# Introduction

Establishing the territory

* + Seed germination is critical for species survival and colonize new territory, which is threshold for reseeding restoration practice.
    - Seed germination capacity variate by species, which is decided by internal and external factors.
    - Along with species evolution, consistent preserved external factors (abiotic and biotic pressure) also shape the species.

Identifying the niche (the Problem)

* + Publications try to detect seed germination patterns
    - Seed germination response to hormones;
    - Seed germination response to environmental factors (fire, flood, cold et al.);
  + However, without phylogenetic information of species may have a mislead conclusion.
    - If species are closely related, the measurement of species may be influenced by their heritable traits, such the germination rate of closed related species may be influenced by heritable dormancy traits. Including Using the comparative phylogenetic method to analyze seed germination could exclude the heritable information and ensure the statistical analysis fulfill the assumption of independence.
    - Phylogenetic analysis for species will be a systematic way to understand species traits. The results will not only benefit the tested species, but conclusion is expandable to tested phylogenetic system.
    - Publications tried to detect the correlation between seed morphology and seed germinations without phylogenetic information.

Occupying the niche

* Hypothesis:
  + Seed traits (mass and surface area) contains phylogenetic signal.
  + If applying comparative phylogenetic method to analyze patterns between seed traits and seed germination, then the seed traits could build a predict model to predict seed germination.
* Approach:
  + Test phylogenetic signal in seed morphological measurements
    - Pagel’s lambda
    - Blomberg’s K
  + Build phylogenetic general linear model for seed morphology and seed germination.
* Prediction:
  + Seed morphology in shortgrass prairie species contains phylogenetic signal
  + Seed morphology is weakly correlated with seed germination

# Methods

## Material

## Data Analysis

# Results

# Discussion

# Citation