Chapter VI
Summary and Recommendations

Summary

The importance of intra-specific competition as a driving force in stand development has been studied extensively since the 1950's. An extensive review of the literature traced the development of two competing theories of competitive interactions: resource depletion and resource pre-emption. Data from two long-term replicated spacing studies and a long-term thinning study provided excellent data to test the two theories.

Analysis of size inequality (as measured by the Gini coefficient) and the distribution of individual-tree relative growth rate in dbh over initial relative size (ratio of dbh to the median dbh) clearly support the resource pre-emption or dominance/suppression theory of competitive interactions. Evidence for dominance/suppression is most convincing from the analysis of relative growth rates. The practice of estimating the relative growth rate/size relationship from class means is shown not to reveal important trends in the relationship.

The slope of the linear relationship between relative growth rate and relative size is shown to follow a predictable trend in time and across a density gradient. The slope coefficient can be modeled as a function of stand density, height, and to a lesser extent, site quality. Mid-rotation thinning is shown to reduce the magnitude of the slope coefficient.

Competition is a result of plant density and size relative to available resources. It is reasonable to expect the switch from a negative to positive correlation between relative growth rate and size is associated with some critical point of stand development. It has been suggested this switch occurs at the time competition for resources begins to impact growth. Attempts to define this point were only marginally successful. The switch occurs once crown projection index exceeds 1.05 or crown ratio falls below 0.75.

The slope of the linear trend between relative growth rate and relative size was used to develop a disaggregation model to distribute stand-level growth over an initial tree list. This approach would have utility with inventory projections. A comparison with two previously published disaggregation models shows the model developed here is slightly less accurate for 12-year projections. The most obvious weakness was the tendency of the model to over predict growth on the largest size classes as compared with the other two models.

Recommendations

During the course of this study, other avenues of potentially fruitful research were suggested:

- The linear approximation used to summarize the relationship between dbh relative growth rate and relative size was quite successful to demonstrate the existence of a dominance/suppression competitive relationship in even-aged loblolly pine plantations. However, the tendency of the basal area disaggregation, model developed from this linear approximation, to over estimate growth on the largest dbh size class may be mitigated through the use of a non-linear model to describe the relationship.

- The patterns in the relative growth rate/relative size relationships demonstrated in this study would seemingly be useful as a diagnostic tool for growth model

validation. Any model that implicitly or explicitly projects an initial tree list could be tested for agreement with the trends reported.

- A logical next step is to examine the dominance/suppression relationship with individual-tree spatial data. This may provide additional diagnostics to examine competition indices or suggest new methods to model individual-tree growth.