Field Experiment protocol

1. Hypotheses
   1. H1
      1. H1A: Forbs with higher dormancy will show least resilience to winter drought as indicated through lower population growth rates
         1. In the presence of grass, forbs with higher dormancy will have higher population growth rates that those with low dormancy under the normal rainfall treatment however grass competition in the winter drought treatment, forbs will lower dormancy will exhibit higher population growth rates
         2. Forbs will have highest germination and per capita growth rates from consecutive wet years in the absence of grasses, but when grown with grasses, they will have highest germination and per capita growth rates in wet years following dry years, confirming that temporal variability in rainfall promotes coexistence.
      2. H1B: In the winter drought treatment, elasticity analysis will reveal that population growth rates are more sensitive to changes in the performance of germinated individuals in high dormancy forbs whereas changes in germination rates will be more important in low dormancy forbs. Conversely, in drought alleviation treatment, population growth rates will be most sensitive to germination rates in both types of forbs
      3. H1C: Projections into the future will show that with increased winter drought, forbs with higher dormancy are at risk of being lost from the system.
   2. H2
      1. H2A - At the community level, plant assemblages in the winter drought treatment will show a weaker storage effect as compared to the alleviated winter drought treatment, indicating weaker coexistence.
      2. H2B - Under the winter drought treatment a larger proportion of the storage effect will be attributed to differences between species in seedling stage than to differences in germination rates.
2. Experimental design, all on lush serpentine soils
   1. 40 “main” plots where Susan’s experiment is taking place
      1. 10 drought + 10 control
      2. 10 water + 10 control
   2. Each plot is surrounded by border where manipulations are taking place
      1. Block 1: competition (green nails)
         1. 0.5x0.5 plot, divided into 4 subsections with one forb per subsection
      2. Block 2: no competition (clipping back biomass) (white nails)
         1. 0.5x0.5 plot, divided into 4 subsections with one forb per subsection
      3. Seedbags will be buried in buffer between main plot and subplots
   3. Study species
      1. **Lupinus**
      2. Lasthenia OR **Plantago**
      3. **Agoseris** OR Clarkia
      4. **Hemizonia** OR Holocarpha
3. Set up
   1. Remove thatch from ground
   2. Place nails around corners and at midpoint = 8 per subplot\*2 subplots per plots = 16 per plot\*40 plots = 640 nails
   3. Place stringed quadrat around area, plant at random
   4. Aboveground: Seed addition
      1. 100 seeds/plot \* 80 plots (1 competition, 1 no competition per plot) = 8,000 seeds/species
      2. Bury 4 seeds per cell of .25 x .25
   5. Below ground: Seed bags
      1. For each species, mix 100 seeds of per species with sand in nylon mesh bags, bury one per MAIN plot = 40 plots, 4 species = 400 bags
      2. Mesh options
         1. http://www.amazon.com/Organza-Drawstring-Pouches-Assorted-Colors/dp/B002HIL50C
         2. Buy small mesh and seal with Impulse sealer
4. Sampling
   1. Census germination in each subplot after each storm?
   2. Visit every 2 weeks in fall, once a month in winter, then every 2 weeks in spring for
      1. Germination – place toothpick next to those that germinate
         1. Remove aboveground cover
      2. Survival
         1. Census those that have toothpicks
      3. Flowering
      4. For seed production, harvest 5 individuals per plot and count and SAVE seed output
   3. At the end of the growing season, dig up mesh bags and determine how many seeds germinated/how many are still viable
   4. Census seedbank for background species number?