

# Does frozen storage change the germination performance of native forb species from the Southwest U.S.?

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# A Brief History of Seed Banking



Agriculture





Agriculture



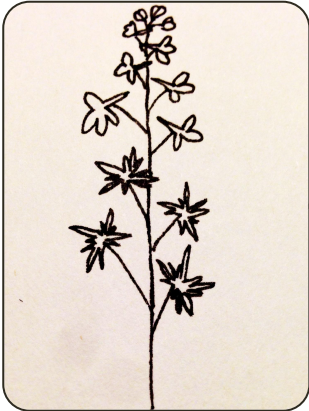
Conservation



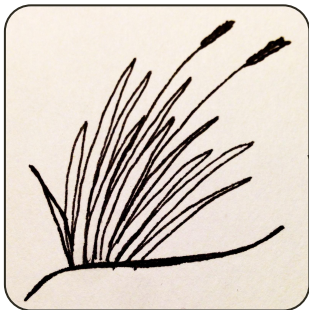




Agriculture



Conservation



Restoration





MILLENNIUM  
SEED BANK  
PARTNERSHIP

Kew

National Center for  
Genetic Resources  
Preservation

SEEDS



OF SUCCESS



CHICAGO BOTANIC GARDEN



M·A·R·S·B

Mid-Atlantic Regional Seed Bank



# Study Location

- Southwest U.S. – Arizona, Colorado, New Mexico, Utah
- Large-scale restorations
- Limited availability of regional native plant material





# Species Selection

- 7 common forb species\*
- Widespread throughout the Southwest
- High priority species for use in large-scale restorations
- Little information about dormancy and germination
- Physiological and combinational dormancy
- Orthodox

\*Selected from a list of species created by the Colorado Plateau Native Plant Program and collaborators



# Seed Banks

- Low moisture and temperature ( $-20^{\circ}\text{C}$  or below)
- Preservation of seeds for hundreds of years
- *Ex situ* collections in case of extinction or population destruction







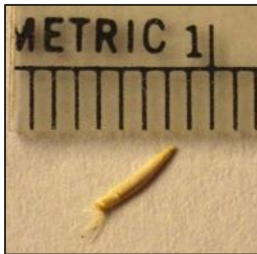
**Action 2.2.1** Conduct seed germination studies and develop seed testing protocols for key restoration species.



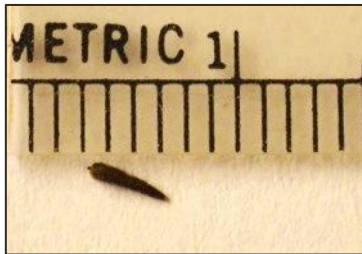
**Action 2.2.2** Develop storage guidelines for restoration species to improve maintenance of seed viability.

# Hypotheses

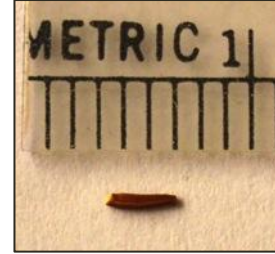
1. Southwestern native forb species will be amenable to seed banking conditions (i.e., drying and storing at sub-zero temperatures)
2. Germination response (proportion and rate) will not differ between non-frozen and frozen seeds
3. Seed bank storage effects will not differ within species



*Dieteria canescens*  
hoary tansyaster



*Heliomeris multiflora*  
showy goldeneye



*Packera multilobata*  
lobeleaf groundsel



*Cleome serrulata*  
Rocky Mountain beeplant



*Penstemon comarrhenus*  
dusty beardtongue



*Plantago patagonica*  
woolly plantain

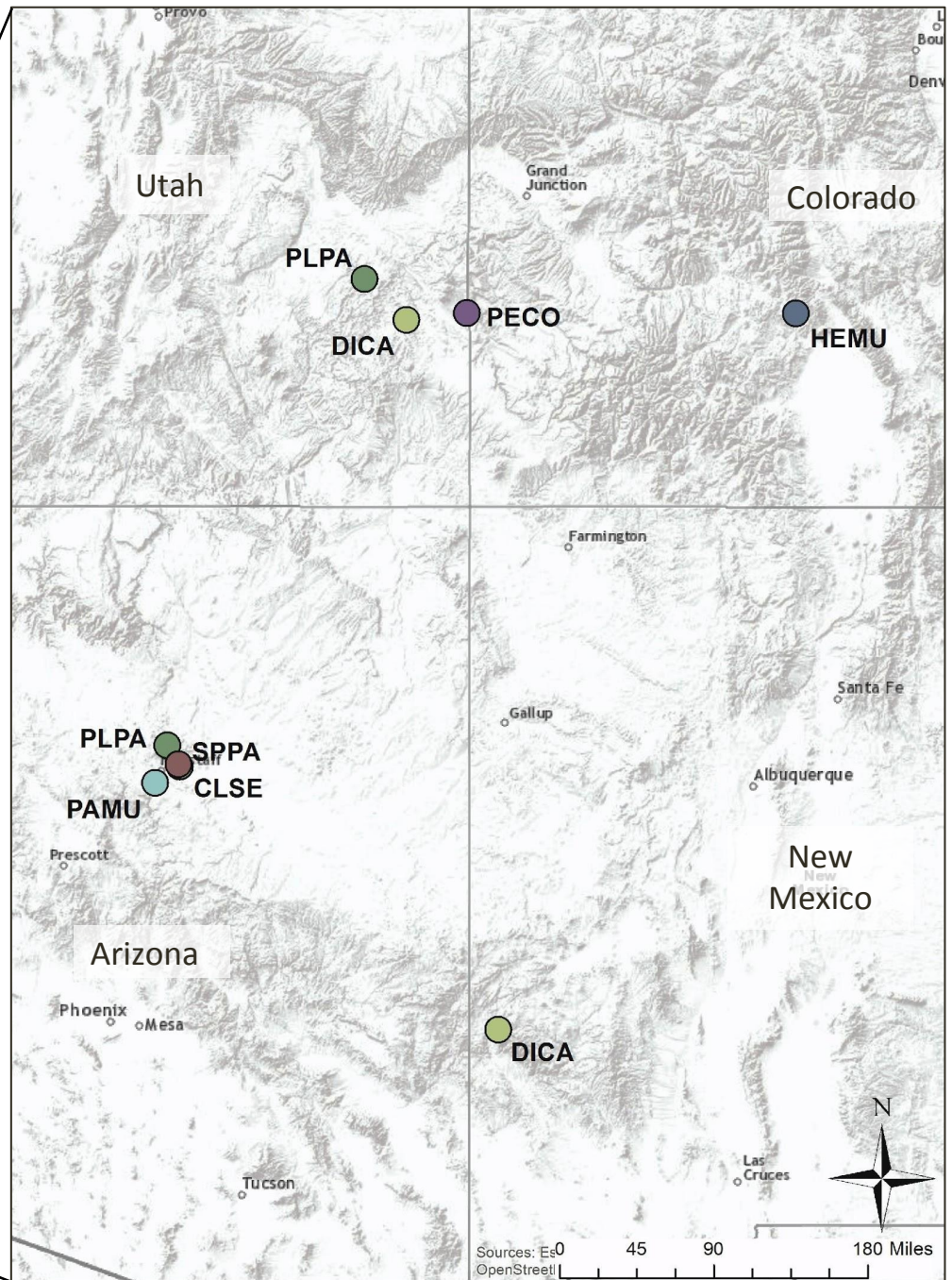


*Sphaeralcea parvifolia*  
small-leaf globemallow



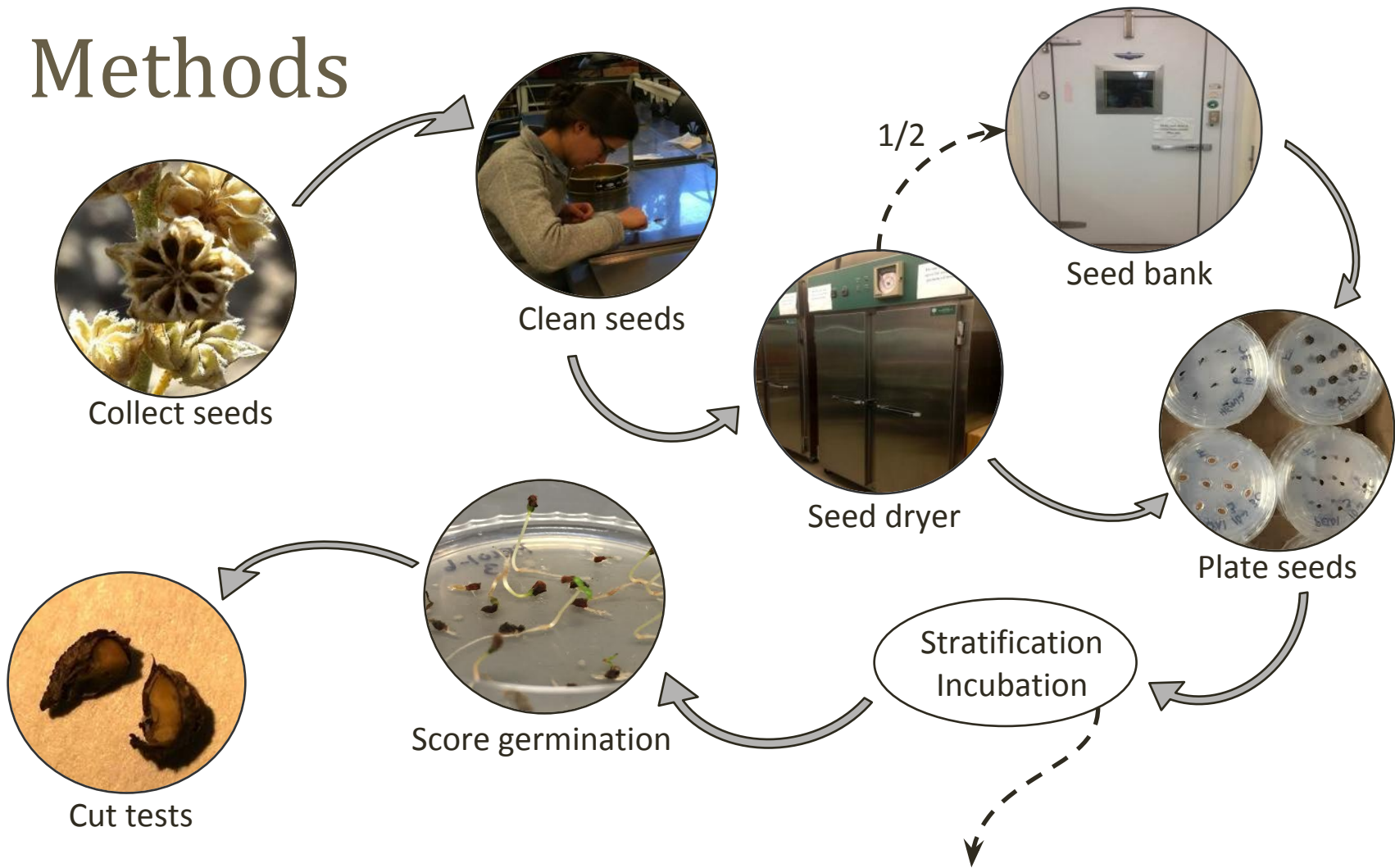
# Seed Collection

- Summer and fall 2015
- 9 populations
- Seeds of Success protocols

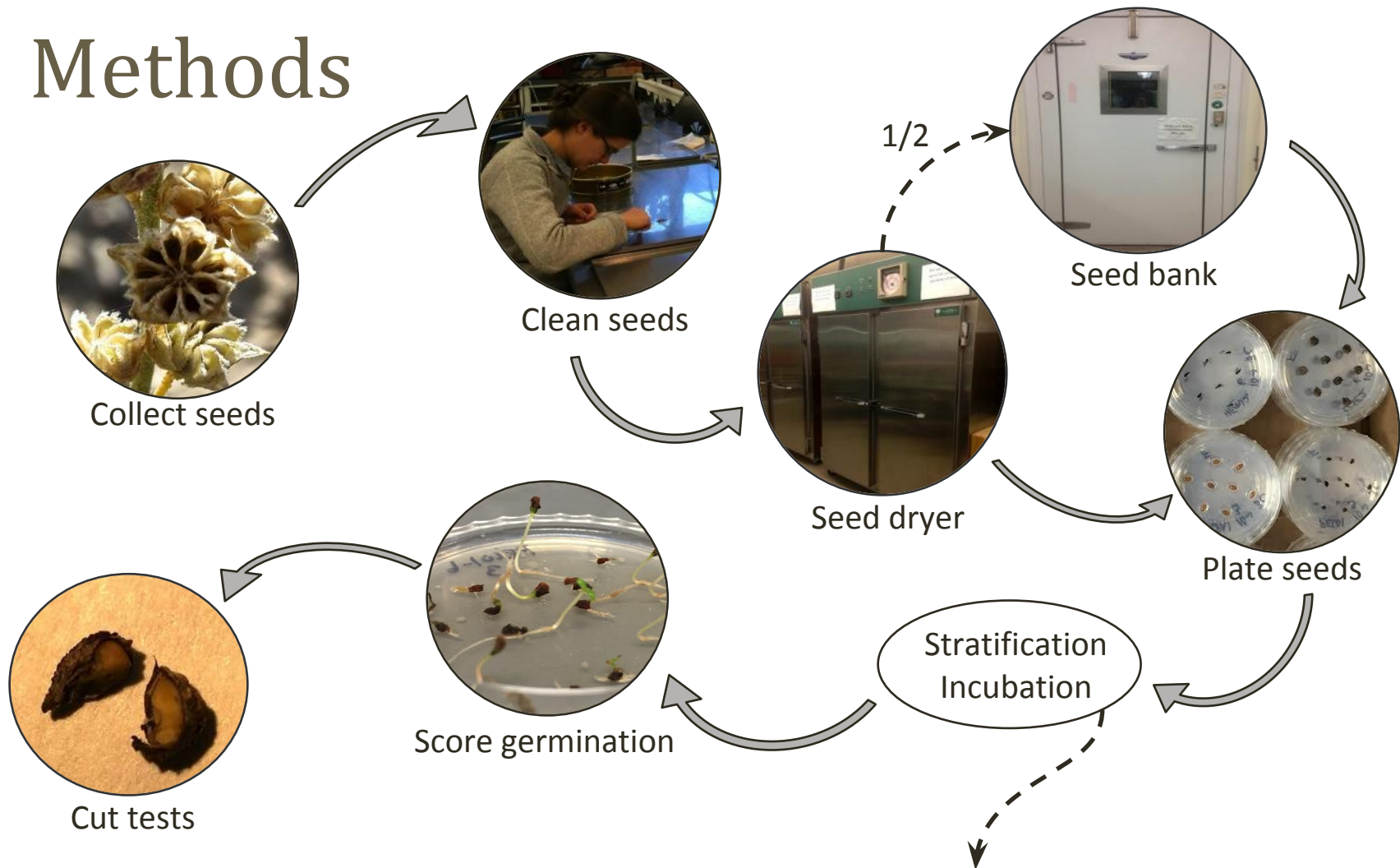




# Methods



# Methods



No stratification

2 weeks  
(3, 6, 9°C)

4 weeks  
(3, 6, 9°C)

6 weeks  
(3, 9°C)

8 weeks  
(3°C)

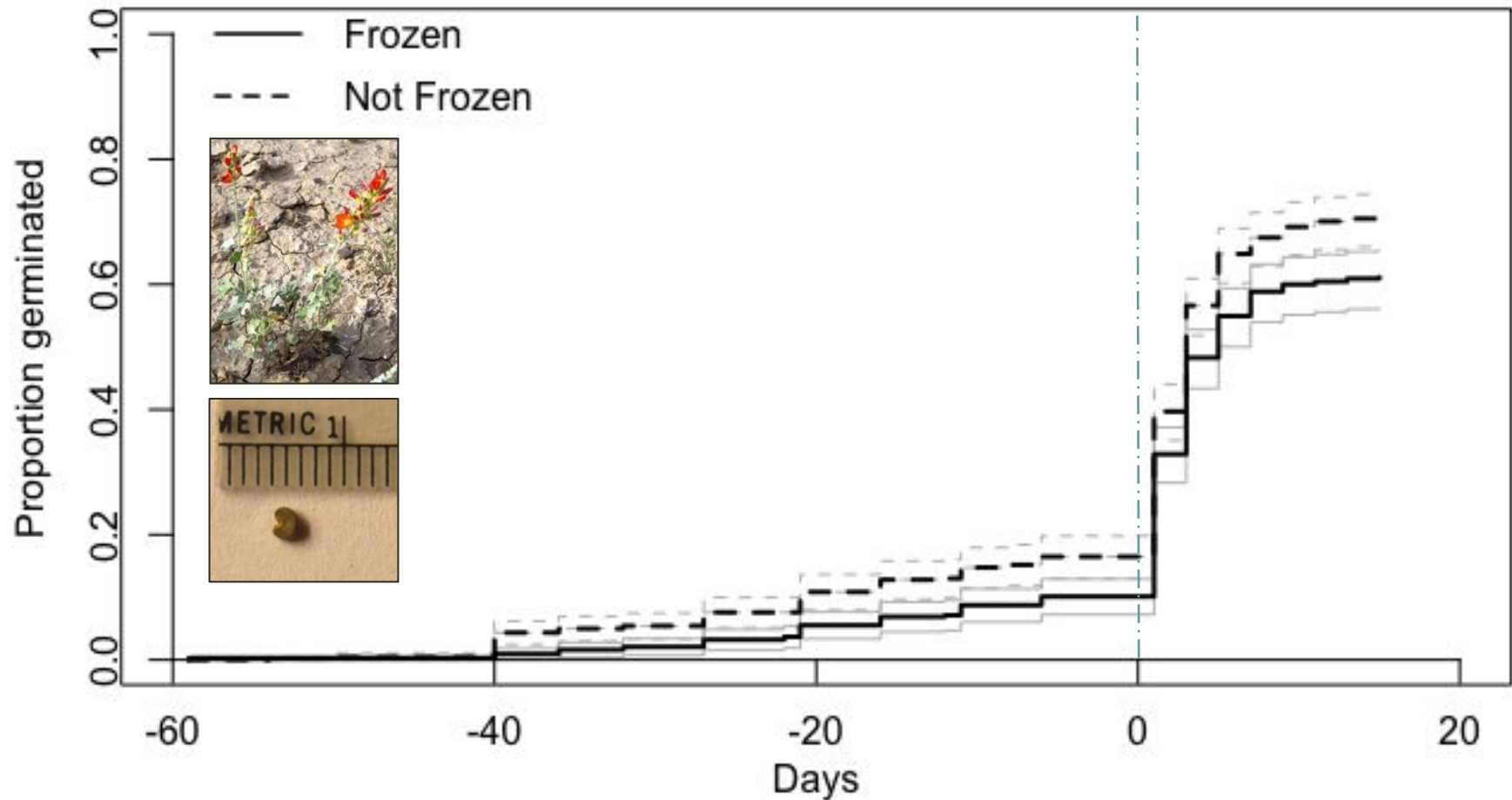
10 weeks  
(3°C)

Incubation

20/10°C

25/15°C

# *Sphaeralcea parvifolia* shows differences between non-frozen and frozen seeds

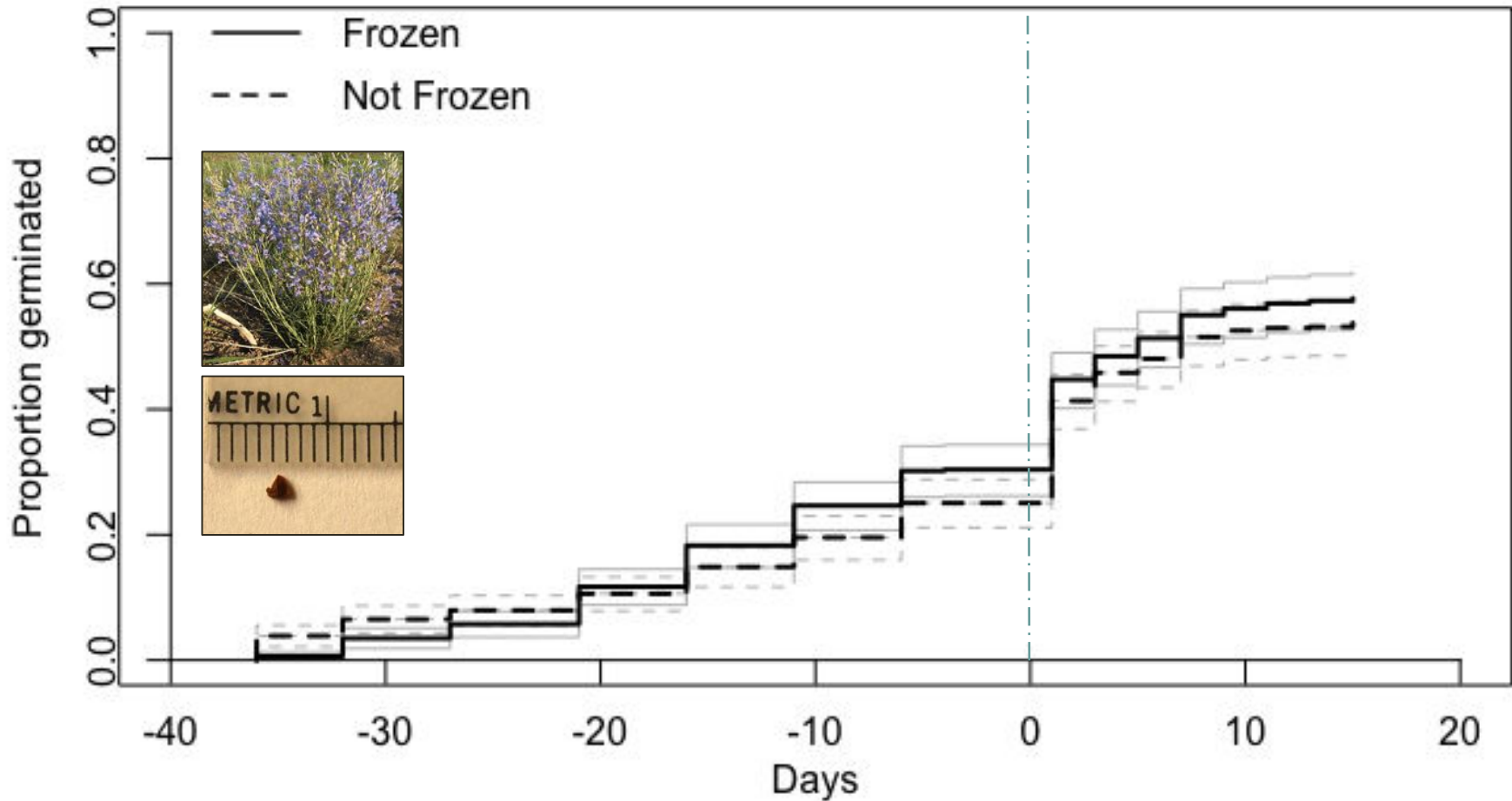


All treatments shown

Cox p-value = 0.001



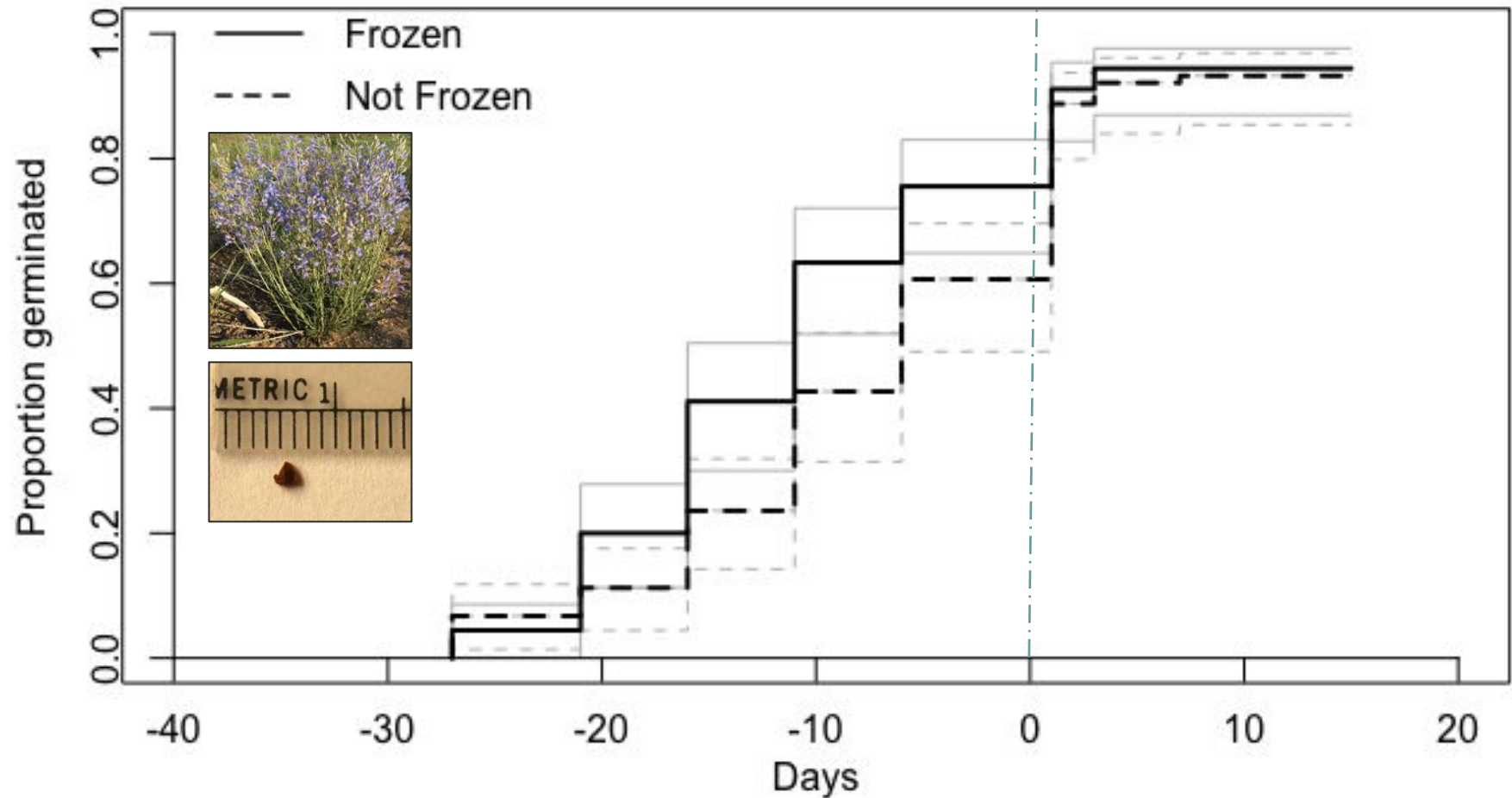
# Rate DOES NOT differ for *Penstemon comarrhenus*



All treatments shown

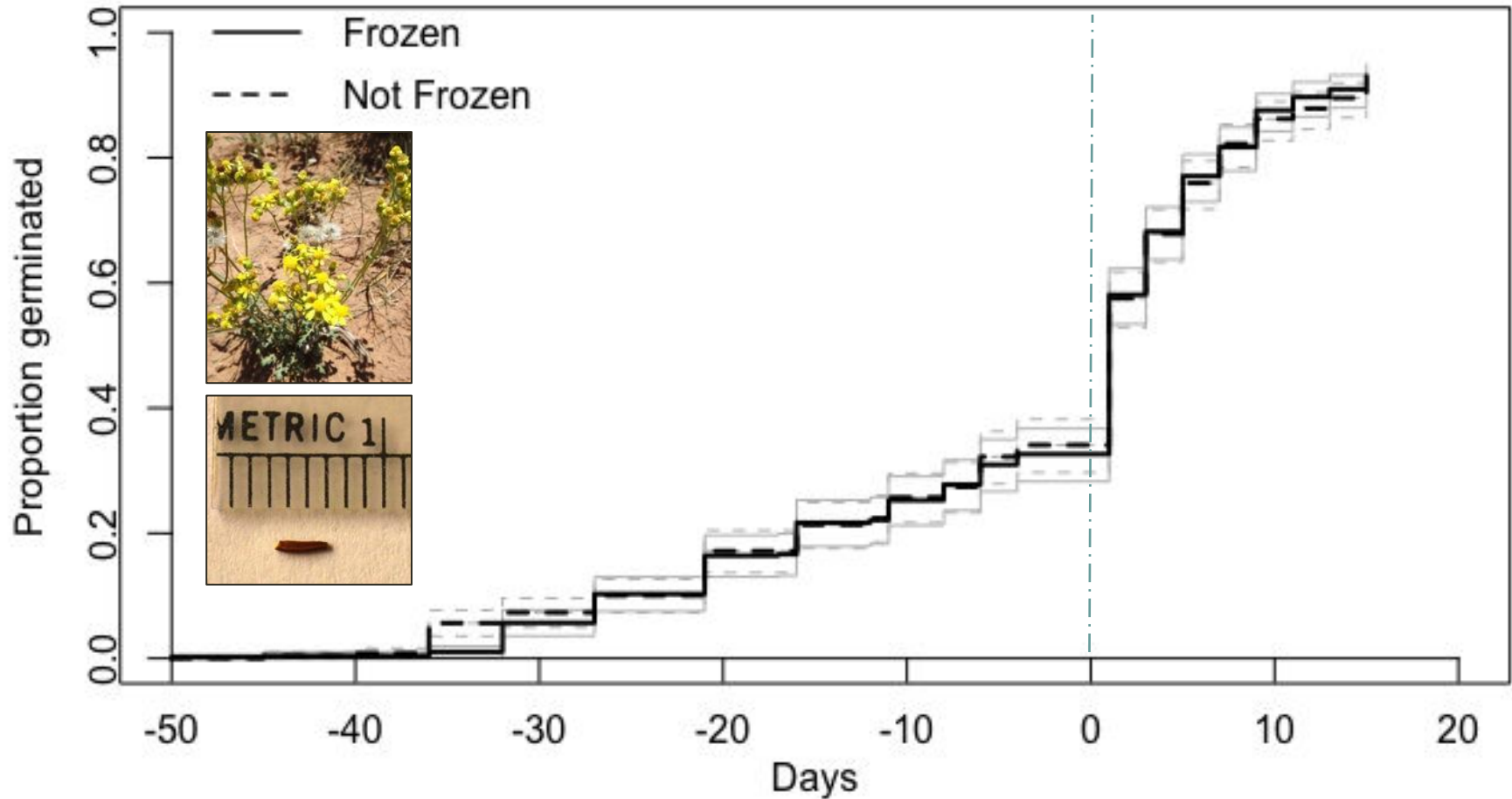
Cox p-value = 0.18

# Rate DOES differ in 10- and 8-week treatments



Cox p-value = 0.05

# *Packera multilobata* shows no difference

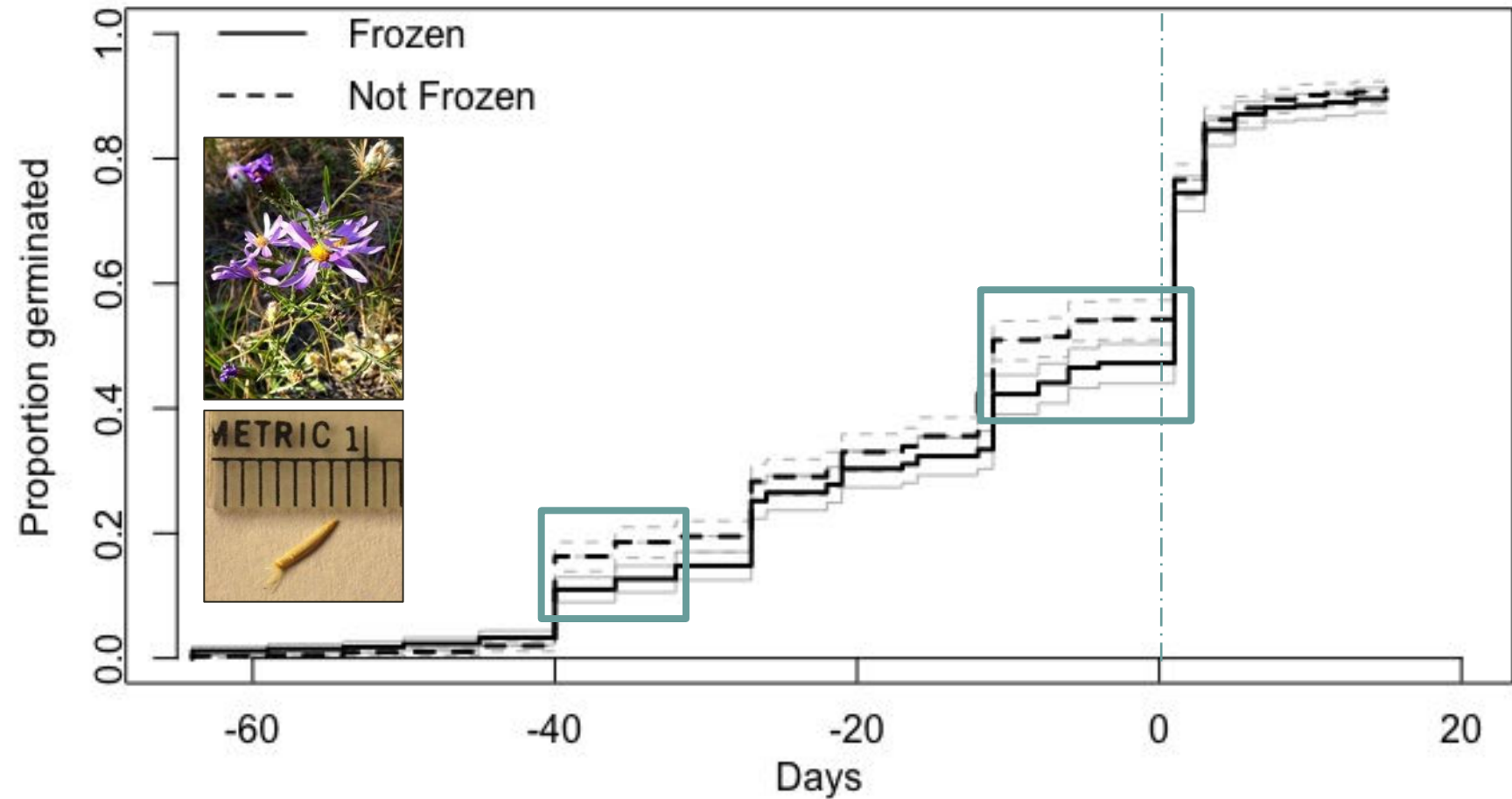


All treatments shown

Cox p-value = 0.58



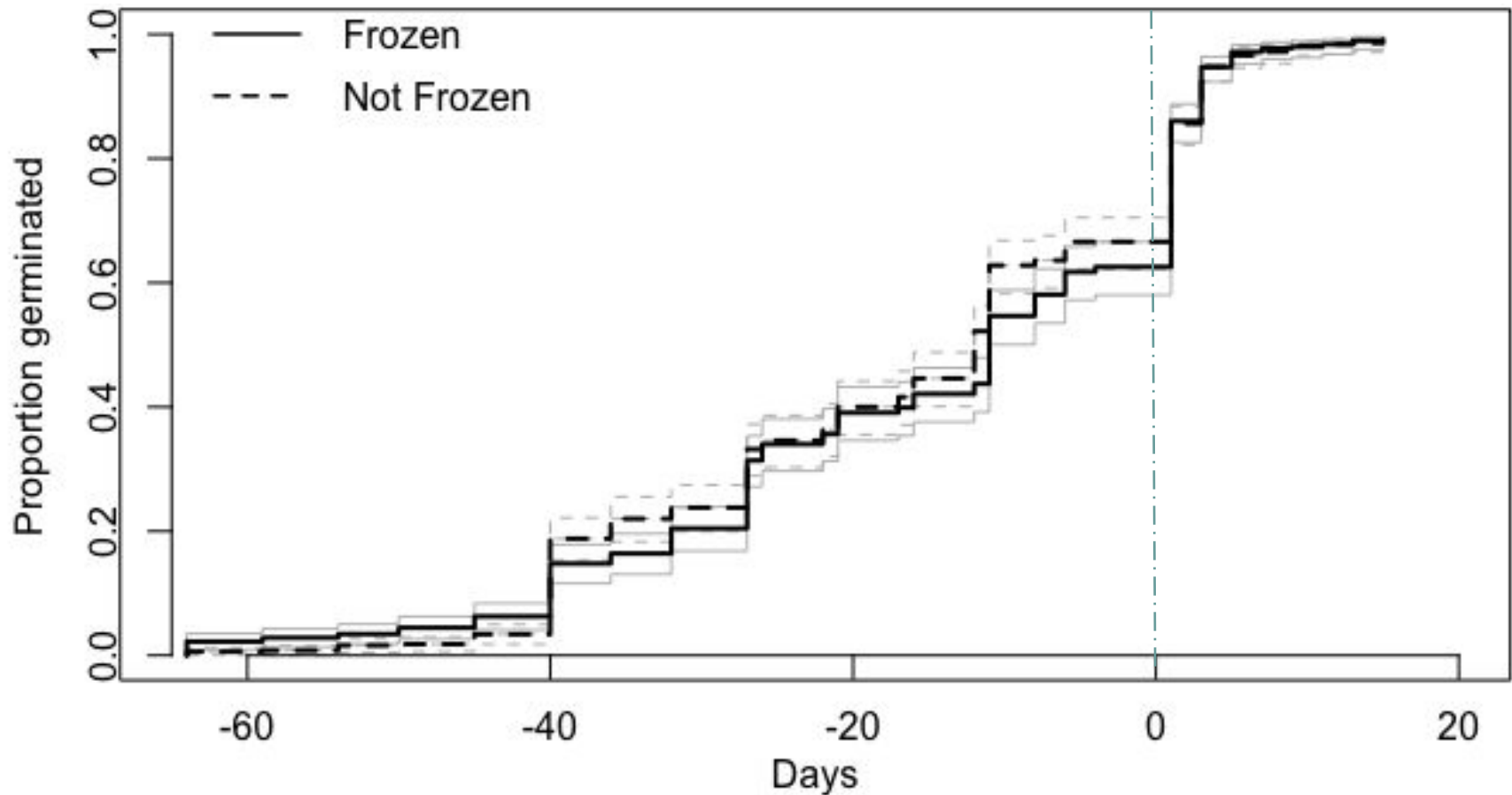
# *Dieteria canescens* shows difference during stratification and in rate



All treatments shown

Cox p-value = 0.03

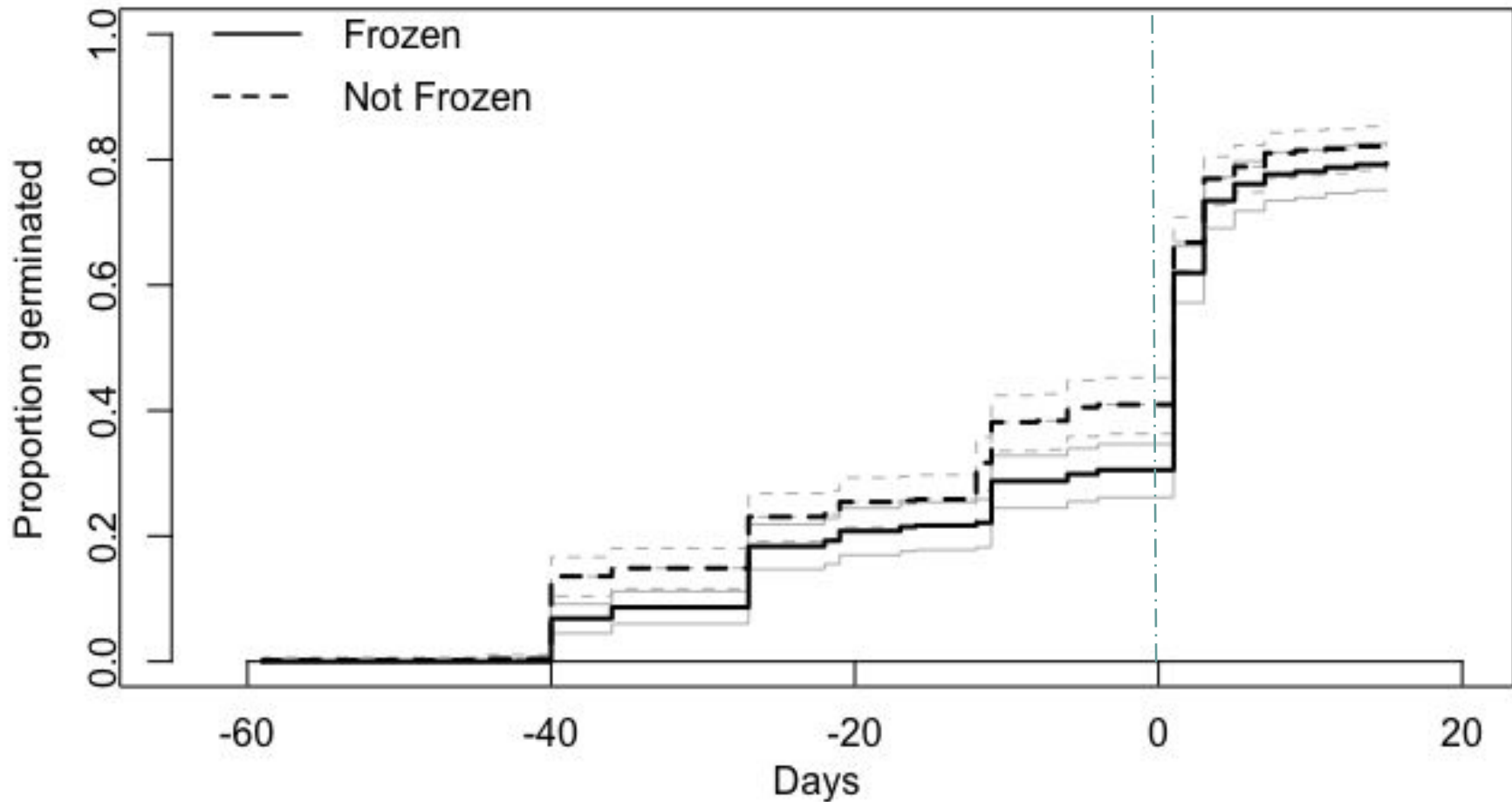
# *Dieteria canescens* Mogollon population shows no difference in rate



All treatments shown

Cox p-value = 0.49

# *Dieteria canescens* San Juan population shows difference in rate



All treatments shown

Cox p-value = 0.03



Species	Pop	No stratification		Monsoon		Short winter		Long winter	
		Cool	Warm	Cool	Warm	Cool	Warm	Cool	Warm
<i>Cleome serrulata</i>	UT								
	AZ								
	NM								
<i>Dieteria canescens</i>	UT1								
	UT2								
	AZ								
	NM								
<i>Heliomeris multiflora</i>	CO								
	AZ								
	NM								
<i>Heterotheca villosa</i>	UT								
	AZ								
	NM								
<i>Machaeranthera tanacetifolia</i>	UT1								
	UT2								
	NM4								
	NM5								
<i>Packera multilobata</i>	UT1								
	AZ								
<i>Penstemon comarrhenus</i>	UT1								
	UT2								
<i>Plantago patagonica</i>	CO								
	UT1								
	AZ								
	NM								
<i>Sphaeralcea parvifolia</i>	UT								
	AZ								

Germination  
Percentage

0-20%

20-40%

40-60%

60-80%

80-100%

# Summary

1. Species are amenable to seed banking



**TRUE**

2. Germination does not differ after freezing



**FOR MOST SPECIES**

3. Effects do not differ within species



***DIETERIA CANESCENS*  
SHOWS DIFFERENCE IN  
RATE**

# Seed bank for restoration!

- All species have orthodox seeds and are amenable to seed banking
- Dormancy and germination largely unchanged following seed bank storage
- Effects were most pronounced during stratification for most species
- Understanding early life stages is critical for restorations now and in the future



**Action 2.2.1** Conduct seed germination studies and develop seed testing protocols for key restoration species.



**Action 2.2.2** Develop storage guidelines for restoration species to improve maintenance of seed viability.



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CHICAGO BOTANIC GARDEN

natural  
areas  
association

  
NORTHWESTERN  
UNIVERSITY





# Questions?

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This and additional presentations available at <http://nativeseed.info>

