Influence of planting treatments on American chestnut (Castanea dentata) seedling performance in eastern Tennessee mine spoil.

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Outline
- Background
  - Mining Practices
  - American chestnut
- Goal
- Objectives
- Methods

Mining
- Surface Mining Types
  - Mountaintop Removal
    - Overburden in valleys
  - Cross-Ridge Mining
    - Overburden replaced
- www.epa.gov
Surface mining

- Historic surface mining reclamation practices
  - Left “as is”
  - Valleys filled in
  - Erosion/Landslides
  - Mass Instability
  - Water Pollution
  - Trees Planted

Surface Mining

- Surface Mining Control and Reclamation Act of 1977
  - Compaction
  - Erosion
  - Heavy Liming
  - Grass Planted

Surface Mining

- The Forestry Reclamation Approach (FRA)
  1. Create a suitable rooting medium for good tree growth that is no less than 4 feet deep and comprised of topsoil, weathered sandstone and/or the best available material.
  2. Loosely grade the topsoil or topsoil substitute established in step one to create a noncompacted growth medium.
  3. Use ground covers that are compatible with growing trees.
  4. Plant two types of trees—early successional species for wildlife and soil stability, and commercially valuable crop trees.
  5. Use proper tree planting techniques (Burger et al., 2005).
Surface Mining

- Current FRA Practices
  - Less erosion
  - Equal or greater productivity
  - Valuable forested land

What Species Do we use?

- Alternative Species Used:
  - Black Locust (Robinia pseudoacacia)
  - Green Ash (Fraxinus pennsylvanica)
  - Pine (Pinus spp.)
- However,
  - Black Locust
  - Green Ash
  - Pine

American Chestnut

- Not available in the past
  - Chestnut blight (Cryphonectria parasitica)
- Center of Range
- Grows well in
  - Increased light levels
  - Moderately acidic soils
  - Well drained soils
Goal
- Determine the effect planting treatments have on physiology and performance of American chestnut on mine spoil

Objectives
- Determine relationship between
  - 1. Available water and performance
  - 2. Available nutrients and performance
  - 3. Soil sterilization and performance

Study Site
- Campbell County - Elk Valley
- 2 sites
- 4 plots
Methods

- 2 sites, 4 plots
  - Flat (A,B)
  - Sloped (C,D)

1.5m x 1.5m spacing

Treatments randomly assigned to planting spots

Directly seeded with planting treatments and ½ cup of pro-mix

18” tall direct seed Blue-X shelter

Pile Native Rock around tube

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Methods

- 9 Treatments (3x3 factorial)

<table>
<thead>
<tr>
<th>Terra-Sorb Applied</th>
<th>Fertilizer Applied</th>
<th>Soil Sterilized</th>
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<tbody>
<tr>
<td>Terra-Sorb Not Applied</td>
<td>Fertilizer Not Applied</td>
<td>Soil Un-Sterilized</td>
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Methods

- Treatments randomly assigned to planting spots

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Treatments

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- Fertilizer Applied
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Directly seeded with planting treatments and ½ cup of pro-mix

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www.coalcreekaml.com
Methods

1. Determine relationship between water availability and performance

Water potential (Mpa): Scholander Pressure Chamber

\[ \Psi_W = \Psi_{\pi} + \Psi_p + \Psi_g \]

Where
- \( \Psi_W \) = water potential
- \( \Psi_{\pi} \) = osmotic potential
- \( \Psi_p \) = turgor potential
- \( \Psi_g \) = gravitational potential

2. Determine relationship between nutrient availability and performance

20-10-5
Methods

2. Determine relationship between nutrient availability and performance
   - Height, root collar diameter
   - Photosynthetic rate (Anet): Li-Cor Infrared Gas Analyzer
     - Anet = mg CO₂ m⁻² s⁻¹

Methods

3. Determine relationship between soil sterilization and performance
Statistical Analysis

- CRD factorial
- ANOVA
- Mean comparison
  - Pairwise - LSD
  - Treatment – Contrast
- All tests will be performed at $\alpha = 0.05$
- SAS® system

Acknowledgements

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Questions?