ABSTRACT

PROJECT TITLE:
Northeastern forest regeneration in a warmer and wetter climate
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Models of tree responses to climate change predict dramatic shifts in northeastern forest species composition that have not been corroborated by field-scale experimental climate change manipulations. Our main objective is to provide a field-based test of model predictions of forest species composition shifts using *in situ* warming and irrigation. Differential regeneration is a major driver of shifts in forest composition and successful species migration, so we approach our objective with a climate manipulation experiment focusing on tree germination and seedling growth.

Research question: Are germination and seedling responses to climate manipulation consistent with model predictions of shifts in tree species in a warmer and wetter climate? We hypothesize that simulated climate change will alter deciduous tree germination and seedling growth rates. Differential species' responses to climate manipulations will support or refute model predictions of species migrations.

The study will take place in Penn State University's Stone Valley Forest, located in Centre County, Pennsylvania. The site is at the interface of two dominant northeastern forest types, but is predicted to change toward more southern (oak-hickory) forest types under future climate conditions.

We will simulate climate change predictions in small field plots (2mX4m) to determine the response of eastern tree species' germination and seedling growth. Climate change will be simulated in a 2X2 factorial experiment increasing air temperature ~2^{o}C and precipitation by 20%. Temperature will be increased in open plots with Kalglo infrared lamps and precipitation with rain collection basins adjacent to study plots. Within treatment plots we will monitor tree germination in both natural and modified seedbanks. Seedbanks will be modified by adding 9 regionally abundant species and 2 southern species that have been predicted to increase in abundance with changing climate. The growth, physiology, morphology and phenology of germinated seedlings will be measured for 3 years. We will compare germination and seedling success with model predictions of climate-driven changes in species' abundances and distributions. The growth, physiology, morphology, and phenology measurements can be used to investigate why seedling species do or do not follow existing predictions.

We will provide a novel experimental test of model predictions that southern species will migrate to the north under plausible climate change scenarios. More specifically, we will test whether germination and seedling growth of 11 prevalent, early successional eastern tree respond to simulated climate change as predicted by one biogeographical model of eastern tree species response to global climate change.