

# B4indoors: Seedling Success Under Future Climate Scenarios

Alida Mau, Nick Fisichelli, and Peter Reich

Department of Forest Resources, University of Minnesota

## Introduction

In response to climate change, northern forests are predicted to shift dramatically in composition. These forests, located in the upper Great Lakes region, contain temperate and boreal tree species near their northern and southern range limits, respectively, and thus are likely to be extremely sensitive to small variations in climate (Pastor & Mladenoff 1992).

Seed germination and early survival are critical early stages of development and those species best suited to current climatic conditions are most likely to form the future forest overstory.

My research entails examining the germination and early survival of temperate and boreal tree species under projected future climatic conditions and in the presence and absence of a leaf litter layer.

## Hypothesis

The treatments with a higher temperature treatment will favor higher growth and subsequent mortality rates, while the lack of litter treatment and decreased precipitation will favor invasive and deciduous species over coniferous.

It was also hypothesized that those with the leaf litter treatment would have lower rates of mortality due to the ability to hold moisture longer under the increased temperature treatments.



Figure A



Figure B

A depicts a chamber under a +6 temperature treatment.

B has undergone the same precipitation and leaf treatment, but has a widely different species makeup at the ambient temperature..

## Methods

455 seedlings of 18 species were subject were placed in trays in a growth chamber and subject to three different treatments. Within each tray there were at least three replicates of each species, randomly assigned spaces in a grid pattern.

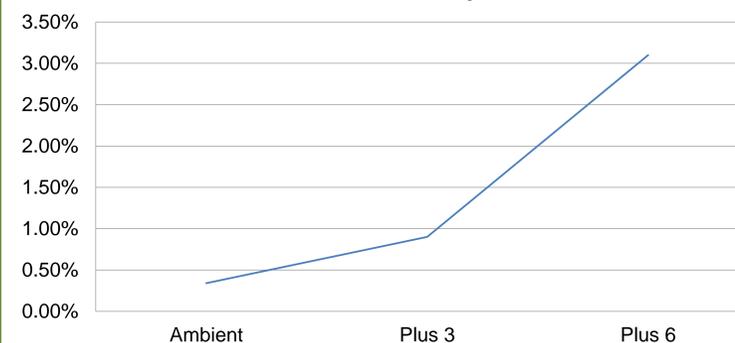
Of the six chambers two were set at an ambient temperature of BLANK DEG, two at +3 DEG, and two at +6 DEG.

The trays were randomly placed within each chamber and given a code to determine the leaf litter treatment and precipitation treatment.

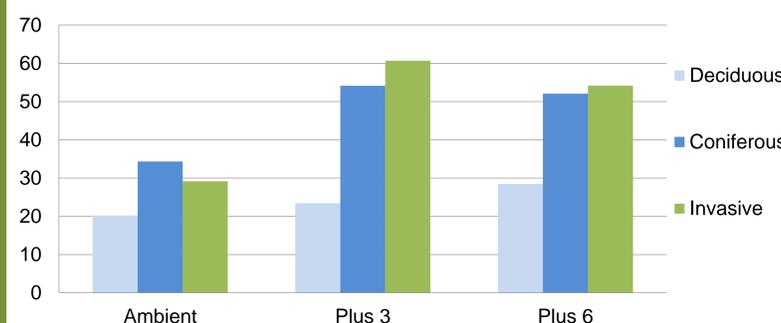
Half the trays had bare soil to simulate earthworm invasion, while the rest were given a thin leaf litter layer.

The precipitation treatment was divided into three categories, with waterings three times a week. Group 0 was watered 100% of the time, group 1 75%, and group 2 50%. Each tray is watered to its respective field capacity.

## Overall Mortality Rates



## Germination By Species Type



## Results

The experiment has gone on for twelve weeks, and there are noticeable differences recorded between treatments. Those at ambient temperatures have lower germination and growth rates. Additionally, these treatments have favored boreal species (**show rate**). The elevated chambers have (**rate%**) greater germination of deciduous species, especially oak and hickory.

The mortality rate of was three times higher for the +6 temperature treatment, with predominate species deaths among the coniferous group. The coefficient of correlation showed that morality differences were significant.

## Conclusions

It should be noted that the experiment is still in progress and scheduled to commence early May, so data is preliminary. Still, that which has been collected supports the hypothesis with the exception of the leaf litter treatment. Mortality and germination have been uniform within the temperature treatments.

As a proxy for climate change in Minnesota, the implications for the future suggest lower biodiversity and species count s in general, coupled with enhanced susceptibility to invasive species.

## References

Pastor J., D. J. Mladenoff. 1992. The southern boreal-northern hardwood forest border. Pages 216-240 In H. H. Shugart, R. Leemans, and G. B. Bonan, editors. A systems analysis of the global boreal forest. Cambridge University Press, Cambridge.

Woodward F. I. 1987. Climate and plant distribution. Cambridge University Press, New York.

## Acknowledgments

I would like to thank Nick Fisichelli, the B4Warmed group, Karen Rice, and Laura Biersach for their help, guidance , and funding.