelia gracilis*)

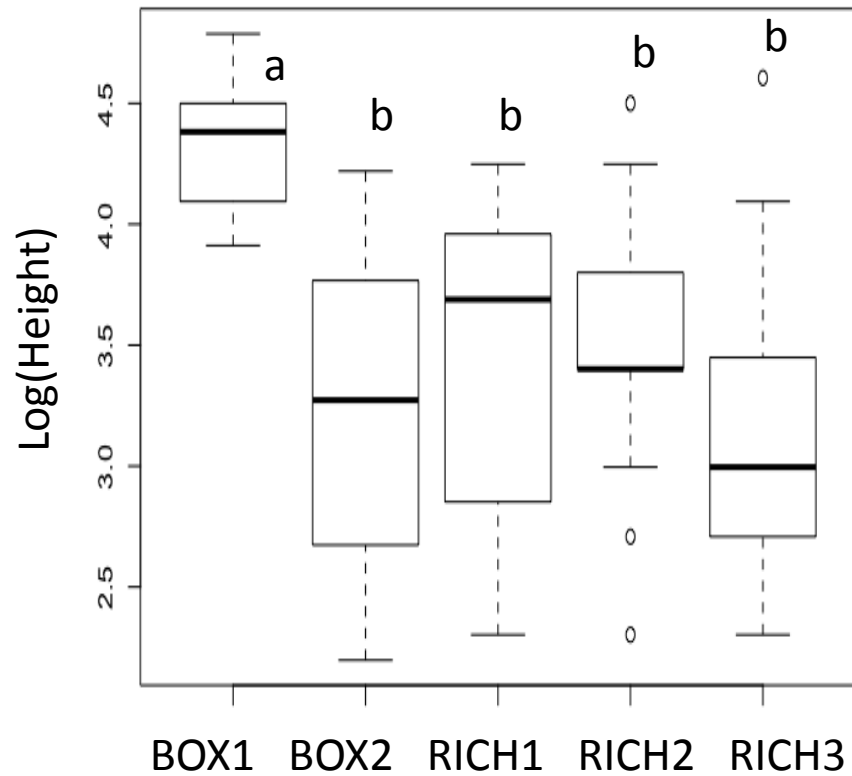


Agoseris heterophylla



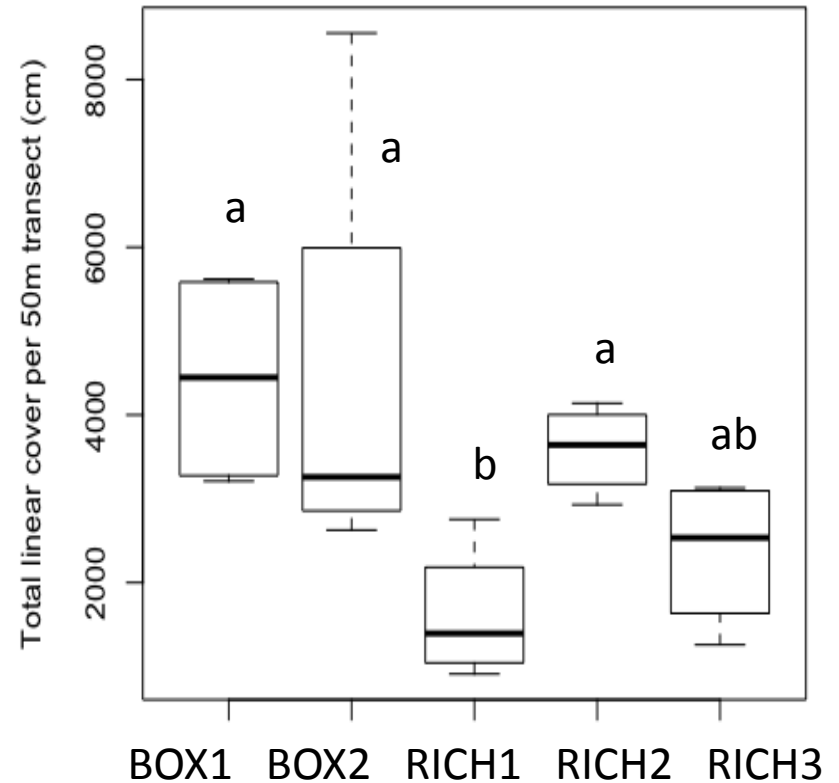
Astragalus geyeri

Artemisia height



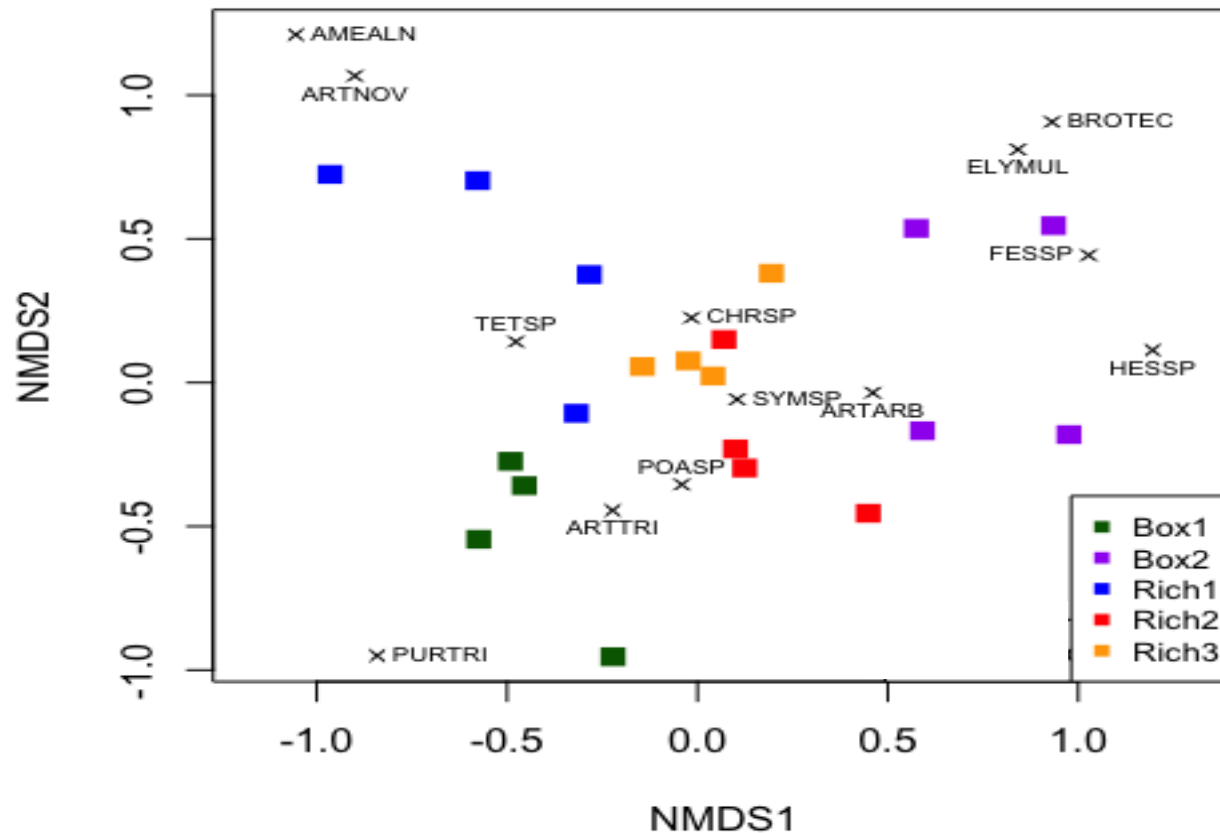
ANOVA, site, $F = 19.09$, $P < 0.001$,
species, $F = 11.40$, $P < 0.001$

Total linear cover (grasses and shrubs)



ANOVA, site, $F = 5.00$, $P < 0.01$

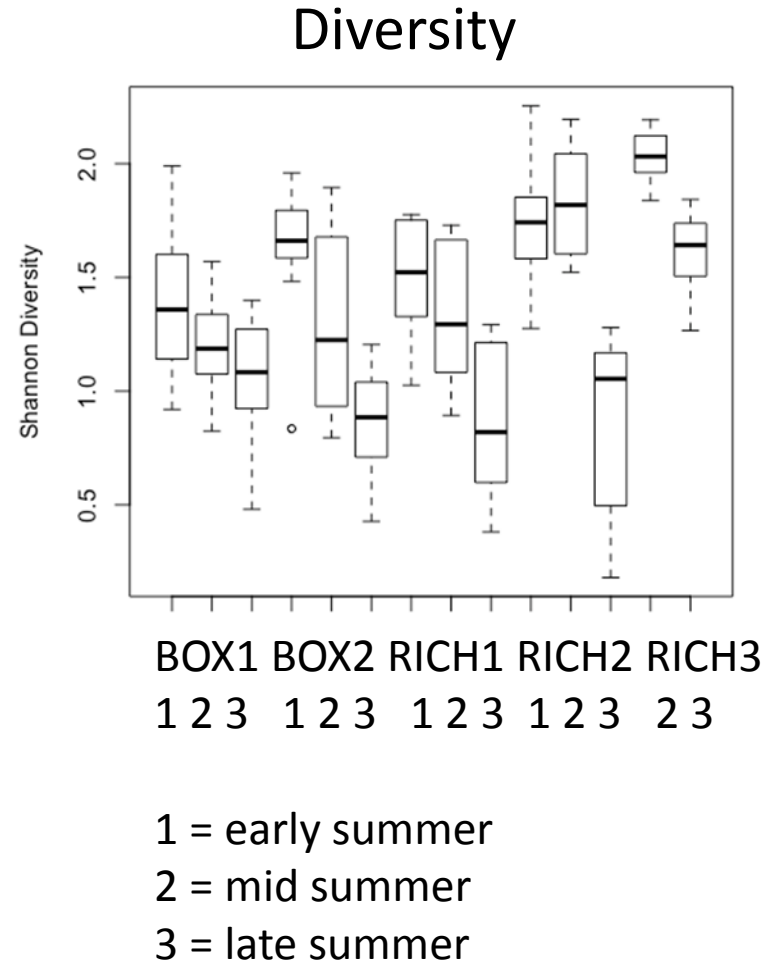
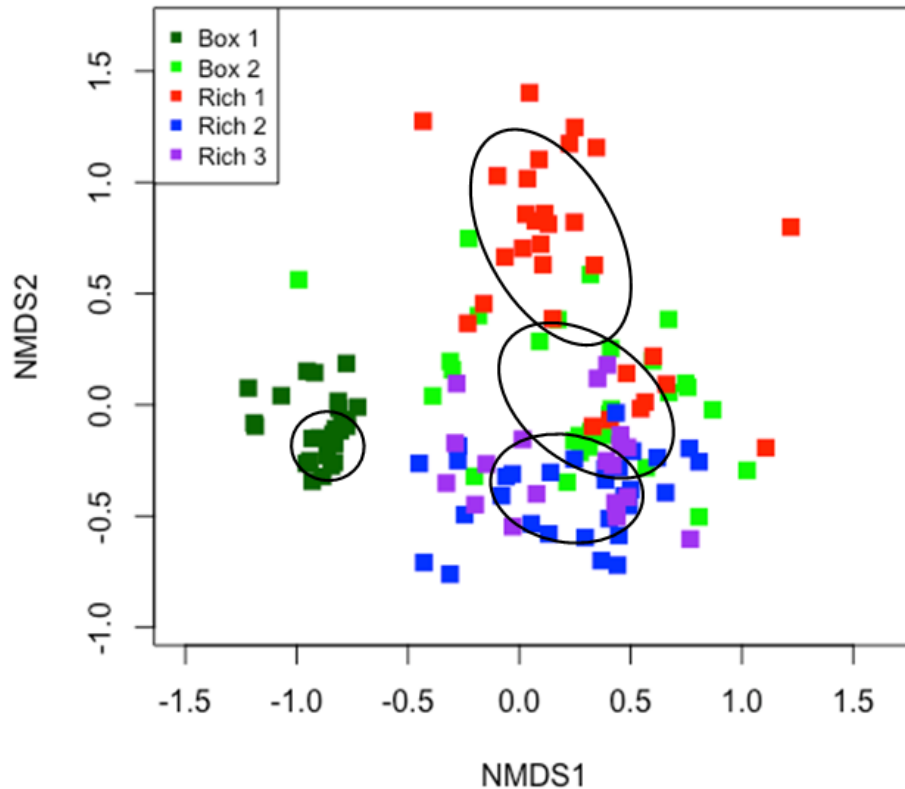
Linear Cover of Grasses and Shrubs



PERMANOVA, site, $F = 5.78$, $R^2 = 0.61$, $P < 0.001$

PERMDISP, site, $F = 4.40$, $P < 0.05$

Forb Abundance, Cover and Composition



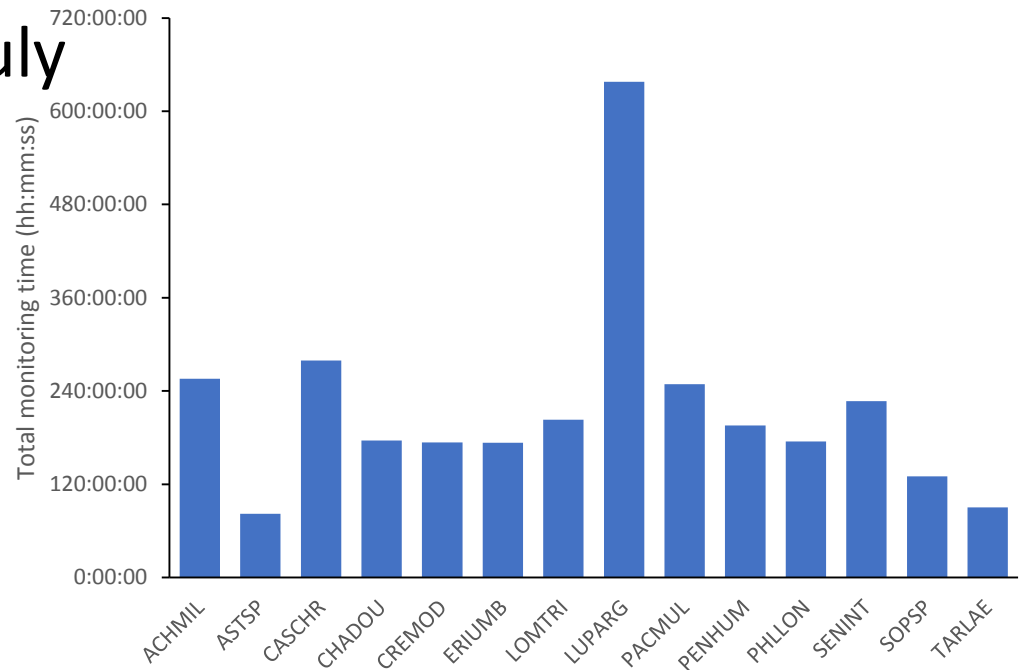
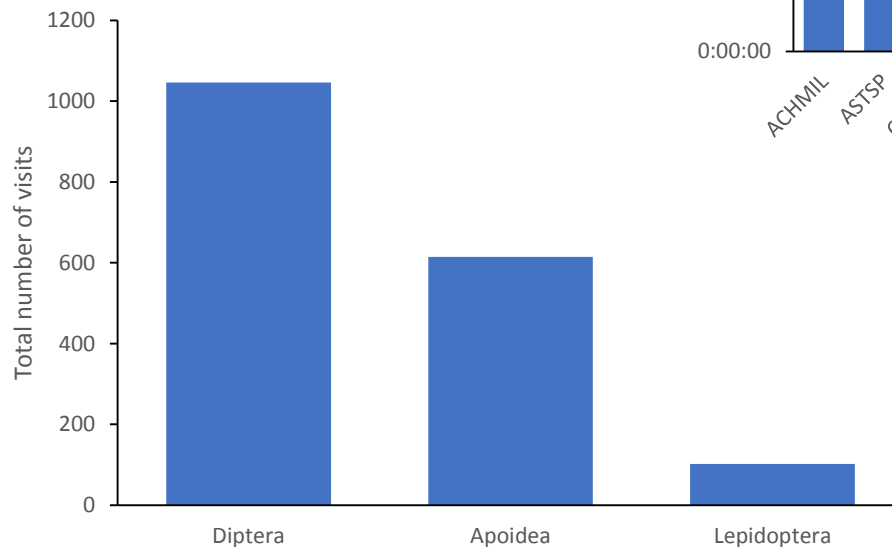
2. Using Rana to Document Plant-Insect Interactions

- Pollination – essential for self-maintaining forb populations
- Herbivory – attracting supporting non-pollinating insects



Rana Pollinator Monitoring

- 4 sites, late May-late July
- 14 forb species
- 75 individuals
- 3047 hrs observation
- 1762 foraging visits



Rana Pollinator Monitoring

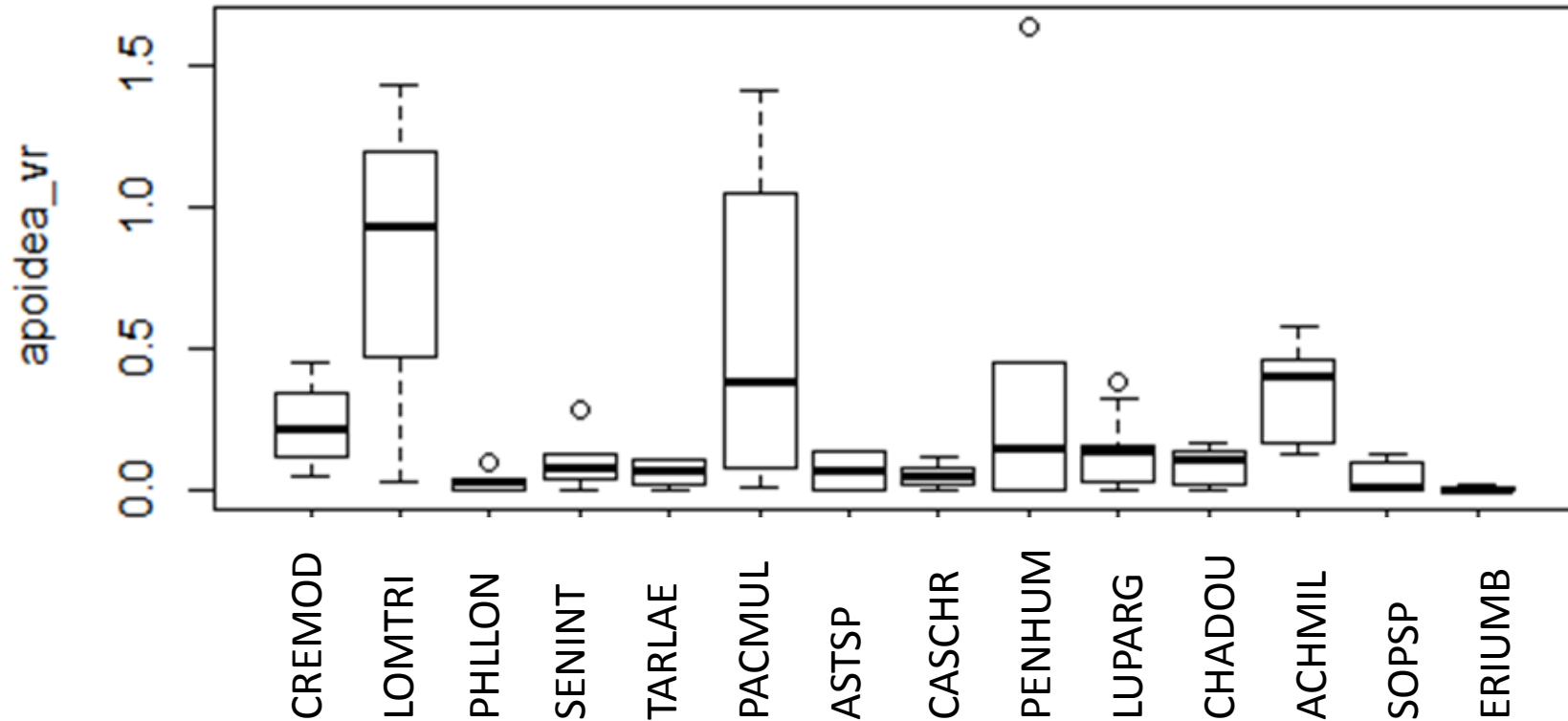


<https://www.youtube.com/watch?v=anLmhcCvqb8>



Visitation Rates (V_R)

resource abundance, pollen movement, pollinator abundance

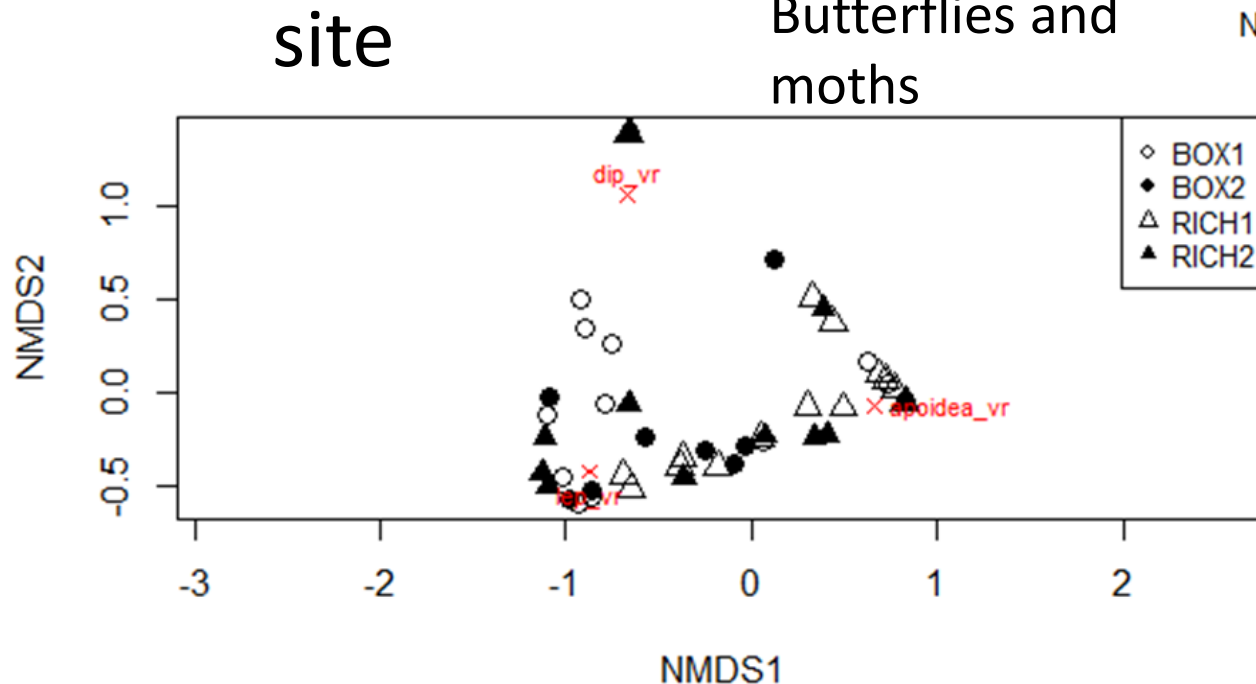
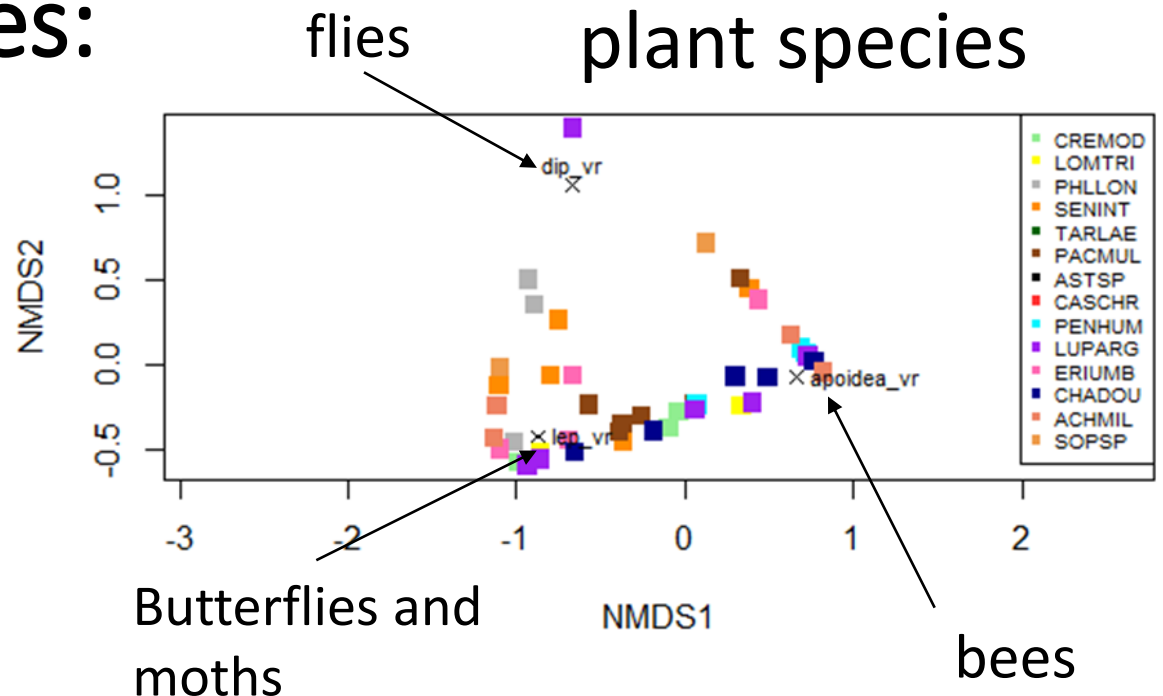


e.g. Bees (Apoidea) do not visit plant species at the same rate

Kruskal-Wallis test, species, $P < 0.001$

Visitation rates:

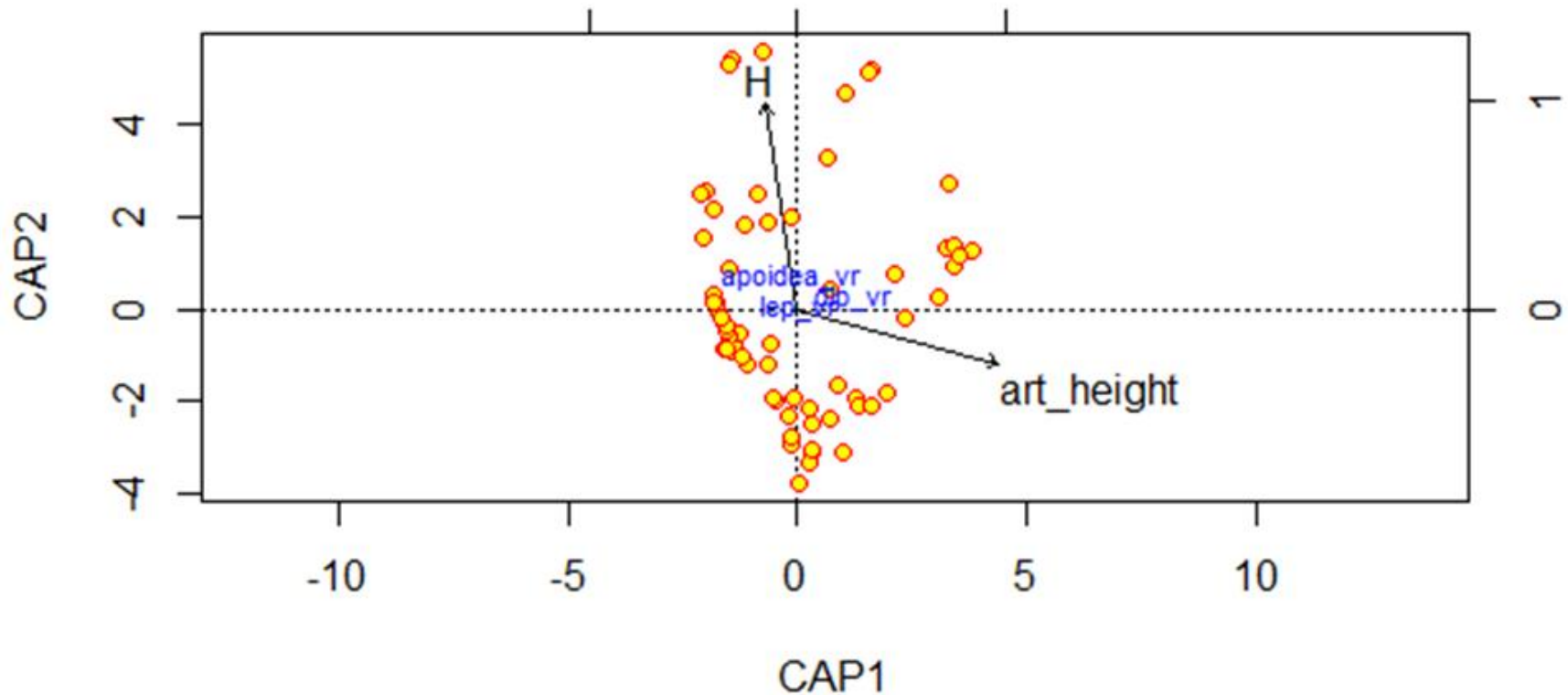
-species &
site-specific



Species*site
 $P < 0.01$

Why does pollinator V_R vary?

Positive correlation with forb diversity (H), negative with *Artemesia* ht



P=0.058

3. Forb Seed Collections for Restoration



3. Forb Seed Collections for Restoration



SOS Collections



Plant Name	Common Name	# Plants Sampled	Seed Estimate	County
<i>Senecio integerrimus</i>	lamb-tongue ragwort	87	1,150	Rich
<i>Balsamorhiza sagittata</i>	arrow-leaf balsamroot	110	1,000	Box Elder
<i>Lupinus argenteus</i>	silver-stem lupine	213	9,500	Rich
<i>Eriogonum umbellatum</i>	sulphur flower buckwheat	145	4,500	Rich
<i>Eriogonum umbellatum</i>	sulphur flower buckwheat	160	18,500	Rich
<i>Eriogonum heracleoides</i>	parsnip-flower buckwheat	50	18,000	Box Elder
<i>Achillea millefolium</i>	common yarrow	150	1,000,000	Wasatch
<i>Eriogonum heracleoides</i>	parsnip-flower buckwheat	250	10,000	Wasatch
<i>Potentilla gracilis</i>	graceful cinquefoil	150	600,000	Wasatch
<i>Achillea millefolium</i>	common yarrow	71	1,000,000	Wasatch

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Expected Outcomes

- Pollinator Support Evaluation
 - identify keystones, specialists and networks of N. Utah
- Comparison of Pollinator Support Indices
 - between forb species and sites (visitation rates + diversity)
- Native forb seed collections for pollinators
- Site-specific restoration? (target taxa, increase forb and insect diversity, pollinator support, seed zones)

Acknowledgements

DOI Bureau of Land Management

Peggy Olwell – Pollinator Initiative and GSG Conservation

Adrienne Pilmanis – funding, connections, standard keeping

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Matt Preston

Brad Jessop

Tyler Nelson

Marcia Wineteer

} GSG expertise

Conservation, Red Butte Garden

Alyssa Chapman

Drew Potter

Avery Uslaner

} field assistance, video analysis

Insect ID

Dr. Vince Tepedino

