



Forest Health Monitoring Update for Marsh-Billings-Rockefeller NHP

Background

The Northeast Temperate Network (NETN) monitors a variety of natural resource indicators, which it calls “vital signs”, for 12 parks in the northeast and the Appalachian Trail. Forest Vegetation is considered a high-priority vital sign and the network developed a long-term monitoring program for forest resources. The program also provides data for three additional high-priority vital signs: Forest Soil Condition, White-tailed Deer Herbivory, and Landscape Context. The overall goal of the forest monitoring program is to assess status and trends in the composition, structure, and function of NETN forested ecosystems.

Methods

The forest health monitoring program tracks site and vegetation measurements in an extensive network of randomly located, permanent forest plots that are sampled every 4 years. Most tree, stand, and diversity measurements are made within these fixed-area 20 x 20 m² plots. Coarse woody debris (CWD) is assessed using line intersect sampling along three 15-m transects that originate from the plot’s center. Soil samples are collected from a location adjacent to the plot. An Ecological Integrity Scorecard is used to help simplify the reporting and interpretation of forest condition in NETN parks. The scorecard examines a host of compositional, structural, and functional data in relation to their natural or historical range, and assigns a rank of Good, Caution, or Significant Concern to each. “Good” represents acceptable or desired conditions, “Caution” indicates a problem may exist, and “Significant concern” indicates undesired conditions that may be in need of management actions. Because of the parks unique forest management history, results are split into Overall, Natural, and

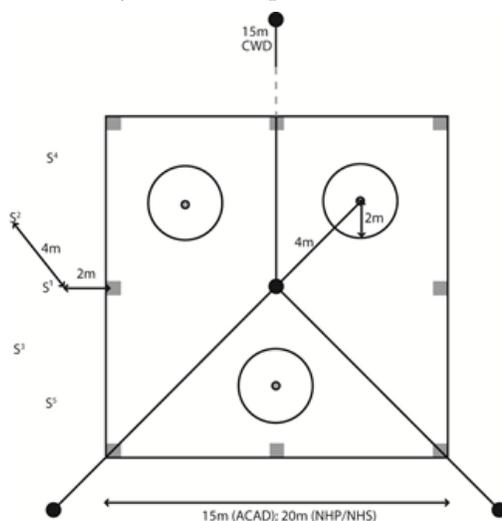


A close-up of beech bark disease on American beech, which affects many beeches in the park’s forest. It causes significant scarring and often eventual mortality of the tree. It results when bark, attacked and altered by the Beech Scale (white, powdery substance on tree conceals the tiny insect) is invaded and killed by fungi. Kent McFarland photo.

Plantation stand types. NETN recognizes that “ecological integrity” may not be the primary goal of park resource management, particularly at historical parks where cultural resource management may take precedence. But being able to compare the condition of park resources to ecological integrity benchmarks is still valuable because it allows for a deeper understanding of park condition, as well as a consistent baseline for assessment of management goals.

Results and Discussion

Prior to European settlement, the northern hardwood forests of the northeastern US were predominantly in late-successional and old growth stages of forest succession. Natural disturbances were primarily small-scale and stand replacing disturbances were rare (as long as 1,000-7,500 years apart for inland, post-glacial northern hardwood forests). Presettlement forests were primarily composed of shade-tolerant tree species, and characterized by a multi-aged structure, abundant standing dead and down trees at varying stages of decay, and an understory composed of advanced regeneration of shade-tolerant tree species. The practice of logging and land-clearing for agriculture post-European settlement constituted a major disruption in the natural processes of these forests, and the second-growth forests of today are structurally and compositionally different from late successional and old growth forests. The distribution of structural stages is important for maintaining a full complement of native species, which vary in their dependence upon different successional stages. Human alteration and management have greatly changed the structural stage distributions of eastern forests such that younger forests are far more abundant, and the amount of late successional and old-growth forest has been greatly reduced compared to presettlement times. These distributions will be further affected by global climate change and outbreaks of exotic



Forest plot layout with three nested 2-m radius regeneration microplots (hollow circles), eight 1 m² vegetation quadrats (grey squares), and three 15-m coarse woody debris (CWD) transects. S¹ is location of soil sample.

pests and pathogens. Comparison of existing distributions with those expected under natural conditions provides an indicator of how much has been altered and habitat availability. While the park had proportionately more plots in late successional forest than some others in the network, it also had higher than expected levels of late successional forest due to differences in the dominant forest type, and therefore was rated *Caution*. Structural stage distribution was similar between Natural and Plantation stands.

Dead wood, in the form of fallen coarse woody debris (CWD) and standing dead trees (snags), is an important structural feature of forests that provides habitat for many life forms, including mammals, birds, amphibians, and insects. Some land management practices and hazard tree removal can reduce the quantity or quality of these features. Despite a relatively high volume of CWD in the park, it was rated *Caution* because live tree volume was also relatively high. Based on field observations, CWD volume may be considerably higher than NETN's current sampling methods capture. On several occasions CWD pieces were encountered in plantations that were originally 10+ m long and that had been cut into 1 - 2 m lengths. While the volume of the combined pieces may be high, current methods only measure the length to the first cut. With less exposed surface area, intact logs are likely to persist longer and provide better quality habitat over time. Where possible, NETN recommends CWD pieces be left intact or kept as long as equipment will allow.

Both Natural stands and Plantations had lower than 10% standing trees as snags. Plantations had a slightly higher abundance of snags than Natural stands, but was rated *Significant Concern* due to the absence of snags ≥ 30 cm DBH.

At the request of the park, the forest crew began recording the presence of small and large tree cavities on live and dead trees as a

tree condition in 2012. While cavity data are not used to rate tree condition, tree cavities are important wildlife habitat that are often lacking in younger and managed forests. The forest crew found that tree cavity abundance in the park was one of the lowest in the network. In general, dead trees tended to have more cavities than live trees, and few large cavities were found on live trees.

Tree regeneration was assessed through looking at the quantity and composition of young trees in the forest understory, which will impact future canopy structure and composition.

Regeneration can be affected by invasive species, acid deposition, and climate change, as well as selective browsing by white-tailed deer. A high percentage

of plots in the park were rated *Caution* due to negative seedling ratios. The park's average deer browse index was fairly low, suggesting other factors such as stand development and/or invasive species may be behind the negative seedling ratios. Natural stands had a higher seedling ratio and stocking index than Plantations, and larger seedlings were more abundant in Natural stands. These patterns are expected, as even-aged plantations tend not to support an abundant understory.

Tree condition and forest pests were assessed by looking at tree condition based on observations of specific tree health problems and canopy foliage condition. As the season progresses, most trees develop minor foliage problems, but more extensive damage to canopy foliage may be indicative of tree health problems within a species or across a region. Tree condition in 2012 was similar to the 4-year average for the park. Beech bark disease (BBD) was the only pest/pathogen on the priority list that was detected in 2012, and the park had the most detections of it out of all NETN parks. BBD was the main reason for the *Caution* rating.

Invasive exotic plant species are a threat to forest health, and are of particular concern in plantations, which had higher diversity and abundance of indicator invasive exotic species than other stands. Natural stands in the park had few indicator invasive exotic plant species and were rated *Good*. Overall and Plantations were rated *Caution*. Ratings and degree of invasion varied by land use group in the park. The less disturbed Natural stands had significantly lower percent cover and fewer species of indicator invasive exotics than Plantations. Continued efforts to eradicate invasive species, particularly in plantation stands slated for harvesting, are important to maintaining forest health. Eradication of exotic shrub species is especially important. Exotic shrubs, such as bush honeysuckle and Japanese barberry, have caused significant impacts to forest condition in other network parks, and once established eradication is costly and labor intensive.

More Information

For a more detailed description of the forest protocol, including background information, field methods, and sample design, download the NETN Forest Health Monitoring Protocol from the network's Forest Health Monitoring webpage, where you can also download the complete 2012 report. The website includes a chance to do a fly over above all the park's forest plots through the use of Google Earth, which will also allow users to view ground-level photos of each plot with NETN's photo-browser (Google Earth Park Maps link is on the leftmost menu items on NETN's homepage).

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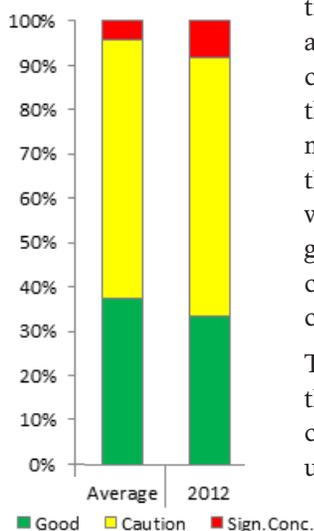
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Full Report online at:
<http://science.nature.nps.gov/im/units/NETN/>

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Proportion of plots receiving Good, Caution, and Significant Concern ratings for tree condition. Average bars include data collected in 2010 and 2012.



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