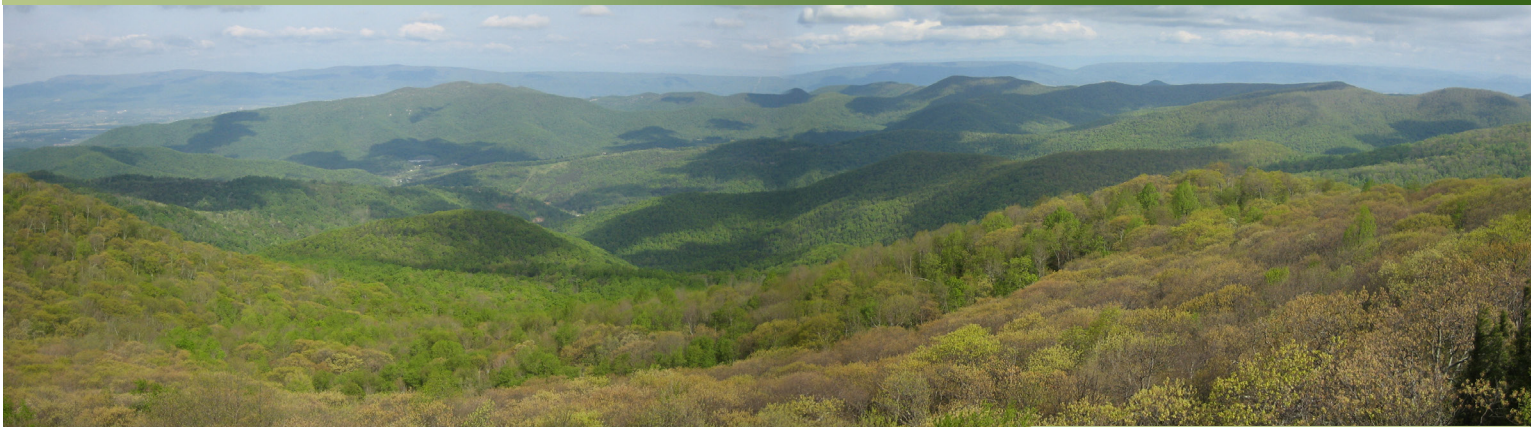




Shenandoah National Park

Forest Vegetation Resource Brief



Forest Vegetation Status and Trends - TREES

The Shenandoah National Park (SHEN) forest vegetation monitoring program evaluates the current status, and long-term trends in forest composition, structure, regeneration, and growth. The program goals are to provide data that informs resource management decisions, provide an early warning of gradual shifts toward abnormal forest conditions, and identify where detailed research is needed.

A series of 160 monitoring sites are used to sample the varied forest communities of the Park. Monitoring sites are stratified on the landscape within 16 Ecological Land Unit (ELU) types based on unique combinations of slope aspect, elevation, and bedrock geology. Three monitoring cycles have been completed since the current program's inception in 2003. The following highlights summarize the status and trends in canopy tree species evident over three monitoring cycles (1: 2003-2005, 2: 2007, 3: 2008-2011). (Cass et al. 2011).

The program defines canopy trees as those

with a diameter greater than 10 cm at breast height (1.37 m). Results are presented for the twelve species with the highest Importance Value (IV), an index based on relative basal area, frequency and density. These results

Figure 1.

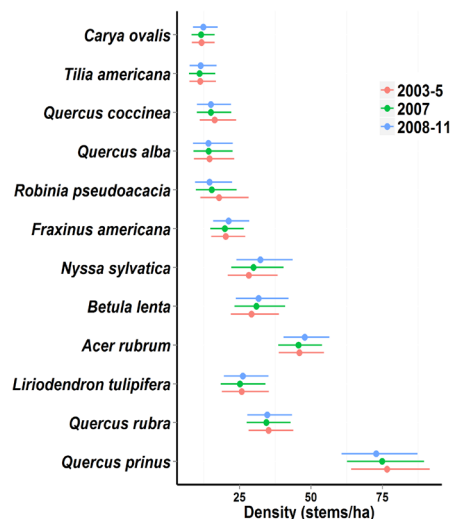


Figure 1. Mean tree species density (with 95% CIs) for the twelve tree species with the highest park-wide importance values in Shenandoah National Park displayed for three monitoring cycles (2003-2005, 2007, and 2008-2011).

Monitoring Measurements

- 1) Diameter, crown health and crown class for woody species > 10 cm DBH and greater than 1.37m in height
- 2) Size class and density for woody species < 10 cm DBH but greater than 1.5m in height
- 3) Density of woody seedlings
- 4) Cover class for all herb species, 41 target exotic species, and ground cover
- 5) Abundance of coarse woody debris and fire fuels

show that Chestnut oak (*Quercus prinus*) is the most abundant tree in the park, with the highest stem density values (Figure 1). Tree stem density values show little variation from 2003 – 2011. This demonstrates stability in the SHEN forest tree canopy over the sample periods. Tree growth in SHEN varies by species, but averages 2% overall (Figure 2). A 2% tree growth rate is the minimum normal value expected for forests with good integrity (Steinman, 2004).

Diameter-density graphs provide a way to examine how abundance varies by stem di-



Importance

Ninety-five percent of Shenandoah National Park is forested. Forests are a key component of the Park's ecological foundations. Forests provide habitat for many animals and other organisms, and are the matrix within which many visitor activities

and park operations occur. Long-term forest monitoring measures changes in forest condition and health, and can detect stressors that may impact forest integrity, and the organisms and human activities that depend on forests.

Tree Status and Trends ...

Figure 2.

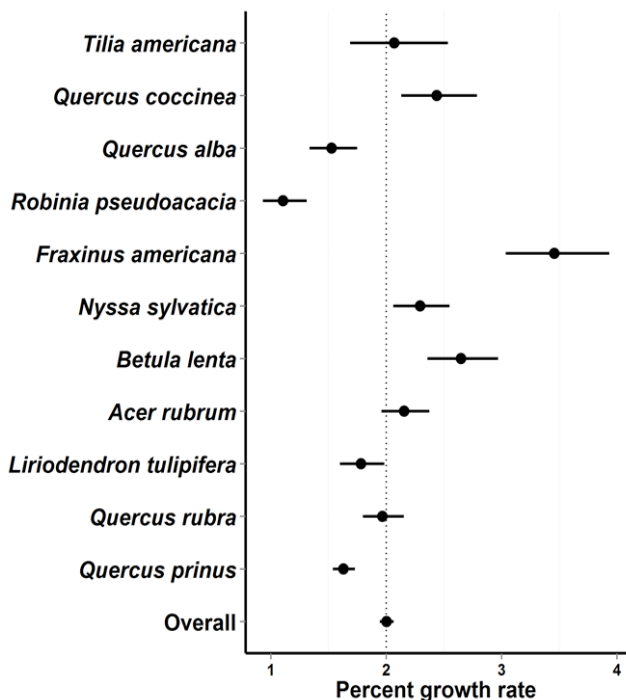


Figure 2. Percent growth rate for tree species with the highest Importance Values in SHEN. The average percent growth rate for all tree species is 12.0.

Figure 3.

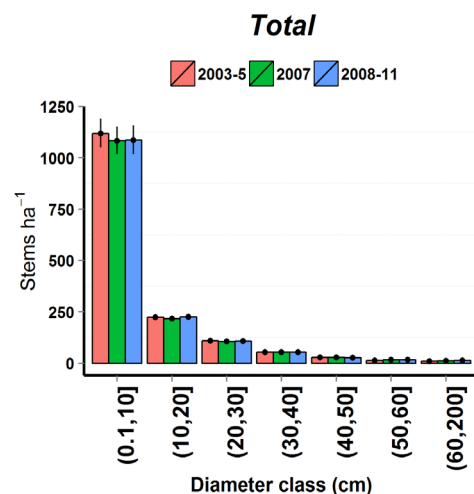
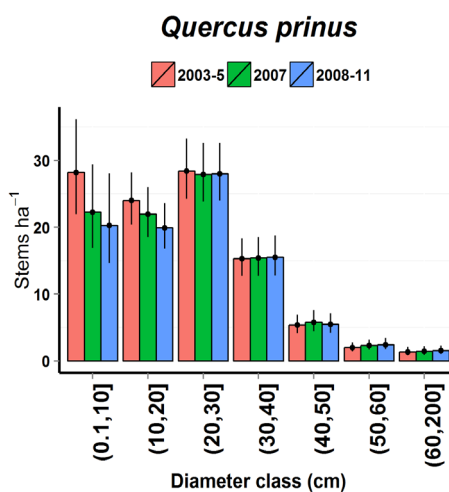


Figure 4.



Figures 3 & 4. Diameter-density distribution for all trees (Fig. 3), and for chestnut oak (*Quercus prinus*) (Fig. 4). Figures show stem abundance (with 95% CIs) by size class over three monitoring cycles (2003-2011).

iameter size class. These graphs describe characteristics of species regeneration and survival, and are influenced by forest age and degree of disturbance (Coomes and Allen, 2007). This information can help predict shifts in future forest composition.

The combined data for all trees sampled ($n=5076$ in sample period 3) within the SHEN forest monitoring program displays the classic reverse “J”- curve expected in a diameter density graph (Figure 3). This shape indicates that there are a large number of small individuals and progressively fewer larger individuals. However, the data for chestnut oak ($n=806$ stems in sample period 3) fails to display the reverse-“J” shape, indicating a lack of regeneration for this species in SHEN (Figure 4). This indicates that environmental conditions or outside influences such as wildlife impacts, or lack of fire may be inhibiting oak regeneration.

Tree regeneration may be impacted by many factors including shade, browse tolerance, and ability to withstand various environmental conditions. Species with fewer stems in the smaller size classes may be at risk of being outcompeted by co-occurring species with more individuals in smaller size classes (Harcombe 2002). In SHEN, species that show strong regeneration include red maple (*Acer rubrum*), black birch (*Betula lenta*), white ash (*Fraxinus americana*), and basswood (*Tilia americana*). These species appear well positioned to replace poorly regenerating oaks. Red

maple in particular is increasingly found to be abundant in the understories of eastern forests, and is predicted to become a dominant canopy tree over time (Abrams, 1998).

Data collection in 2015 will complete the fourth monitoring cycle since 2003. Continuation of the program is essential as the Park faces large-scale emerging threats to forest health such as Emerald Ash borer (*Agrilus planipennis*).

References and Acknowledgements

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