Seeing Past the Green: Quantifying the Characteristics of High-graded Forests

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Introduction

- High-grading is a timber harvesting method wherein the largest and most valuable trees are removed.
- High-grading is a commonly used method to harvest timber on private lands in the Northeast.
- Previously high-graded forests are expected to require targeted rehabilitation practices.
- Forest managers need objective methods to incorporate an understanding of high-grading history into informing future management practices.

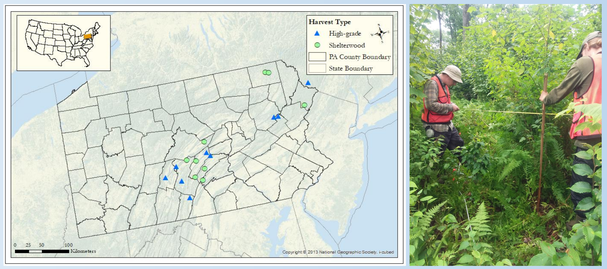

Figure 1. *Left*: Map displaying stand locations for high-grades (blue triangles) and shelterwoods (green circles). *Right*: Collection of seedling regeneration data.

Methods

- We selected 9 mixed oak stands that were high-graded 8-15 years ago, and, for comparison, we selected 9 stands that received the seed/establishment cut of a shelterwood sequence (Fig. 1).
- We systematically sampled the regeneration and overstory layers using nested fixed-area plots.
- Regen Plots: We tallied all tree seedlings < 2.5 cm DBH and ≥ 5.1 cm tall by species and height class.
- Overstory Plots: We collected diameter at breast height (DBH), tree quality, tree height, and uncompacted and compacted live crown depths for all trees ≥ 12.7 cm.
- We used a mixture of linear and non-parametric models to evaluate the effect of harvest type on stand-level variability, tree form/health, distribution of diameters, and tree crown dimensions.

Objective

To quantify unique structural and compositional attributes of high-graded forests in order to learn about stand history and inform future management activities.

Results

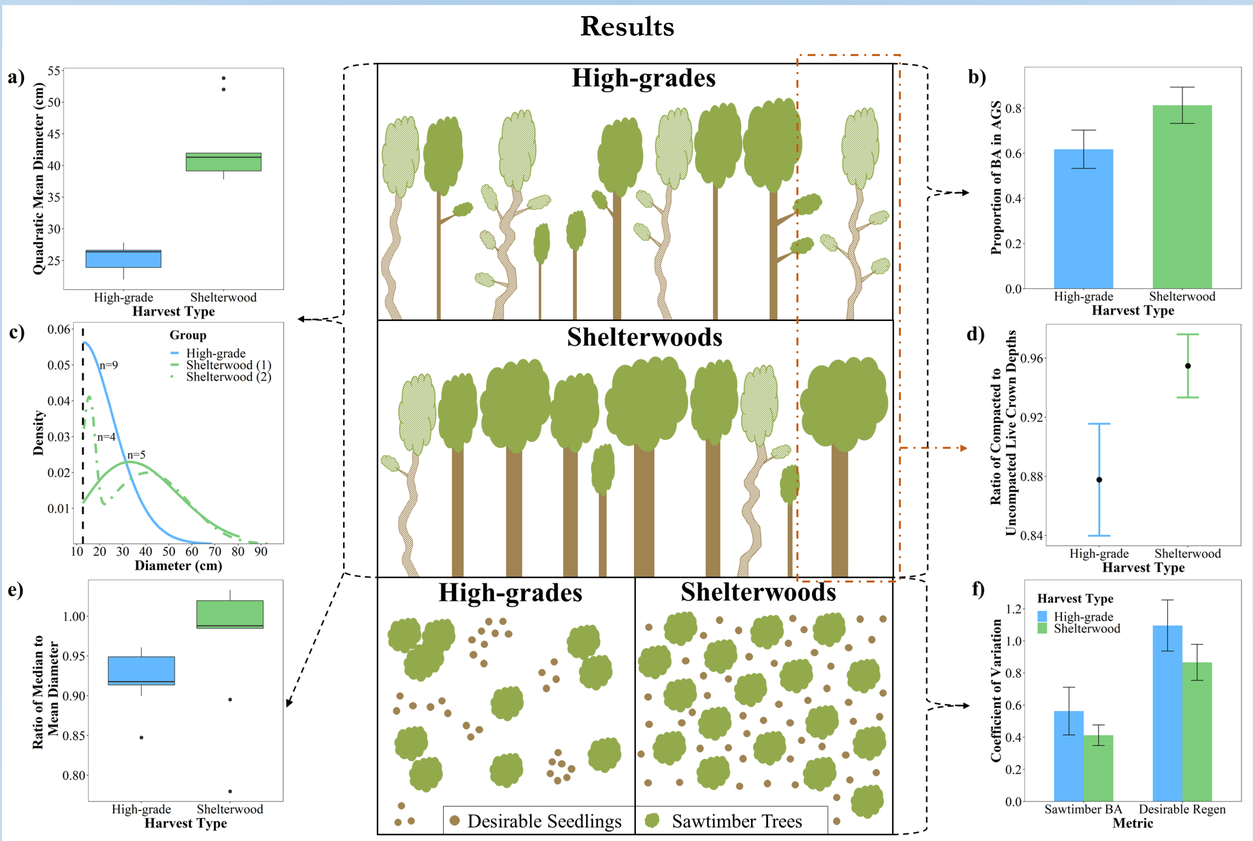

Figure 2. a) Quadratic mean diameter (QMD) by harvest type. b) Proportion of total basal area (BA) that is acceptable growing stock (AGS) by harvest type. c) Fitted Weibull probability density function of tree diameters for high-grades (solid blue line), unimodal shelterwoods (solid green line), and bimodal shelterwoods (dashed green line). Dashed vertical black line represents the minimum inventory diameter of 12.7 cm. d) Ratio of the compacted to uncompacted live crown depths by harvest type. e) Ratio of the median to mean tree diameter by harvest type. f) Coefficient of variation (CV) of plot-level sawtimber BA estimates (all trees ≥ 29.2 cm DBH) and of plot-level desirable seedling regeneration density estimates. All overstory data in graphs except for d use all trees ≥ 12.7 cm. Error bars in graphs b, d, and f represent 95% confidence intervals.

Discussion

- High-grades have lower BA in AGS, which results in lower economic value and stand health (Fig. 2b).
- The larger difference between compacted and uncompacted live crowns (Fig. 2d) in high-grades likely reflects a prevalence of epicormic branching, and consequently, reduced tree quality.
- The lower QMD, left-skewed diameter distribution, and lower ratio of median to mean DBH of high-grades reflects a predominance of small diameter trees of mostly non-oak species (Figs. 2a, 2c, 2e, & 3).
- Higher CV's of sawtimber BA and desirable regen in high-grades reflects more irregular understory and overstory conditions (Fig. 2f).
- High-grades exhibit unique characteristics that can be quantified using simple forest inventory measurements.
- Results will inform decision-support tools that foresters and private landowners can use to identify past high-grading and guide management decisions.

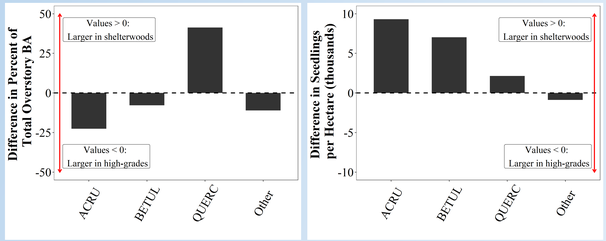

Figure 3. *Left*: Difference in the percent of total overstory basal area (BA) (all trees ≥ 12.7 cm DBH) between shelterwoods and high-grades (i.e., shelterwoods minus high-grades) by species group. *Right:* Difference in seedlings per hectare between shelterwoods and high-grades by species group. (ACRU = *Acer rubrum,* BETUL = *Betula spp.,* QUERC = *Quercus* spp., and Other = All other species).

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