



## Forest Health Monitoring Update for Saratoga 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 fixed-area 20 x 20 m<sup>2</sup> 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 obtained 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



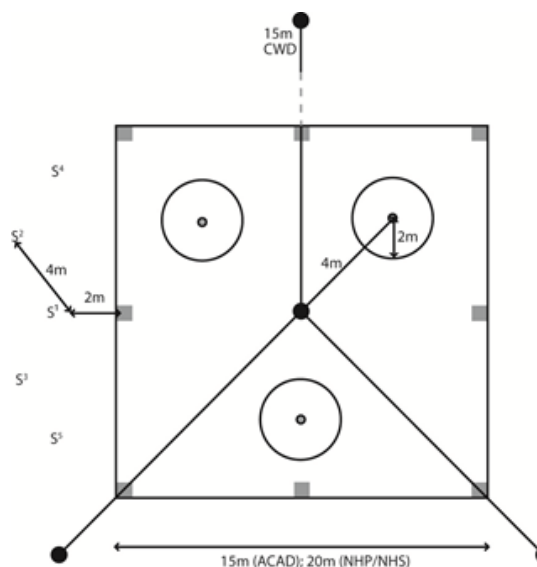
Many of Saratoga NHP's forest plots lack coarse woody debris and snags. NPS photo.

may be in need of management actions. NETN recognizes that “ecological integrity” may not be the primary goal of park resource management, particularly at historical parks and historic sites 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.

Monitoring plots in the park are separated based on land use history. The “Field” category represents areas that were open field in 1927 when the park was established, and the soils in these areas were likely plowed and some soil amendment (e.g., manure, liming) may have occurred. Many of these areas have since succeeded to forest, including areas where forest plots are located. The “Forest” category includes sites that were forest or woodland in 1927 and have been continuously forested since.

### 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. 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. Different structural stages are important for maintaining a full complement of native species.

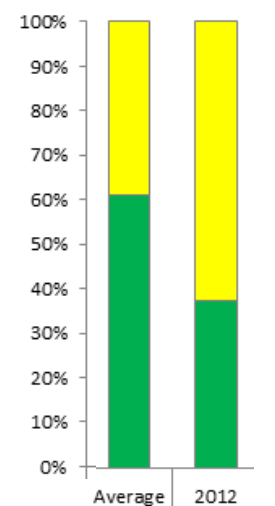


Forest plots with three 2-m radius regeneration microplots (hollow circles), eight 1m<sup>2</sup> vegetation quadrats (grey squares), and three 15-m coarse woody debris transects. S<sup>x</sup> is location of soil sample.

Future forest structure will be affected by climate change and outbreaks of exotic pests and pathogens. Out of all NETN parks, Saratoga NHP had one of only a couple of groups that scored a *Good* for structural stage distribution with desired levels of late successional forest in the Forest category (park Overall and Field still received a *Caution* rating). This follows predictable patterns of land use history in the park, with plots that have succeeded to forest since 1927 more likely to be in early successional or pole stages than plots that were forested at that time.

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 taxonomic groups, including mammals, birds, amphibians, and insects. Some land management practices and hazard tree removal can reduce the quantity or quality of these features. Part of Acadia NP and the Field group in Saratoga were the only groups to receive a *Good* rating for CWD and snags. Unfortunately, the high abundance of snags is due in large part to die back of American elm from Dutch elm disease.

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 deer browse index is indicating moderate deer impacts, and is highest in the Field group. Regeneration patterns also differ between the Field and Forest groups. Seedlings of all sizes are represented in the Forest group, but seedlings over 1 m are rare in the Field group. Heavy browsing on hardwood seedlings was noted in several plots in the Field group, and browsing was less evident in plots in the Forest group. It is possible that deer browse is keeping seedlings from reaching larger height classes in the Field group, and this, along with invasive species, may be hindering forest succession in these habitats.



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

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. Slightly elevated levels of leaf loss, necrosis (dead leaves/

needles) and holes (herbivory), primarily on hardwood species, were the main factors for the parks *Caution* rating. The known range of the emerald ash borer (EAB) continues to expand in the eastern US. EAB has officially been detected in one of the Roosevelt-Vanderbilt NHS's, and in 2011 in a single prism trap in Selkirk, New York - approximately 40 miles south of Saratoga's borders. White ash is a common forest species in the park, and it appears to be one of the few tree species capable of penetrating and persisting in exotic shrub thickets. White ash is also the most abundant seedling in the 15-30 and 30-100 cm height classes. Loss of ash in the park would cause major changes in forest composition and structure.

Invasive exotic species plants have the potential to impact structure, composition, and function of forested ecosystems, and are one of the leading threats to biodiversity and ecological integrity of ecosystems worldwide. Early detection of invasive exotic plants is an important NETN vital sign that has been incorporated into several long-term monitoring protocols, and the status and trends of invasive exotic species are monitored in all NETN forest plots. The park Overall was rated *Caution*. Ratings and degree of invasion varied by land use group, with the Forest group having a significantly lower number and percent cover of indicator invasive exotic species than plots in the Field group.

## Conclusions

The combined impacts of invasive species and deer herbivory appear to be altering forest condition in the park. Continued eradication efforts are encouraged, and reduction in deer densities may also be an important part of the solution. Emerald ash borer poses a significant threat to park forests. Early detection and outreach efforts to prevent its spread are important. Eradication efforts focused on managing exotic shrub species are equally important to create and maintain conditions where other tree species can regenerate.

## 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 the complete 2012 report can also be downloaded. 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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### Full Report online at:

<http://science.nature.nps.gov/im/units/NETN/>



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