



Forest Health Monitoring Update for Weir Farm NHS

Background

The Northeast Temperate Network (NETN) monitors a variety of natural resource indicators, called “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 help parks better understand the status and trends in the composition, structure, and function of their forested ecosystems.

Methods

The forest health monitoring program collects data within a network of randomly located, permanent forest plots that are sampled every 4 years. An Ecological Integrity Scorecard was created to help simplify the reporting and interpretation of forest condition in NETN parks. The scorecard crunches a wide swath of data and compares current conditions to their “natural” or historical range of variation. A rank of Good, Caution, or Significant Concern is assigned to the health indicators. “Good” means acceptable or desired conditions are present, “Caution” indicates a problem may exist, and “Significant concern” warns of undesired conditions that may be in need of management action. 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

The 2013 field season marked the 8th consecutive year of forest health monitoring for the Network, and nearly all 351 plots in NETN have been sampled twice. Though still early in a long-term monitoring program to draw sweeping conclusions, the latest report provides helpful comparisons of ecological integrity measurements between cycle 1 (2006 – 2009) and cycle 2 (2010 – 2013). Below is a sampling of some of these findings.

Structural Stage Distribution

A variety of forest structural stages is important for maintaining a full complement of native species that depend upon specific forest types (old growth, clearings, pole-sized trees, etc.). Before European settlers wrought massive changes to the Northeast, the northern hardwood and spruce-fir forests of the region were



The invasive plants Japanese Barberry and Garlic Mustard were fairly frequent residents of park forest plots in 2013 and seem to be spreading. NPS photo.

mostly in late-successional and old-growth stages of forest succession. Several cycles of logging and land-clearing created major disruptions in the natural processes and usual forms of disturbances, resulting in forests of today that are much younger and structurally and compositionally different than what Native Americans and the earliest settlers would have recognized as typical regional woodlands.

Park management actions can continue to influence forest makeup and structure today. It is highly likely that in the near future, disturbances resulting from global climate change and outbreaks of exotic pests and pathogens will play increasingly greater roles in forest health and make-up. The Northeastern Interior Dry-Mesic Oak Forest type of the park met desired levels of late-successional forest and was rated Good for both the first and second cycles of monitoring.

Coarse Woody Debris and Snag Abundance

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, fungi, amphibians, and insects. In addition, live trees toppled by strong wind events contribute to forest soil turnover when the roots pull up copious amounts of dirt with them and create important microhabitats for tree seedlings, lichens, mosses, and even bird nesting sites. Land management practices can either reduce the quantity or quality of these features, or maintain and enhance snags and CWD. Along with most other NETN parks, Weir Farm ranked Caution for CWD (both cycles).

The park had some of the lowest overall snag densities of all of NETN, though it did improve from Significant Concern in cycle 1 to Caution in cycle 2. Though not statistically significant, the improved rating was primarily the result of a slight increase in snags over 30 cm diameter at breast height.

Tree Regeneration

The tree seedlings and saplings on the forest floor of today will be the forest canopy structure and composition of tomorrow. Tree regeneration can be affected by a variety of factors, including invasive species, acid deposition, and climate change. Another relatively recent and highly destructive impact on seedling establishment, growth, and composition is selective browsing by a historically high population of white-tailed deer in parts of the Midwest and Northeast U.S.

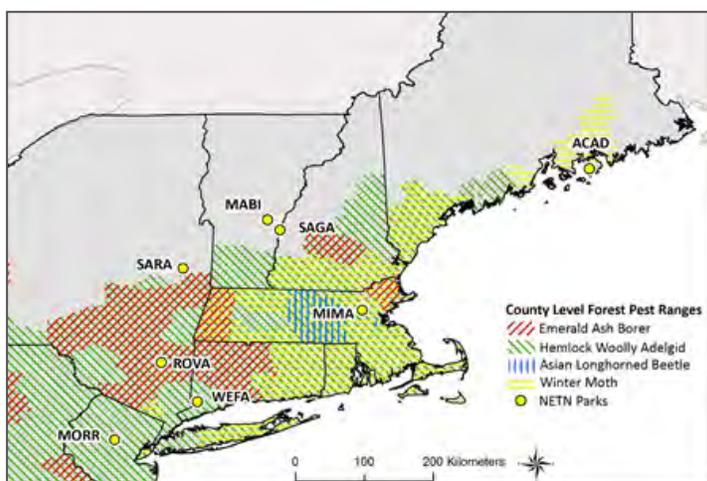
All plots in the park were either rated Caution or Significant Concern for Tree Regeneration, seedling densities were low, and average deer feeding sign was abundant (browse-preferred species rare to absent and non-preferred or browse-resistant vegetation limited in height by browsing), suggesting that impacts from deer overabundance are likely occurring in the park.

Tree Condition and Forest Pests

As the season progresses, most trees develop minor foliage damage and problems. However, more extensive damage to canopy foliage may indicate tree health problems within a species or across a region, and could be related to any combination of soil chemistry, climate, pathogens, or other stresses. Several species of exotic pests and pathogens pose serious threats to northeastern forests if they advance into the region. These NETN “Priority 1” pests are Asian longhorned beetle, emerald ash borer, hemlock woolly adelgid (HWA), and sudden oak death. Along with a couple other NETN parks, Weir Farm had some of the highest proportions of plots with Significant Concern ratings in both cycles, primarily due to the presence of HWA in some plots. Only a few plots were rated Good, particularly in the second cycle. The Caution ratings in the park were mostly the result of high levels of necrosis (dead/dying leaves) and leaf loss on plots in wet areas.

Invasive Exotic Plant Indicator Species

Invasive exotic species 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



Hemlock Woolly Adelgid has been found in the park and the Emerald ash borer is not far away. Diligent monitoring will be needed to prevent further spread of these pests into park forests.

ecosystems worldwide. Early detection of invasive exotic plants is an important NETN vital sign that has been incorporated into several long-term monitoring protocols. Indicator invasive species were fairly widespread in the park and may be increasing. The average number of indicator species per plot and per quadrat were significantly higher in cycle 2, pushing the park from a Caution to a Significant Concern rating. These results may be an early indication of invasive species expansion, or could be the result of phenological differences between cycles or better plant identification skills of field crews in the second cycle. NETN expects patterns in invasive species abundance and richness to become clearer as more cycles of data are collected.

In addition to well-documented ecosystem impacts, recent studies have suggested that exotic shrub thickets can also have an indirect effect on human health. By creating a more favorable humid microclimate, exotic shrub thickets can harbor higher densities of blacklegged ticks than uninvaded forests. Research even shows that there is a higher incidence of blacklegged ticks infected with human pathogens, such as Lyme disease, in exotic shrub thickets due to altered movement and habitat use by mammals that disperse ticks. Blacklegged tick populations and infection rates dramatically decreased when the exotic shrub thickets were removed.

Conclusions

Forest health in the park appears to be impacted by a number of factors, including white-tailed deer overabundance, forest pests, invasive exotic species, and a lack of snags and coarse woody debris. CWD and snag abundance are expected to increase over time as the park’s second-growth forests mature. Management efforts to improve park forest health should focus on controlling invasive species and reducing deer densities. Early detection of new invasive species and forest pests should also be a priority in the park.

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 2013 report. The website includes a chance to view all the park’s forest plots through the use of Google Earth, which will also allow users to see all other NETN study locations within the park. The Google Earth Park Maps link is one of 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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