

Final Report: Using FIA Data to Predict Future Forests
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Introduction

Forest inventories conducted from 2000 to 2004 by the Northern Research Station's Forest Inventory and Analysis (NRS-FIA) unit indicate that Pennsylvania's forest land base covers approximately 16.6 million acres or 58 percent of the total land area – a figure that has remained relatively unchanged since the mid 1960s (McWilliams et al. 2007). With increases in sawtimber volume slowing, and the current saw timber volume of 88.9 billion board feet the highest recorded volume since the beginning of the FIA program in 1955 (McWilliams et al. 2007), it is safe to assume that large portions of forest land in Pennsylvania are at or near financial maturity, and thus positioned for harvest.

In most situations, native tree species are maintained through naturally occurring regeneration that captures free growing space allocated by the removal or mortality of mature trees. However, tree regeneration can be limited by many factors, including herbivory, competition from interfering vegetation (both native and exotic), lack of seed, poor soil conditions, etc. Understory conditions are often indicative of forest health and sustainability.

We used overstory and understory tree species composition data from the Pennsylvania Regeneration Study (PRS) to calculate overstory and understory tree species diversity and similarity indices, and to make predictions about the future species composition of forest land in Pennsylvania. While several studies have investigated the adequacy of tree regeneration in Pennsylvania (McWilliams et al. 1995; Fredericksen et al. 1998), I am unaware of any statewide studies that have incorporated the methods we chose.

To date, data analyses are complete and we are in the process of summarizing the results. A final report will be submitted to FIA by the end of the year.

Progress by Objectives

1. Describe current levels of overstory and understory tree species diversity across Pennsylvania by FIA forest type and ecoregion.

Multiple diversity indices that represent species richness, evenness, and dominance have been calculated for both the overstory and understory. They will be presented in the FIA report by forest-type group and ecoregion.

2. Describe the similarity between overstory and understory tree species communities across Pennsylvania and explain how variations in similarity are related to forest-type group, forest type and ecological subregion.

The statistical package EstimateS was used to calculate the following community similarity indices: Jaccard, Sorenson, Morisita-Horn, Bray-Curtis, and the Chao abundance-based versions of Jaccard and Sorenson. Since the indices define similarity in their own way, (often yielding different values for any given pair of communities) it was important to assess the strengths and weaknesses of the six indices. The Bray-Curtis index was ultimately selected for use based on its well documented ability to detect known community changes and discriminate sample groups (Bloom 1981; Cao and Epifanio 2010).

Analysis of variance (ANOVA) was used to test the hypotheses that overstory and understory tree species similarity (measured with the Bray-Curtis index) differed between maple-beech-birch and oak-hickory forest-type groups, between the forest types that make up these groups and between seven different ecological subregions. Discriminant analysis was also used to gain a better understanding of how certain environmental variables (overstory age, relative density, deer impact, percent cover estimates of non-tree vegetation, slope, aspect, etc.) simultaneously influence overstory and understory tree species similarity.

3. Calculate future forest types from the current understory conditions given a complete overstory removal or diameter limit cutting were to occur.

Dr. Chris Nowak and his graduate student, Bill Van Gorp, have made good progress on this objective. They have examined the cover type changes associated with 3 different levels of diameter limit cutting (12, 5 and 1 inch residuals) with all plots analyzed for type change and species shifts. Bill is in the process of learning analysis of variance – the next step in the analysis.

Assignments

FIA report preparation: Hanson, Ristau, Nowak and Van Gorp

Updated Timeline

Spring-Summer 2011: Prepare final FIA report on PRS.

Fall-Winter 2011: Submit completed report to FIA.

Literature Cited

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