Background

The purple coneflower, *Echinacea angustifolia*, has been found to have lower fitness in small remnant populations due to scarcity of mates and inbreeding depression. The association between density dependence and the fitness of each individual within the population is known as an Allee effect. Furthermore, for self-incompatible species, such as *Echinacea angustifolia*, the limitation of possible mates and inbreeding depression are not the only factors restricting individual's fitness, but rather there is also a genetic limitation that prohibits genetically similar plants from reproduction. This genetic limitation is expressed through the S locus, which is encoded onto the proteins surrounding pollen and in the styles of florets. The acceptance or refusal of pollen by styles has been shown to be dependent on a dominance relationship between S alleles. Consequently, it is possible for non-reciprocal pollination between two individuals. This self-incompatibility caused by the S allele results in an S-Allee effect in small, remnant populations given that diversity in dominant S alleles can be lost due to genetic drift.

The classic Allee effect and the S-Allee effect can be considered to compose certain aspects of the hindrances on fitness that have been labeled as pollen limitation. Pollen limitation has been used to describe pollen release, pollen transport, pollen deposition, pollen germination, and fertilization of the ovule. I present the idea that pollen limitation is not only restricted to these five stages, but is also dependent on synchrony of floret production between individuals in a population. In most circumstances, it is reasonable to presume that individuals in close proximity are under similar microenvironmental conditions (water, elemental resources, sunlight), and have enough genetic similarity such that the production of anthers and styles are synchronized allowing pollination to occur. However, given the restricted gene flow and genetic drift between remnant populations it is possible that floret production between remnants is now asynchronous. It is also possible that remnant populations have higher intercompatibility of S alleles given that S allele loss due to genetic drift would most likely not be identical between two remnants. The balance of selecting genetic diversity while allowing for sustainable self-recruitment in native prairie restoration could consequently be more difficult for species that have evolved for long periods in isolated remnants.

In this study I will observe if timing of floret production of *Echinacea angustifolia* in remnants is similar to inbred plants from that remnant under separate environmental conditions. I will also look at the effects of distance and synchrony on the compatibility of S alleles between individual plants.

Methodology

I will observe the differences in timing of floret production of *Echinacea angustifolia* between the remnants and their corresponding inbred progeny that have been planted in the common garden.

To the effects of distance and synchrony on the compatibility of S alleles I will randomly select 3 inbred individuals from each remnant population that are found in the common

garden and have produced florets. The dates of production of anthers and styles on each of the individuals' florets will be recorded. Distances between remnants will be recorded and categorized such that inbred plants from the same remnant can be tested for a relationship between distance and compatibility. Each of the three inbred individuals from each remnant will be tested for compatibility with each of the three individuals from other remnants along with the two individuals from the same remnant. Pollen collection will be done at the first appearance of anthers on each floret. The pollen will then be stored to be tested with all later produced florets. Pollen and style compatibility tests will be done by marking the floret that corresponds with each style and pollen combination, and then placing a mesh bag over the composite flower such that pollinators can not enter. Styles will then be checked for shriveling 24 hrs after selective pollination was done.