

Effective Methods of Regenerating Whitebark Pine Through Direct Seeding



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Intro – Drawbacks to Current Methods

- Expensive
- Labor Intensive
- Time Consuming



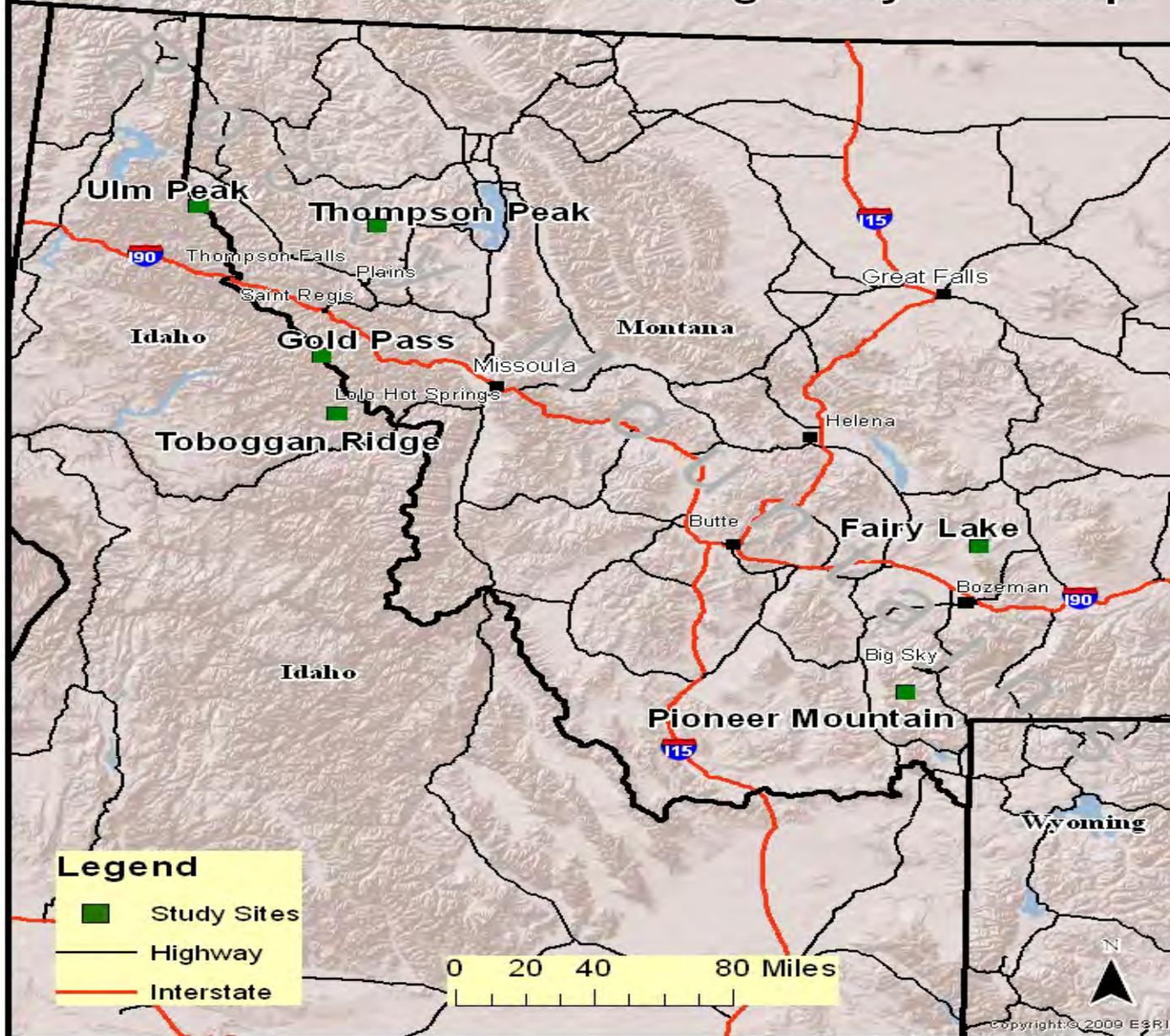
Intro – Main Objectives

- 1. Investigate what treatments (if any) are most effective at increasing germination of directly sown seeds
- 2. Investigate what treatments (if any) are most effective at increasing survival of germinants from directly sown seeds.
- 3. Investigate if caging affects germination of directly sown seeds and survival of germinants from directly sown seeds.

Intro – Main Objectives

- n 4. Compare long term survival of directly sown seeds versus long term survival of outplanted nursery grown seedlings.
- n 5. Compare germination and survival data of directly sown seeds in seed caches versus non-cached or individually directly sown seeds.
- n 6. Investigate what effect (if any) surface and subsurface soil temperatures have on the survival of germinants from directly sown seed.

Whitebark Pine Direct Seeding Study Area Map



Single Site



5 Blocks

Block 1



Block 2



Block 3

Block 4

Block 5

Single Block

(20 Seeds Per Treatment)

Control:Cage
Stratification
Scarification + Stratification
Stratification:Cage
Control
Scarification:Cage
Scarification + Stratification:Cage
Scarification



Site Installation and Data Collection

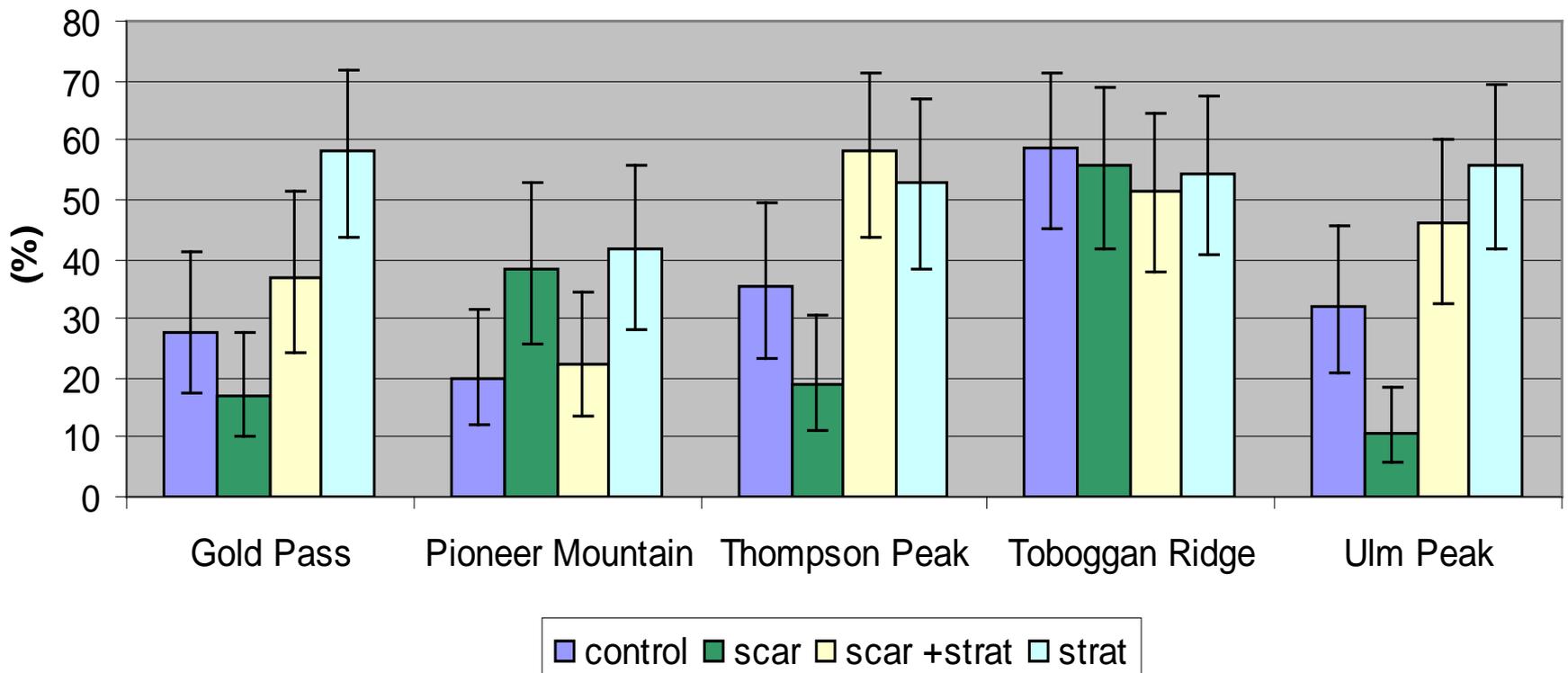
- 2009 Installations – Gold Pass, Thompson Peak, Ulm Peak, Fairy Lake
- 2010 Installations – Pioneer Mountain, Toboggan Ridge
- Data collected twice a year

Data Analysis

- Logistic Regression
 - Step by step exclusion of terms from a saturated model
 - Drop in deviance Chi-squared tests
 - Created final models for analyses

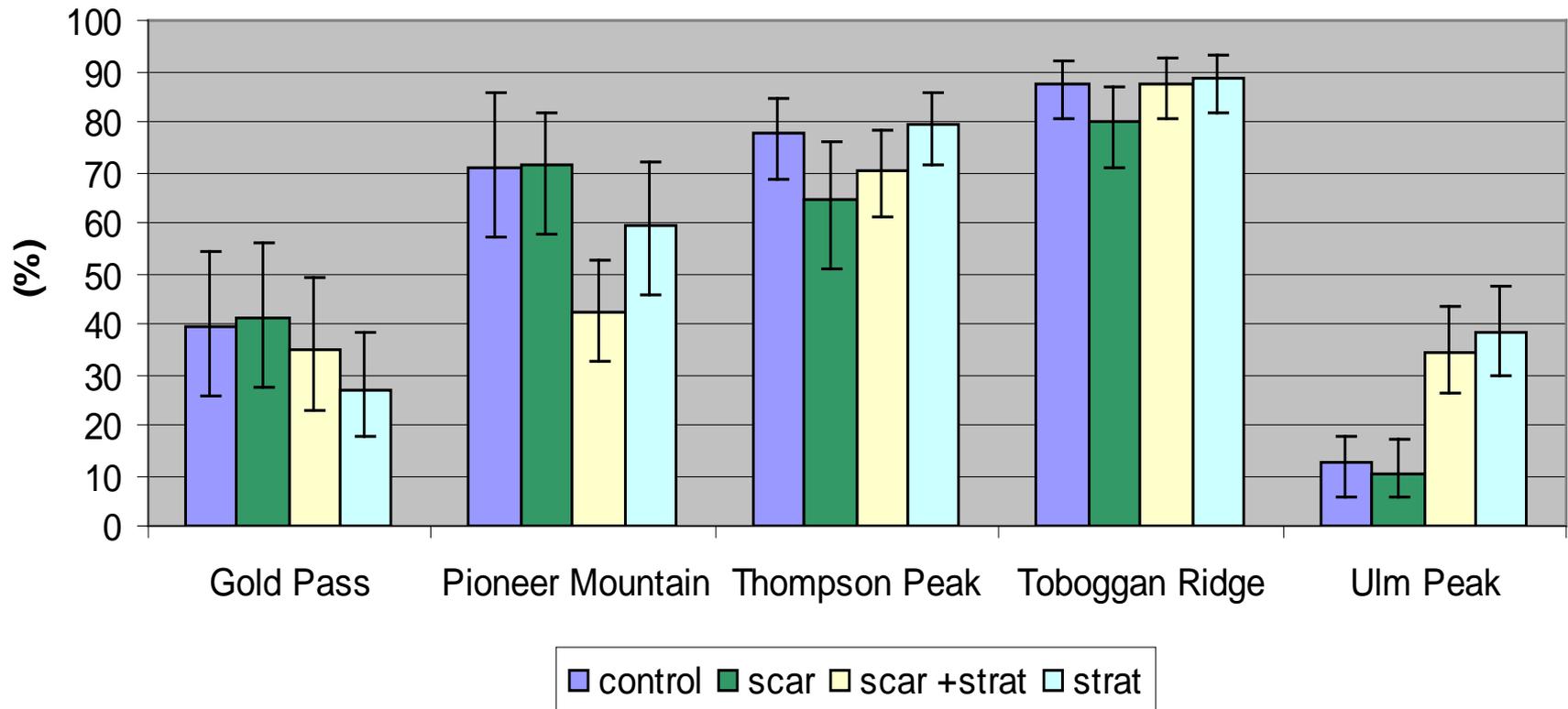
Germination Results

Germination Estimates and 80% CI's



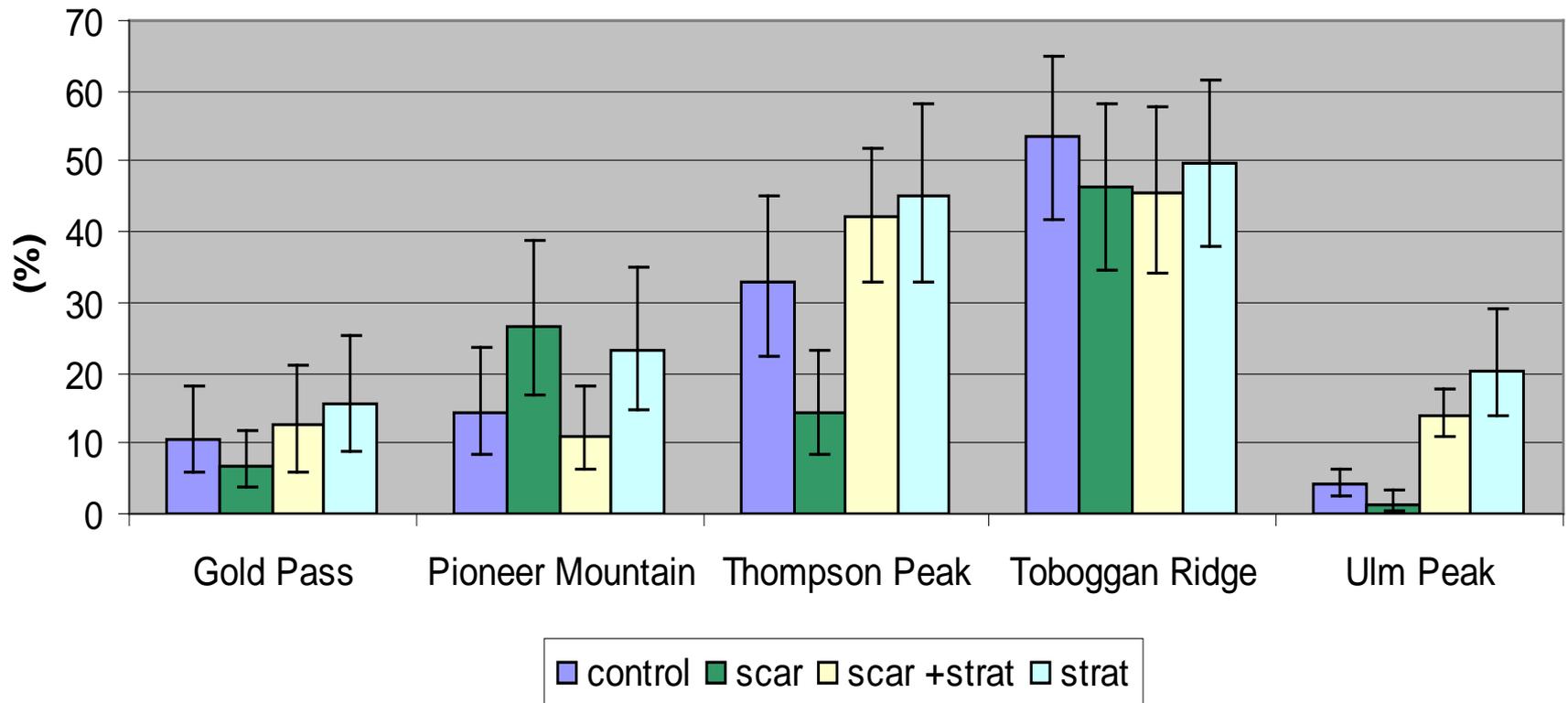
Survival Results

Survival Estimates and 80% CI's



Germinated and Survived Results

Germinated and Survived Estimates and 80% CI's

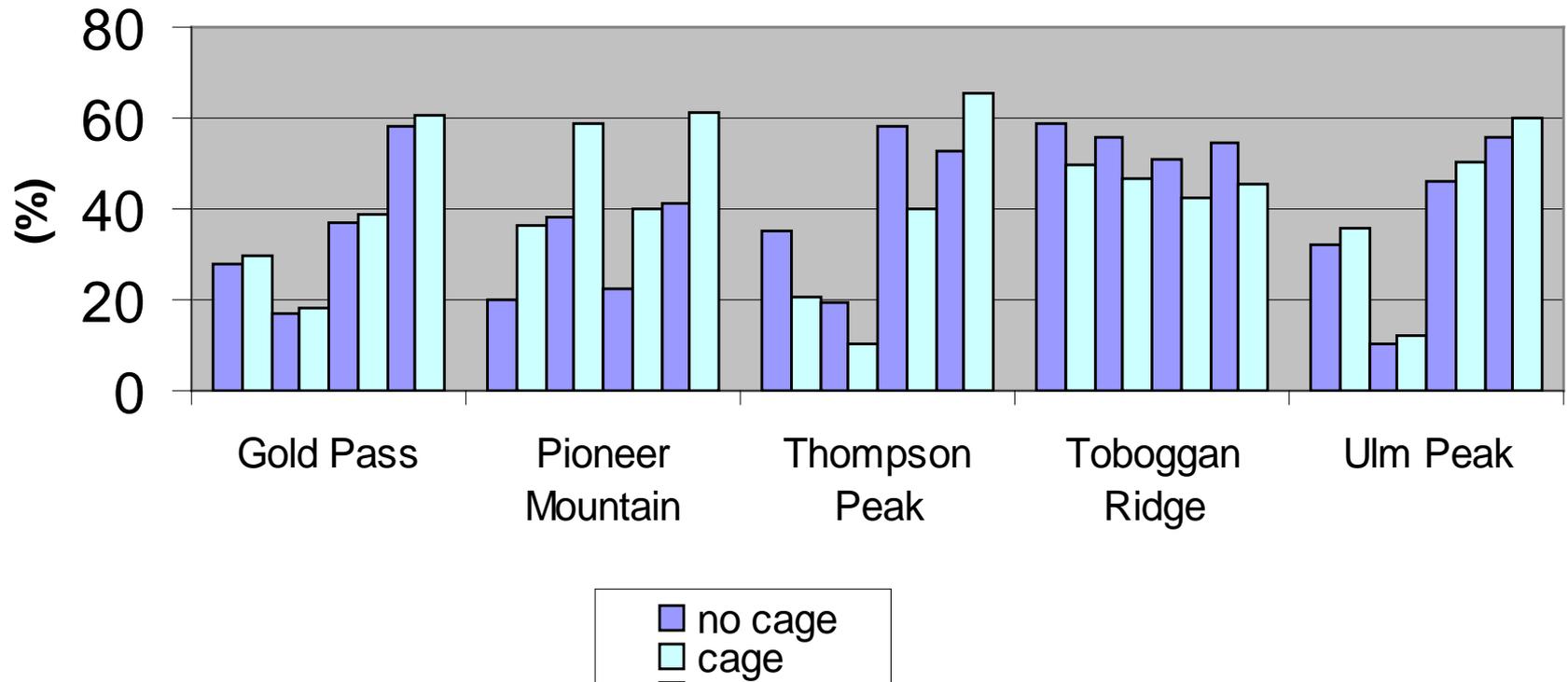


Caging Effects on Germination

- Caging Interaction terms tested for –
cage*seed*site, cage*(site/block),
cage*site, and cage*seed
- Evidence against model without term –
cage*(site/block) p-value = 0.0006

Caging Effects on Germination

Germination Estimates Caged vs. No Cage



Caging Effects on Germination

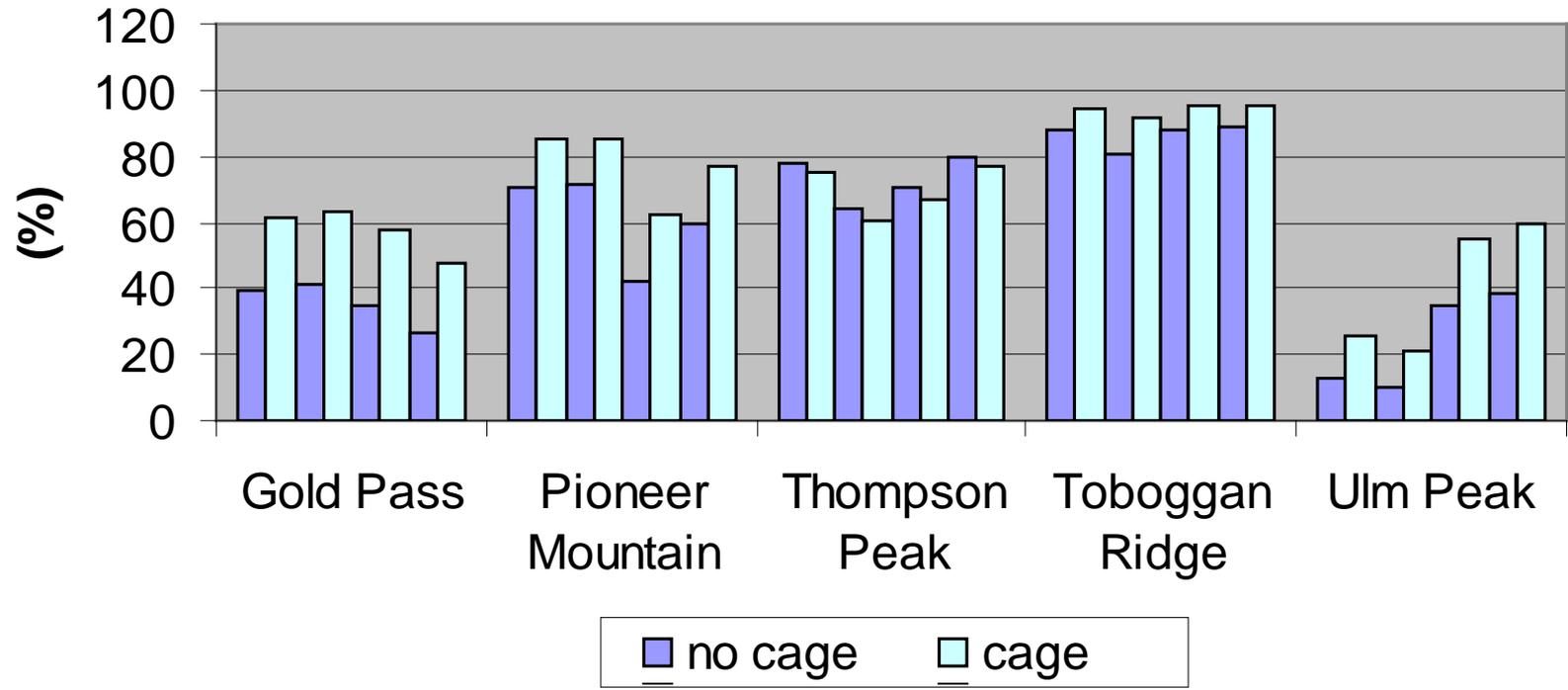


Caging Effects on Survival

- Caging Interaction terms tested for –
cage*seed*site, cage*(site/block),
cage*site, and cage*seed
- Evidence against model without terms –
cage*(site/block) p-value = 0.0365
cage*seed p-value = 7.74 E-07

Caging Effects on Survival

Survival Estimates Caged vs. No Cage



Caging Effect on Survival



- n The significant effect that caging has on survival is likely coming from the shade it provides
- n Points out the importance of planting in microsites

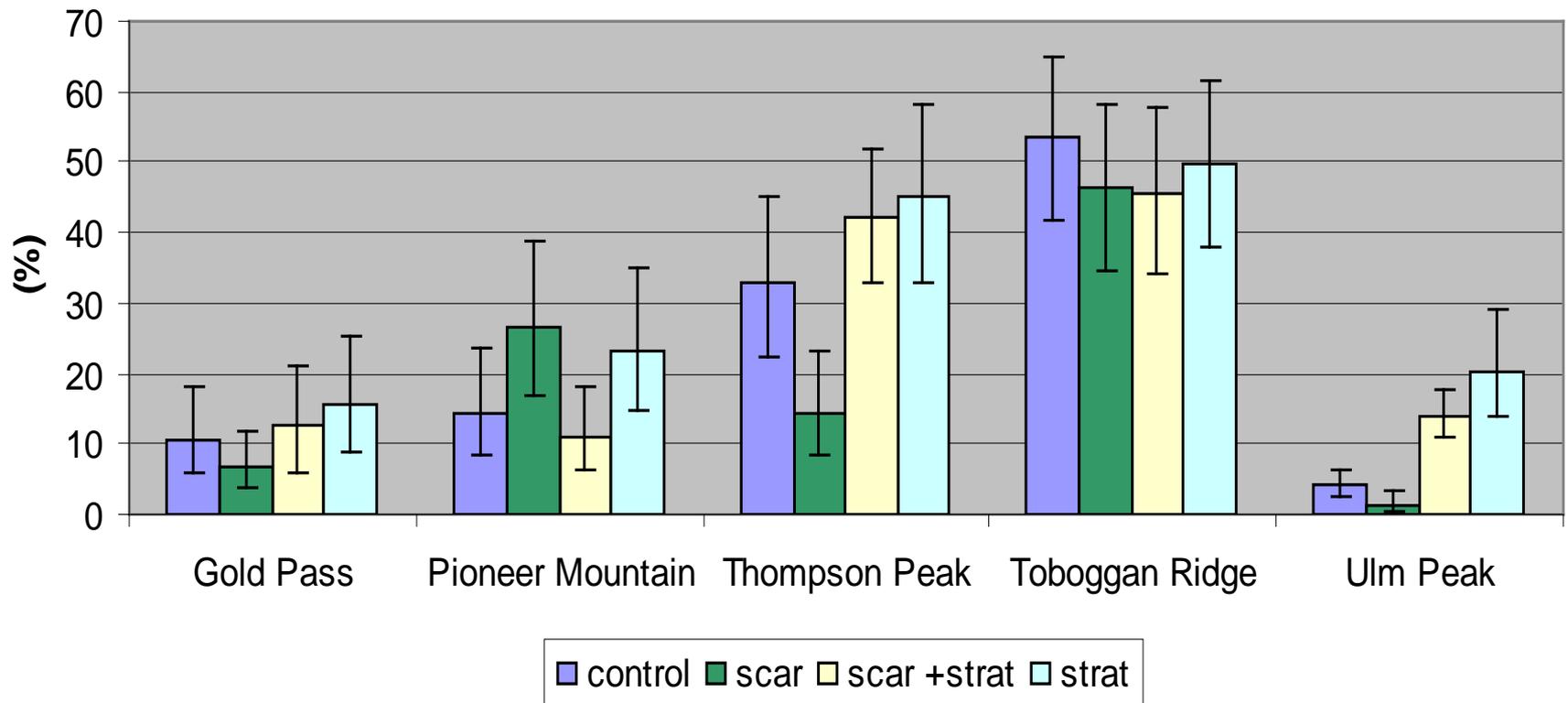
Conclusions – Seed Treatments

- Direct Seeding – If found successful in the field could greatly benefit restoration efforts.
- What is considered effective?
- Germinated and survived rates as low as 10%



Conclusions – Seed Treatments

Germinated and Survived Estimates and 80% CI's



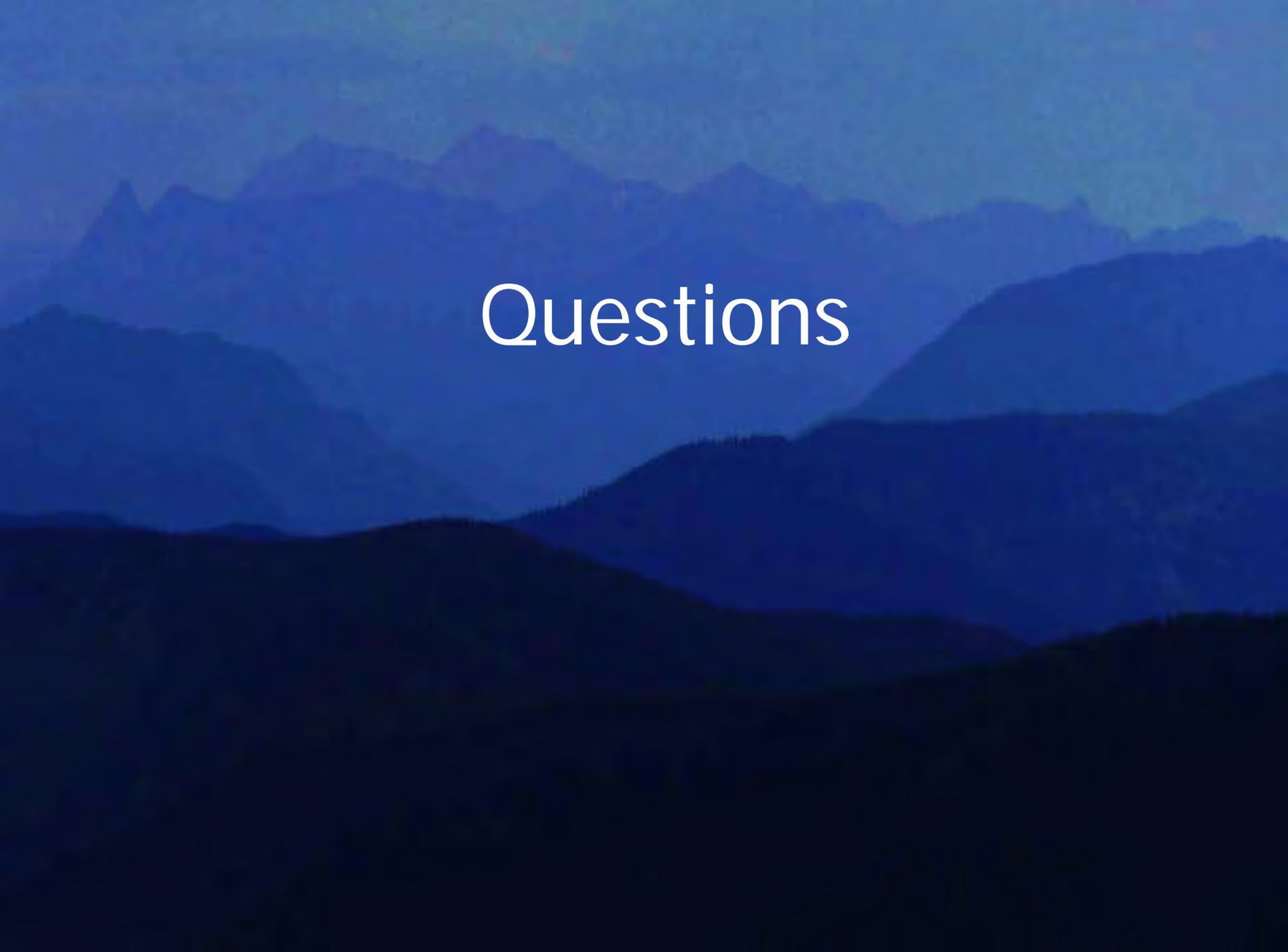
Conclusions - Caging

- Should caging be used as a restoration practice in the field?
 - Labor intensive
 - Cumbersome and Heavy
 - Advantages do not outweigh the disadvantages



Conclusion – Future Research

- More Direct Seeding Trials
 - Jackson Hole Ski Resort, WY – 2012
 - Island Park, ID – 2012
- Direct seeding trials have recently been established to test sowing depth and sowing time
 - Rocky Mountain Research Group (Terri Jain)
 - John Schwandt and Paul Zambino

The background of the slide is a blue-tinted landscape featuring a range of mountains and rolling hills. The mountains in the distance are sharp and jagged, while the hills in the foreground are softer and more rounded. The overall color palette is a gradient of blues, from a deep, dark blue in the foreground to a lighter, almost white-blue in the sky.

Questions