

Simulating Natural Light Environments to Examine Ecological Reference Conditions and Niche Conservatism for the Federally Endangered *Astragalus bibullatus*

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The objective of the experiment was to determine the optimal light conditions in terms of germination, survival, and growth on *A. bibullatus*. It was hypothesized that *A. bibullatus* would have the highest amount of survival and growth in conditions which emulate the light environment of a deciduous savannah that historically would have been created by prescribed fire. Researchers also aimed to determine whether *Astragalus crassicaarpus*, which is the closest living relative to *A. bibullatus*, is a suitable surrogate for experiments testing the impacts of certain ecological conditions on *A. bibullatus*. The effects of six light environments on *A. crassicaarpus* and *A. bibullatus* were measured in an unshaded common garden at the Missouri Botanical Garden's Shaw Nature Reserve (SNR). Three experimental light treatments were imposed, the first being open grassland: no shading (0%), the second being savanna: 30% reduction in sunlight by covering each block with shade cloth, and the third being closed woodland: a 60% reduction in sunlight by covering each block with shade cloth. Each week of the growing season (April – October) survival and growth (number of leaves and diameter of plant) were recorded. Two months after the start of the experiment, a shade cloth transition took place to emulate the leafing out of a deciduous canopy. It was found that the shade treatments did not have any significant effects on germination but did have a significant effect on survival of seedlings ($p = 0.01$). There were also significant differences in germination rates ($p = 0.02$) and survival ($p = 0.001$) between *A. bibullatus* and *A. crassicaarpus*. *A. bibullatus* had a higher germination rate than *A. crassicaarpus* and experienced a decrease in survival as the amount of shade increased, while *A. crassicaarpus* had a higher rate of survival in the 30% shade treatment, followed by the 60% and then 0% shade treatments. Analyses were not performed on survival for *A. bibullatus* plugs due to zero percent mortality at the point of data analysis. Further analyses will be performed at the end of the experiment in October of 2014. Due to the significant difference in germination rates and survival between *A. bibullatus* and *A. crassicaarpus*, it was concluded that *A. crassicaarpus* cannot be used as a surrogate for experiments testing the impacts of ecological conditions on *A. bibullatus*. Based solely upon preliminary data from before the shade cloth transition, *A. bibullatus* is better suited to an environment that has high light in the spring and early summer (0% shade) and may transition to a more deciduous savannah type habitat (30% shade) or remain completely open (0% shade). This information implies that *A. bibullatus* historically grew in an environment that was very open and with few cedar trees which provide year-round shade.