Photo: Bronwyn Taylor

The Reproductive Ecology of *Astragalus microcymbus*

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Astragalus microcymbus

(Skiff milkvetch)

Photos: Bronwyn Taylor

What We Know

Denver Botanic Gardens Demographics study

- Year to year variability in reproduction
- Mast years follow winters with high precipitation and cooler spring and summer temperatures.
- Dormancy

Photo: Bronwyn Taylor

Purpose of Study

This study seeks to gain a broader understanding of the ecology behind the reproduction of *Astragalus microcymbus* by addressing the following questions:

1.) What is the reproductive success of *A. microcymbus* as measured by fruit to flower and seed to ovule ratios, and does reproductive success vary across sites?

2.) Does *A. microcymbus* require pollinators for successful seed set? If so, what are its primary pollinators?

3.) What is the presence of mammal herbivory, insect herbivory, and seed predation?

4.) Is there a soil seed bank and if so, what are its characteristics?

5.) What are the plant community characteristics of the studied sites including: skiff milkvetch density, big sagebrush density, and microhabitat structure.

Experimental Design

2019:

3 sites at Hartman Rocks in the South Beaver Creek Drainage in Gunnison, CO.

- Reproductive success study
- Soil seed bank study

2020:

5 sites at Hartman Rocks in the South Beaver Creek Drainage in Gunnison, CO.

- Reproductive success study
- Pollinator exclusion experiment
- Pollinator observations and IDs
- Soil seed bank study
- Plant community study

Reproductive Success

2019: 50 plants at 3 sites

2020: 30 plants at 5 sites

- Stem, raceme, fruit and flower counts
- Length of longest stem
- Mammal and insect herbivory, seed predation occurrences
- Microhabitat characteristics of plant's location
- In 2019, fruit were collected to make seed counts. Seeds will be tested for viability.

Photo: Bronwyn Taylor

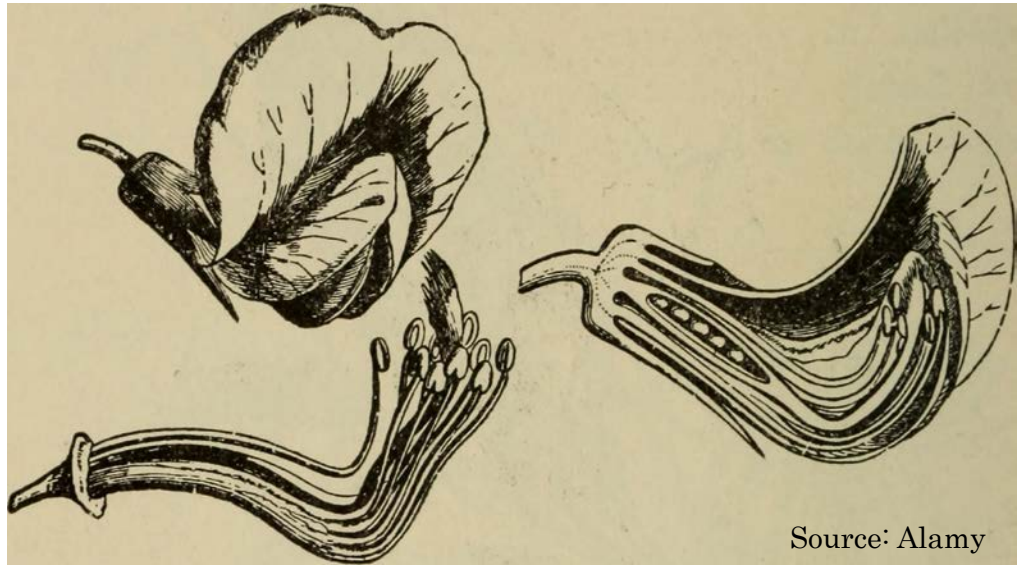
Pollinator Exclusion Experiment

- 30 plants at 3 sites
- One to two racemes bagged per plant
- Racemes were monitored until flowers abscised
- Flowers and fruit counted and recorded

Photo: Bronwyn Taylor

Pollinator Interactions

- Behavior observations of insect visitors
- Collected specimens of insect visitors for identification



Source: Alamy

Ashmeadiella sp.

Photo: Bronwyn Taylor

Soil Seed Bank Study

- 10 plants in November of 2019 and June of 2020 at one site.
- Samples taken at 0.0 m, 0.5 m, and 1.0 m from each plant
- 6.5 by 4.6 cm tin
- Seed present were counted and will be tested for viability.

Photo: Bronwyn Taylor

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Results

- Population survey
- Reproductive success
- Herbivory interactions
- Pollinator exclusion experiment
- Pollinator identification
- Soil seed bank characteristics

Population Survey

Site	Site count	Year	2019 Density (plants per m^2)	2020 Density (plants per m^2)
Dirty Sock 1	315	2019	0.3	0.4
Dirty Sock 2	736	2019	0.74	0.3
S. Beaver Creek	559	2019	0.95	0.55
Yucca	1177	2019	0.76	0.28
Douglas Fir	83	2020	no data	0.33

Reproductive Success

2019:
Exceptionally good reproductive year, high winter and spring moisture.

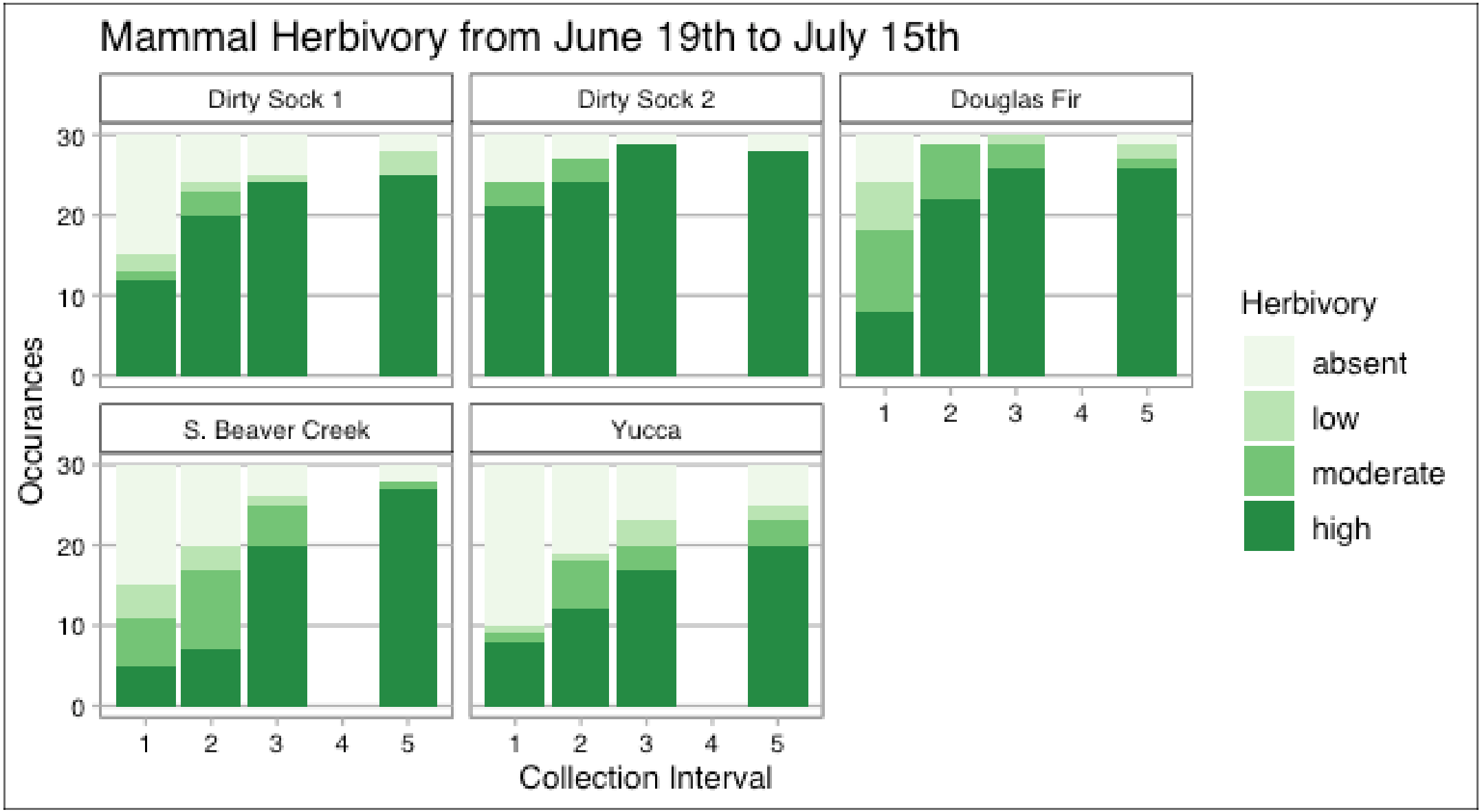
Max flower count made close to 8000
Average counts between 100-1000

2020:
Low reproduction year:

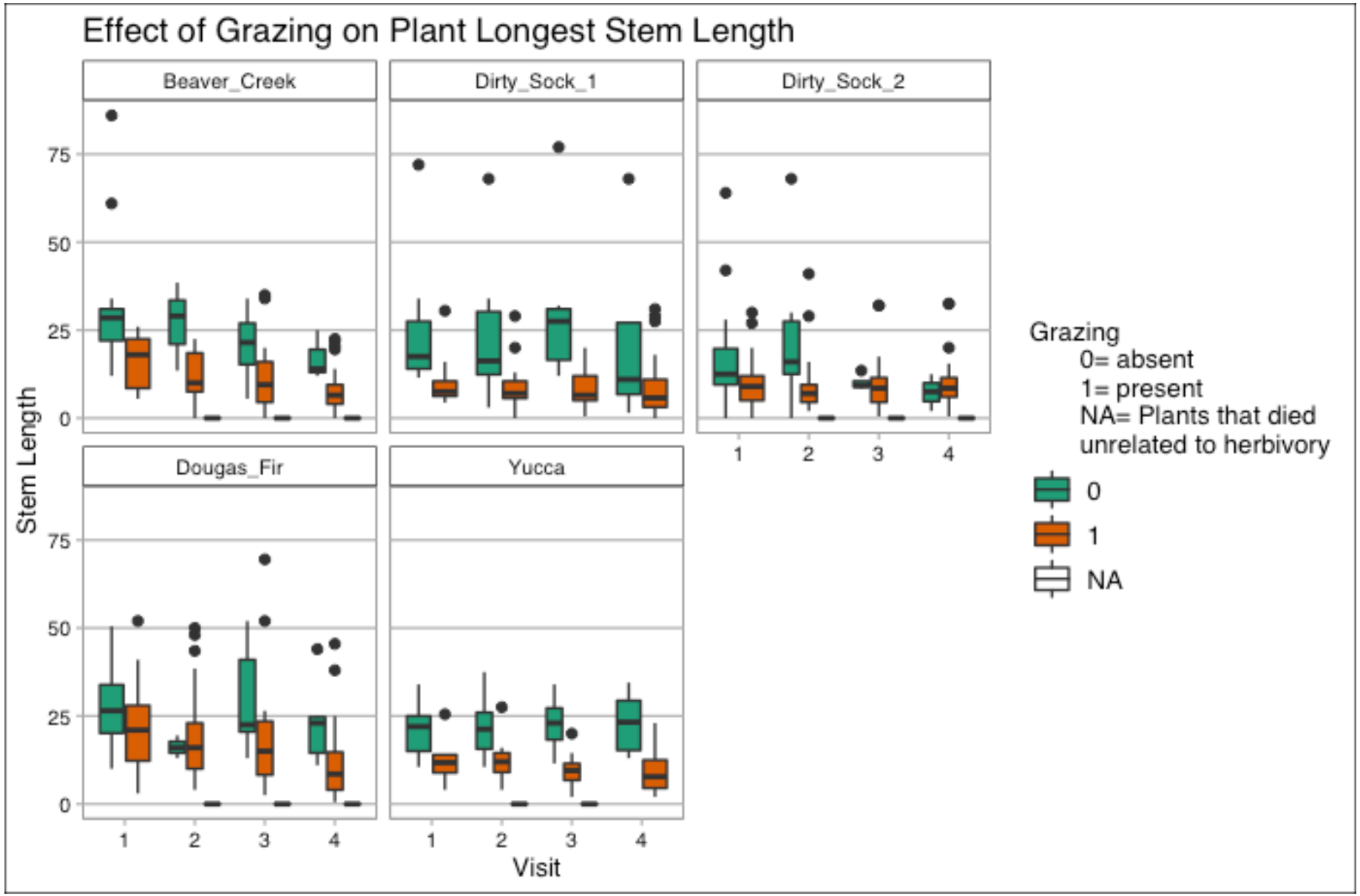
- Rest year after last year's masting
- Dry conditions
- Herbivory

Photos: Bronwyn Taylor

Herbivory Interactions



Herbivory Interactions



Herbivory Interactions

Diagonal cuts- rabbit herbivory

Site	Diagonal cuts
Dirty Sock 1	88%
Dirty Sock 2	78%
S. Beaver Creek	84%
Yucca	83%
Douglas Fir	88%

Photo: Bronwyn Taylor

Mountain Cottontail Rabbits

S. Beaver Creek Site- 8/09/20 around 8:30pm

Photos: Bronwyn Taylor

Pollinator Exclusion Experiment

Site	Plant ID	number of flowers	number of fruit
Dirty Sock 1	# 2	2	0
Dirty Sock 1	# 8	18	0
S. Beaver Creek	# 8	2	0
S. Beaver Creek	# 16	6	1 (aborted)
S. Beaver Creek	# 25	2	0

Photos: Bronwyn Taylor

Order: Hymenoptera
Family: Megachilidae

Ashmeadiella sp.

Photos: Bronwyn Taylor

Order: Hymenoptera
Family: Megachilidae

Hoplitis sp.

Photos: Bronwyn Taylor

Hoplitis sp.

Photo: Bronwyn Taylor

Order: Hymenoptera
Family: Megachilidae

Anthidium sp.

Photos: Bronwyn Taylor

Order: Hymenoptera
Family: Apidae

Ceratina sp.

Photo: Bronwyn Taylor

Order: Hymenoptera
Family: Helictidae

Lasioglossum sp.

Male?

Female?

Photos: Bronwyn Taylor

Order: Lepidoptera
Family: Lyceanidae

Plebejus melissa – Melissa blue

Photos: Bronwyn Taylor

Order: Lepidoptera

Micromoths

Photo: Bronwyn Taylor

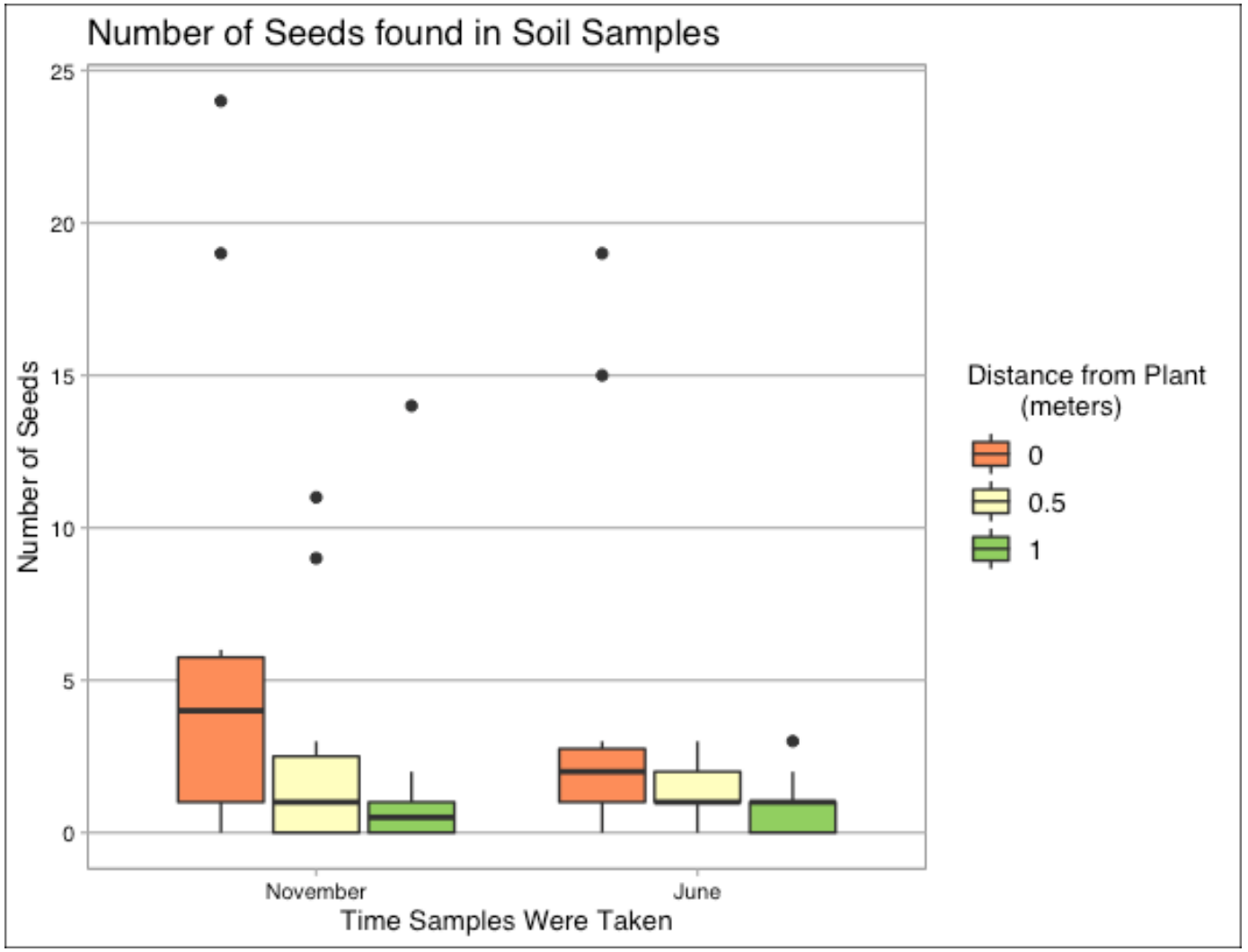
Order: Diptera
Family: Bombyliidae

Geron sp.

Photo: Bronwyn Taylor

Soil Seed Bank Characteristics

Photo: Bronwyn Taylor



Microhabitat Categories

Bare ground

Rocks

Herbaceous understory

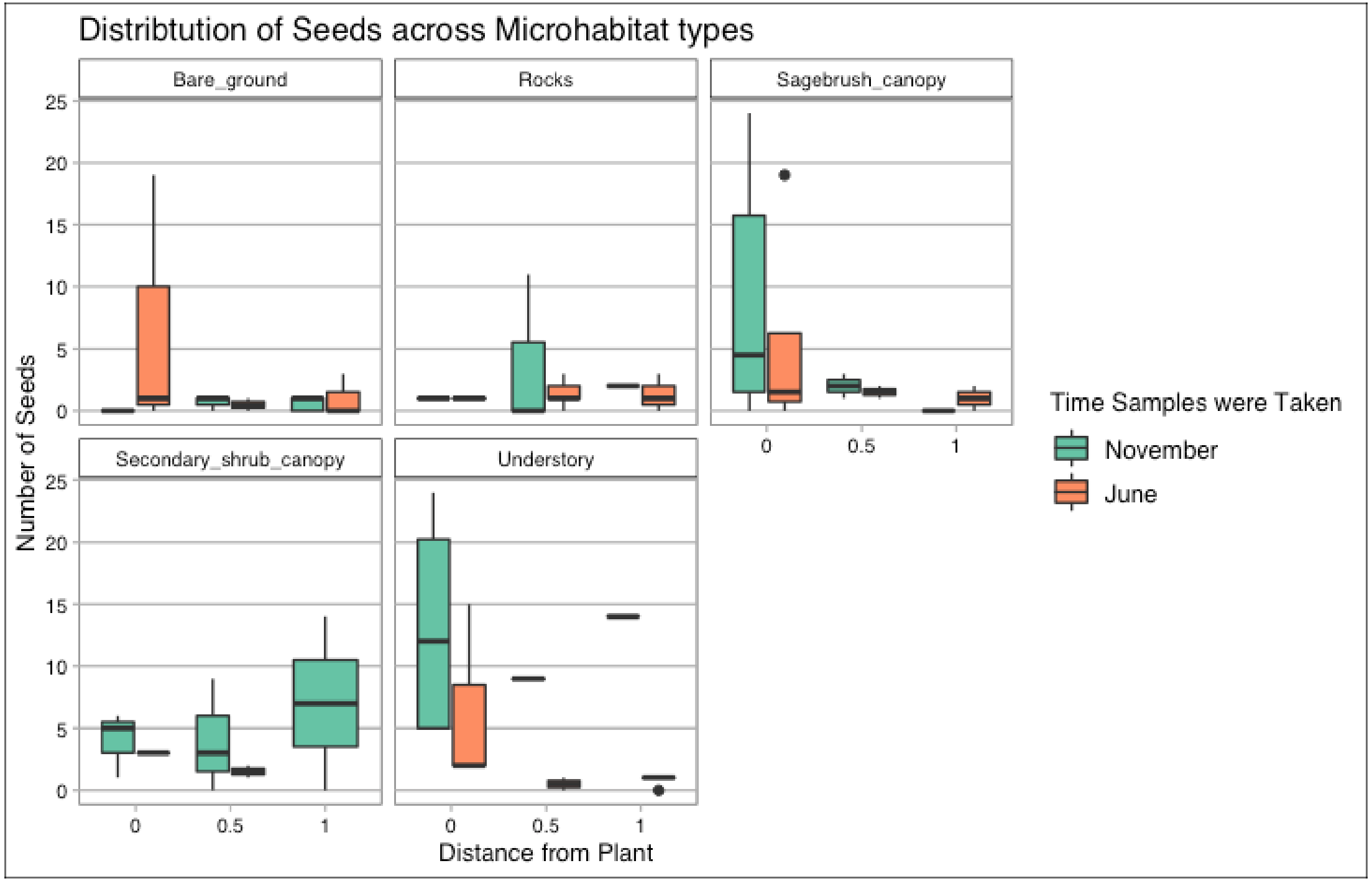
- Perennial grasses
- Forbs
- Prickly pear
- Star moss

Big sagebrush canopy

- Big sagebrush canopy
- Dead big sagebrush

Secondary shrub canopy

- Yucca
- Bitterbrush
- Rabbit brush


Distribtution of Seeds across Microhabitat types
Bare_ground
Rocks
Sagebrush_canopy
Secondary_shrub_canopy
Understory
Number of Seeds
0
5
10
15
20
25
0
0.5
1
Distance from Plant
Time Samples were Taken
November
June

Next Steps

- Sagebrush density and plant community characteristics of sites
- Seed to ovule ratios from 2019
- Seed viability testing
- Further soil seed bank collections this November

Photo: Bronwyn Taylor

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