Most angiosperm species require animal pollinators in order to fully reproduce. To test how limited plant reproduction is by pollen receipt, ecologists conduct a pollen supplementation experiment in which flowers that are hand pollinated using an excess of outcross pollen are compared to control flowers which are naturally pollinated. If the flowers produce more seeds in the supplement treatment than the control treatment, then it is concluded that pollen receipt limits plant reproduction.

To examine how pollen limitation influences the fecundity and population growth rate of a plant population, researchers studied both the demography and conducted a pollen supplementation experiment for Trillium grandiflorum. Trillium grandiflorum is a perennial plant that is primarily pollinated by bumblebees. Reproductive individuals produce a single flower and fruit. Seeds have a 40% chance of germinated and becoming seedlings in the next year.

Scientific question: Do reproductive plants produce more seeds when given supplemental pollen? What is the population growth rate in control and pollen supplement conditions?

Metadata for Trillium plants:

Each row of data is an individual plant, the columns represent the stage class the plant was in in year 0 and the stage in year 1. The plant lifecycle can be described as seedlings (these are new plants that result from seeds that germinated), oneleaf (these are plants that have one true leaf), smallNR (these are small non-reproductive plants; they have three small leaves and no flower), largeNR (these are large non-reproductive plants; they have three large leaves and no flower, reproductive (these plants have three large leaves and a single flower).

Metadata for Trillium fecundity:

Each row of data is an individual reproductive plant. These plants were tagged in the field (PlantID) and randomly put into pollination treatments (treatment). Control plants have a single flower and were not manipulated in any way (i.e., open to natural pollination). Supplement plants were hand pollinated with outcross pollen from several donor individuals and were also open to natural pollination. Fruits were collected and the number of seeds per plant (seeds per plant) was counted for each individual. Note, some individuals failed to produce a fruit, and these therefore produce 0 seeds.

Please present:

1. A short overview of *Trillium grandiflorum,* including a life cycle graph.
2. Hypotheses
3. Your methods (modelling approach)