**Introduction**

Economic performance standards for forested wetland compensatory mitigation sites in Virginia include:

- >9900 stems/ha (>400 stems/acre)
- >10% increase in height/year

The woody stem density standard can be accomplished through:

- Natural tree colonization from surrounding forests
- Introduction of planted trees

Wetland compensation sites are not meeting economic performance standards mainly as a result of:

- Poor survival of planted woody vegetation
- Poor quality nursery stock
- Improper species selection
- Improper stocking techniques

Previous studies suggest that species and stocking should be matched to hydrologic conditions.

The purpose of this study in part, is to determine the appropriate species and stocking combinations for use in wetland compensation sites and other afforestation or reforestation projects.

**Hypotheses**

Within each cell, gallon stocktypes and primary succession species will have greater probabilities of survival and height growth rates when compared to other stocktypes and secondary succession species.

Bare root stocktypes will be the least expensive stocking to ensure meeting the required stem density.

**Methods**

Three Nursery Stocktypes

<table>
<thead>
<tr>
<th>Bare root</th>
<th>Tubeling</th>
<th>1 - Gallon Container</th>
</tr>
</thead>
</table>

**Survival**

There was significant three-way interaction among cell, species and stocktype (p=0.0089), suggesting that the species and stocktype did not have similar probabilities of survival among each cell. Gallon stocktypes frequently had greater survival than other stocktypes and all species had similar survival probabilities within each cell (Figure 2). Gallon stocktypes may have increased root mass allowing for increased uptake of water and all species were matched to hydrologic conditions. Few species-stocktype combinations exhibited less than 58.8% survival in the ideal and saturated cells, while 6 combinations had less than the flooding, including all three oak species.

**Growth**

There was significant three-way interaction among cell, species and stocktype (p=0.001). No stocktype consistently had greater positive percent change in height in height, suggesting stocktype has little influence on height growth. The primary succession species had marginally greater percent change in height in the ideal cell, while species had similar growth within the Saturated and Flooded cells (Figure 3). Few very few species-stocktype combinations satisfied the 10% increase in height standard within the Flooded cell, suggesting trees planted under stressful hydrologic conditions may not reach this required performance standard.

**Economic Analysis**

Gallon stocktypes often had the lowest initial planting density required to reach the >9900 stems/ha performance standard, however due to the low cost, the bare root stocktype often was the least expensive per ha to ensure >9900 stems/ha. This suggests that based on purchasing cost only, the bare root stocktype is often the most economical choice.

**Future Dissertation Work**

To determine how the following variables influence the net primary production of planted trees:

- Distance to forest edge
- Hydrology Morphology
- Photosynthetic Rate
- Leaf area index
- Physiological Position
- Woody competition
- Relative growth rates

**Acknowledgments**

Peterson Family Foundation, Wetland Studies and Solutions, Inc., Virginia Department of Forestry, New Kent Forest Preserve Center, Sewer Design Group, Jel Sulli, Chris Hauser, Master Naturalist, CNU Center for Wetland Conservation, VIMS and VIMS Students, Friends and Family

**Literature Cited**

Table 1. Economic comparison of species and stocktypes. The initial density required is the number of trees needed to reach the 9900 stems/ha economic performance standard based needed to reach survival for each combination. * Represents soil removed prior to shipping. Highest yields are lowest.