Integral Projection Model for a Reproducing Population of American Chestnut

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Objectives
- Create an integral projection model for a population of American chestnut

Why Care?
- Attempts to restore the American chestnut to Eastern forests will be most efficient if the tree is properly managed
- Effective management requires a thorough understanding of the tree’s lifespan

Description of the Sites

<table>
<thead>
<tr>
<th>Vermont Size Distribution</th>
<th>Maine Size Distribution</th>
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<tbody>
<tr>
<td>2.6 acres 533 Trees</td>
<td>8.7 acres 1057 Trees</td>
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Modeling

We created an integral projection model of the Maine site. Both survival and fecundity were binary data and their regressions were fit logistically. The growth regression was fit as quadratic and is shown below left. The recruit sizes were normally distributed with a mean of 0.237 cm. Combining the survival and growth regressions, we obtain the growth kernel shown below center. Combining the fecundity regression, ratio of recruits per flowering tree, and recruit size distribution, we obtain the fecundity kernel shown below right. When these two kernels are combined then iterated 200 years, a lambda value of 1.08 is found. Note for the kernels that hotter colors indicate higher probabilities. A sensitivity analysis showed that the most important factor in increasing population growth is the survival and quick growth of new recruits.

Using the Model

In an attempt to explain the Vermont population structure, we ran a simulation of the Maine model starting with a population of only adult trees the same size as those in Vermont. We then iterated this initial population 20 years. Comparing population data from the Vermont site to this data (shown graphically at right) using a chi-squared test, we found there is no statistical difference between the simulated and actual populations. Assuming my model is valid, this indicates the population in Vermont experienced a recent understory disturbance and is in the process of recovery.

Acknowledgments