# Identifying species and ecotypes suitable for assisted migration in the Northeast U.S.

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## INTRODUCTION

- In the Northeast US, climate change will likely cause hotter temperatures, more sporadic and extreme precipitation, and increased pressure from droughts within the next century
- Forestry assisted migration, the movement of tree genotypes adapted to the future climate of a region, has gained attention for its potential to mitigate climate change impacts on forest health and productivity
- Several studies have measured establishment success of assisted migration seedlings but lack in-depth physiological explanations for local species
- Understanding which species and source locations (ecotypes) perform best under forestry assisted migration in the Northeast US could improve implementation success

## RESEARCH QUESTIONS

When grown in a common garden…

1. Does ecotype influence seedling success?
2. Is seedling performance affected by drought exposure?
3. Does ecotype influence capacity for drought acclimation?

## METHODS

- Seedlings from 7 species and 3 source regions (ecotypes) were planted in a modified polyhouse at the UNH MacFarlane Greenhouses (photo right; Durham, NH)
- Once acclimated, plants were divided into control (n=146) and drought (n=300) treatment groups
- Control plants were drip irrigated each morning and droughted plants were withheld water for 22 days (7/18-8/8)
- Water content and tree physiology were measured throughout the experiment (table below)

| Measurement | Tool | Frequency |
|---|---|---|
| Stomatal conductance | Porometer | Twice/week (n=90) |
| Stomatal conductance | Li6400xt | Weekly (n=60) |
| Photosynthetic assimilation | Li6400xt | Weekly (n=60) |
| Predawn water potential | Pressure bomb | Weekly (n=60) |
| Midday water potential | Pressure bomb | Weekly (n=60) |
| Height and diameter | Tape, calipers | 4 times (n=450) |
| Phenology | Visual | Will measure in yr. 2 |

## HYPOTHESES

1. In terms of growth, I expect that local ecotypes will outperform assisted migration seedlings in the control group. In the drought treatment group, I expect the southern ecotype (VA) to outgrow the other ecotypes
2. Physiological responses between ecotypes will be greatest in species that do not tightly regulate stomatal control e.g., black cherry and red oak

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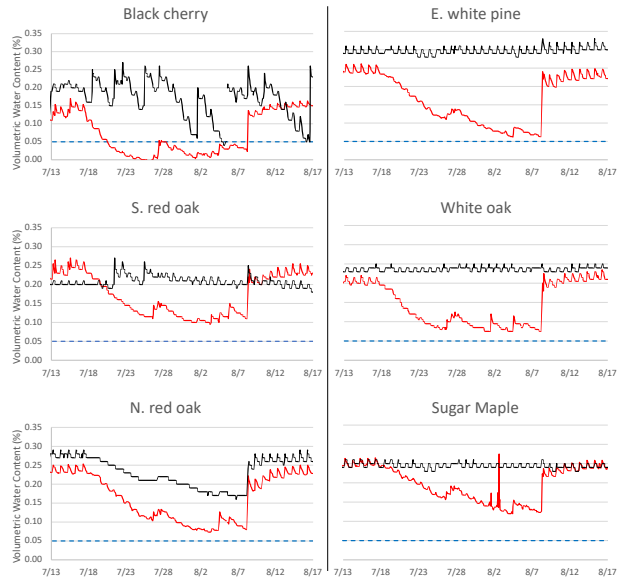
## THE DROUGHT

Seedlings were randomly assigned into blocks and allowed to acclimate for >1 month before they were assigned an experimental group (above). Seedling survival was relatively low for southern red oak and since virtually no black walnut from MI survived, this ecotype was removed from the study (below).

| Ecotype | N. red oak | E. white pine | Sugar maple | Black cherry | White oak | Black walnut | S. red oak |
|---|---|---|---|---|---|---|---|
| NH | n = 33 | n = 33 | n = 33 | - | - | n = 32 | - |
| MI | n = 33 | n = 34 | n = 33 | n = 33 | n = 32 | - | - |
| VA | n = 33 | n = 32 | - | n = 33 | n = 33 | - | n = 19 |




**Black = control** **Red = treatment** **Blue = 5% VWC threshold**

On average, black cherry experienced the greatest number of days under 5% VWC with individuals recorded at 0% VWC with a Teros10 soil moisture sensor buried mid-pot

## RESULTS & DISCUSSION

- Height growth (bottom figure)
  - Pines grew least with little treatment or ecotype effect
  - In other species, a weak trend of MI > NH > VA
  - Black cherry growth was most limited by the drought
- Physiological traits (below)
  - Seedlings from VA displayed the strongest response to drought stress in photosynthesis and conductance
  - Interestingly, the local NH ecotype, showed the least effect to the drought treatment for the above traits
- I suspect initial height and leaf area played major roles in the length and severity of drought experienced by seedlings
- Two drought treatments will be applied in the second year of this study, 2023