The use of open top chambers to understand the response of two rare alpine species to increased warming

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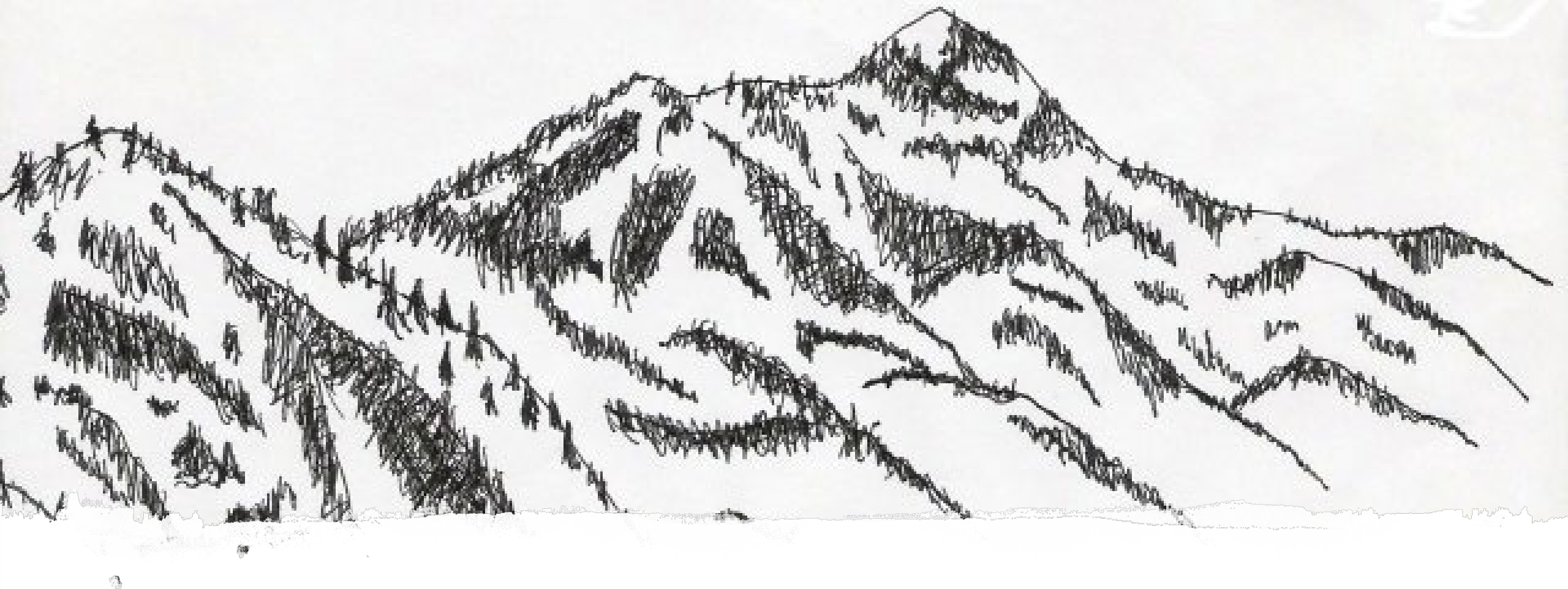


Alpine plant species

- Vulnerable to climate change
- Increased temperatures, reduced snowfall, earlier snowmelt

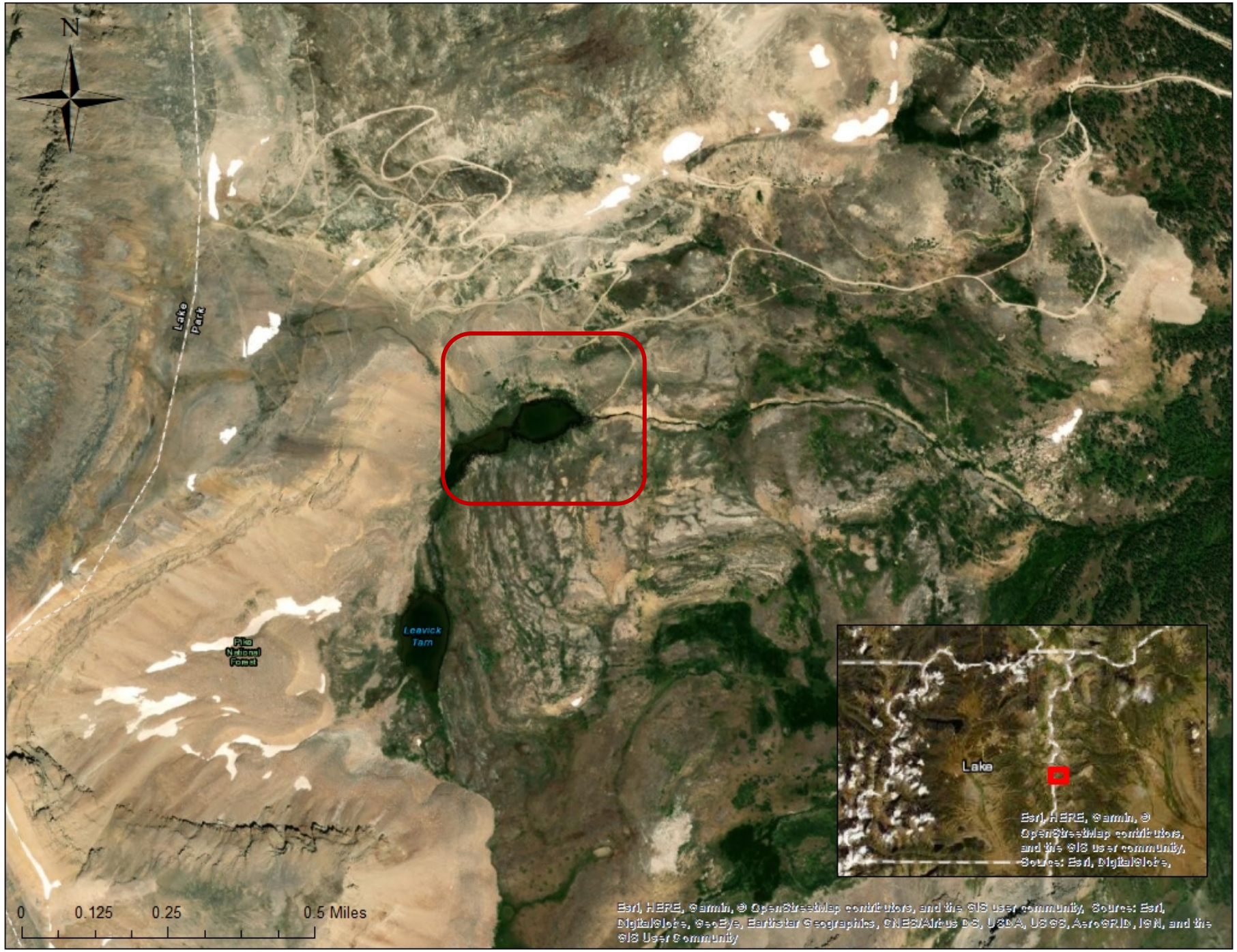
Rare plant species

- Specific conditions for survival, reproduction, and recruitment
- Small populations, limited range
- Low levels of genetic diversity

Rare alpine plants could be some of the most at-risk species from climate change

Study Overview

- Two rare species: *Physaria alpina* and *Saussurea weberi*
- Horseshoe Mtn, outside of Fairplay
- Open top chambers (OTCs) simulate projected climate warming – used in the International Tundra Experiment
- 5-year study
- 8 plots for each species: 4 control and 4 warmed
- Data collected within each plot:
  1. Height/width, flower number, and fruit number
  2. Plant community composition
  3. Phenology


N
Lake Park
Leavick Tarn
Pike National Forest
Lake
Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user community, Source: Esri, DigitalGlobe,
0
0.125
0.25
0.5 Miles
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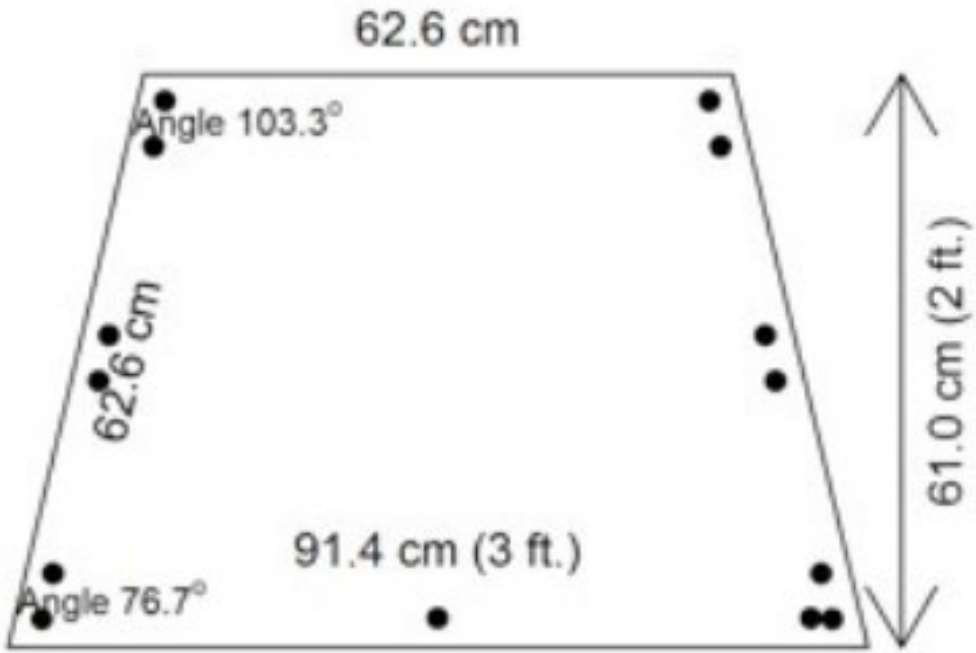
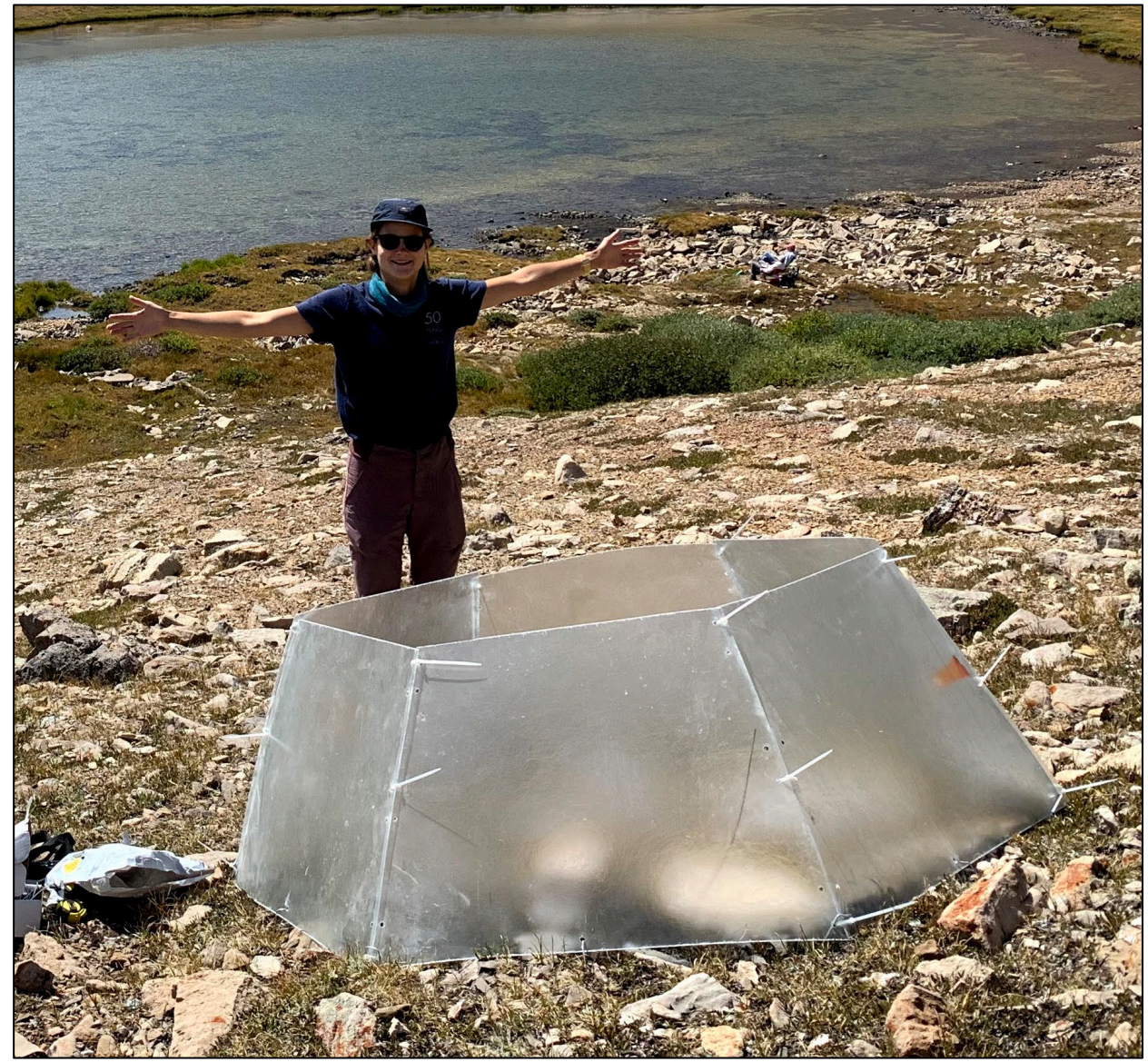
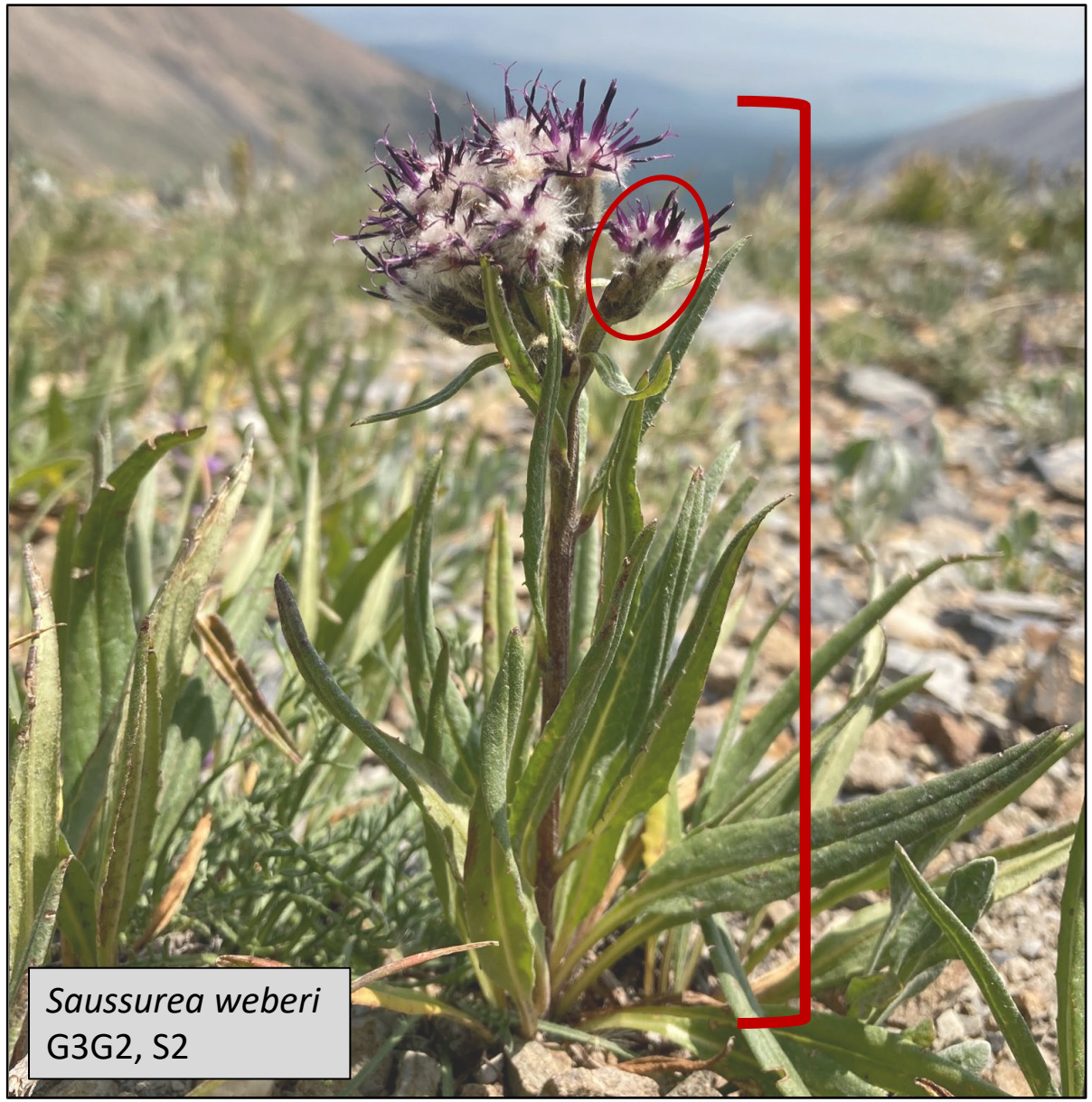
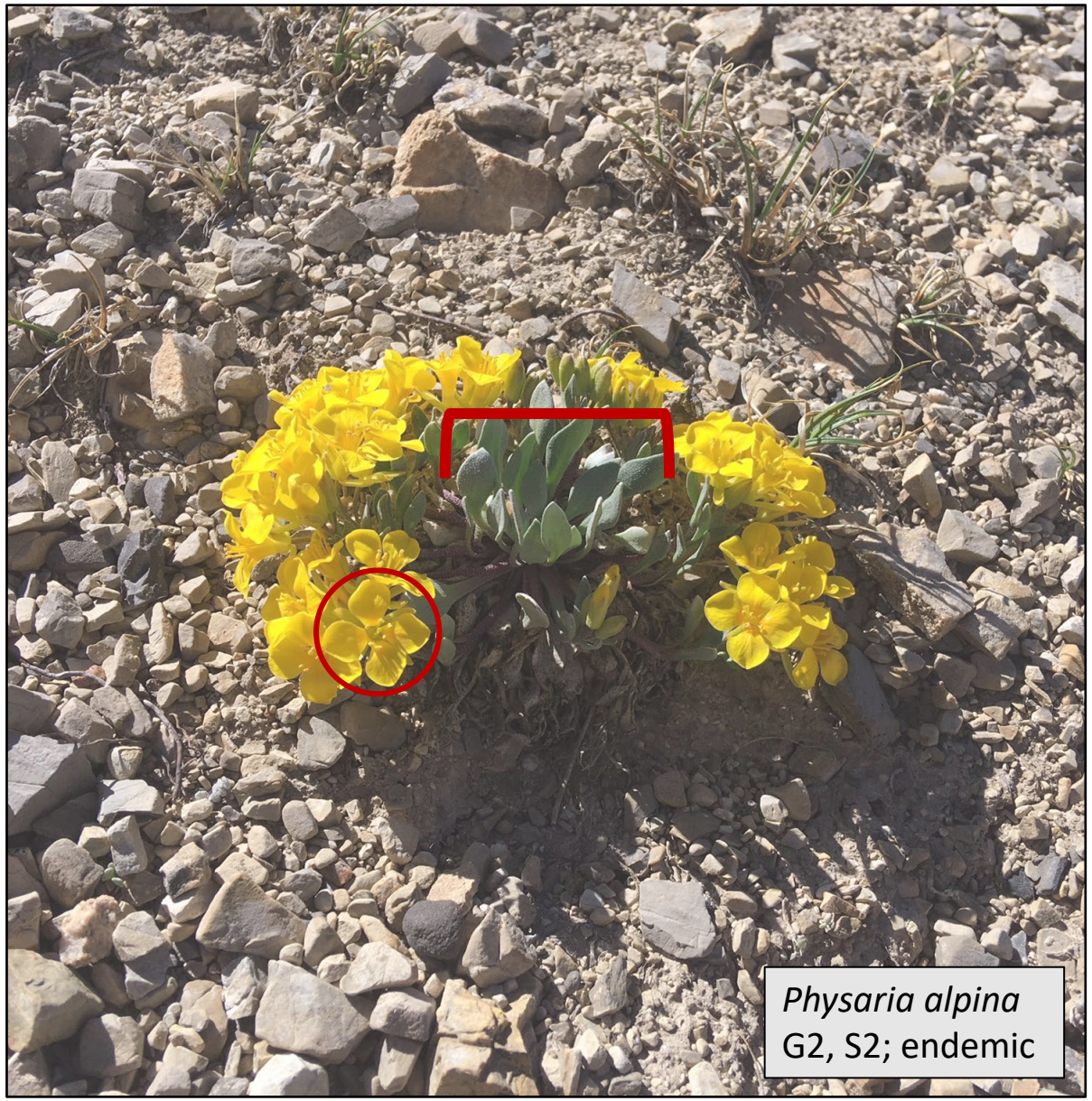

62.6 cm
Angle 103.3°
62.6 cm
61.0 cm (2 ft.)
91.4 cm (3 ft.)
Angle 76.7°




Saussurea weberi
G3G2, S2

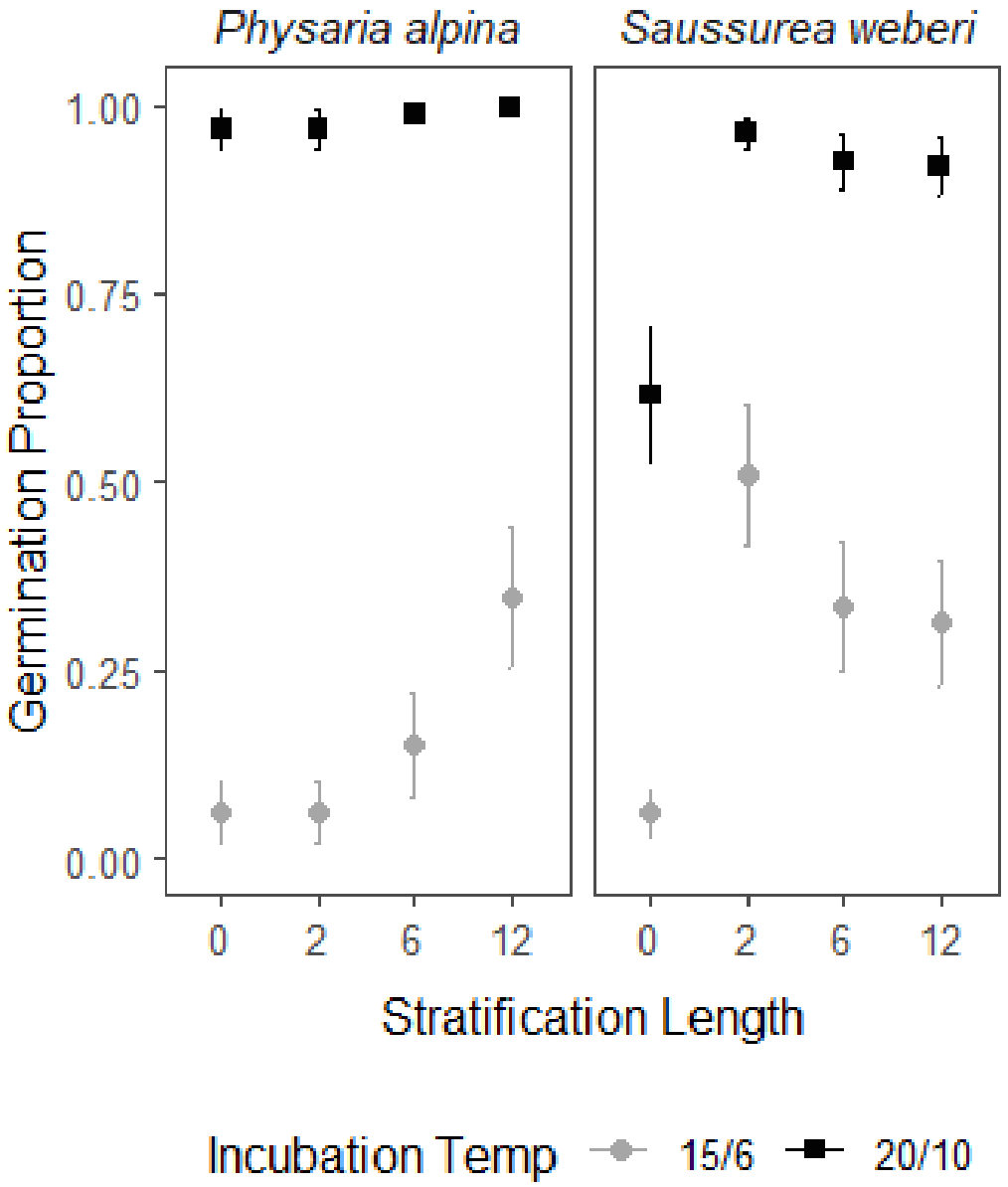

Physaria alpina
G2, S2; endemic

Climate Data

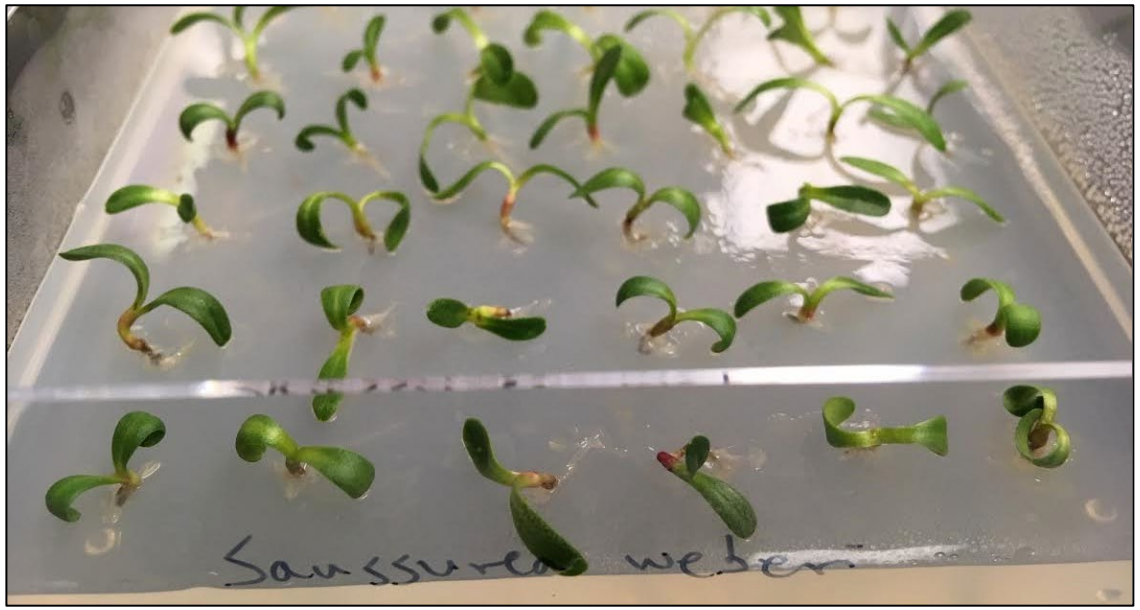
- Data loggers record:
  - temperature
  - relative humidity
  - dew point
  - heat stress index
- Site/plot characteristic measurements:
  - mean annual temperature/precipitation
  - elevation
  - slope/aspect
  - soil type

Seed Study

- Seed collection and germination experiments
  - Collected from control and OTC plots
  - Previously determined germination conditions
  - How does increased warming influence recruitment and germination requirements?


Physaria alpina
Saussurea weberi
Germination Proportion
1.00
0.75
0.50
0.25
0.00
0
2
6
12
Stratification Length
Incubation Temp
15/6
20/10


Physaria alpina


Saussurea weberi

North American Botanic Gardens Strategy for Alpine Plant Conservation

2. Conserve Plants and Habitats

- 5. Protect 50% of Important Alpine Plant Areas
- 6. Conserve 25% of all alpine plants *in situ*
- 7. Conserve 60% of all threatened alpine plants *in situ*
- 8. Ensure 60% of all alpine plants conserved *ex situ*
- 9. Ensure 75% of all threatened alpine plants conserved *ex situ*

Conclusions

- Study showed that alpine temps in Colorado increased 1.2°C from 1983-2007

- What are the impacts and how do we prioritize conservation?

- In situ and ex situ methods

Acknowledgements

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Thank you! Questions?