



Forest Health Monitoring Update for Marsh-Billings-Rockefeller NHP

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 created massive changes in the Northeast, the northern hardwood and spruce-fir forests of the region were mostly in late-successional and old-growth stages of forest succession.



Park forests exhibit minimal snag and CWD forest structure. NPS photo.

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.

Comparisons between monitoring cycles revealed some interesting findings. Of all network parks, Marsh-Billings-Rockefeller NHP had the highest percentage shift (17%) of plots moving into a later successional category. While NETN scientists do not want to read too deeply into these findings, the amount of change in only 4 years of monitoring was still surprising. Careful review of the data revealed that in most cases, the change from Pole to Mature or Mature to Late-succession was the result of one or two trees in a plot reaching the next largest size category in the second cycle. There were very few examples of plots moving into earlier successional categories, so these changes are likely real.

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.

Though the park did improve slightly for CWD when comparing cycles, it still sits firmly in the Caution category for this forest health

measurement. The park also rated Significant Concern for snag abundance in both cycles, mostly because of a lack of larger sized snags. Snag abundance and CWD volume may continue to be lower than levels indicative of high ecological integrity in the park for some time, as this is a common issue in forests managed for timber production. Adapting forest management approaches to encourage more snag and CWD retention may be necessary to improve these important structural components.

Small and large cavities were comparatively rare in live and dead trees, though it should be noted that the chances of seeing tree cavities, especially smaller ones, decreases with tree height and density of the canopy. True cavity densities are likely higher than the data suggest. In addition, these numbers are only based on one survey from half of the plots so they should be considered preliminary.

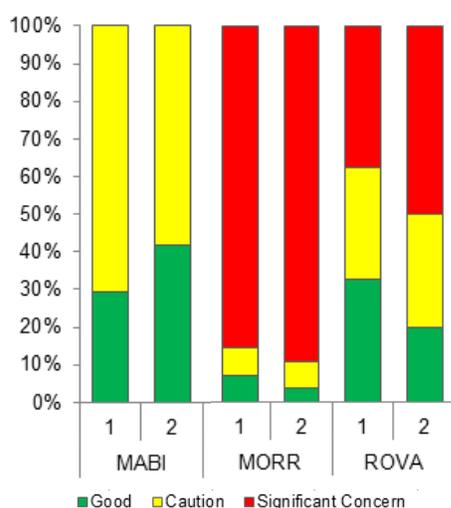
Tree Regeneration

The tree seedlings and saplings on the forest floor of today will become 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.

A high percentage of plots were rated Caution in the park due to negative seedling ratios, even though deer browse pressure is fairly low. Other factors such as stand development and/or invasive species may be behind these numbers.

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



Comparison between a park with relatively light deer impacts and invasive species (MABI - Marsh-Billings-Rockefeller NHP), to ones with significant deer and invasives (MORR - Morristown NHP & ROVA - Roosevelt-Vanderbilt Parks) shows how drastically tree regeneration can vary between parks. The numbers 1 & 2 represent the two monitoring cycles in each park.

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, and sudden oak death. Tree condition was

similar between cycles in the park, with a few less plots rating Significant Concern during the most recent round of monitoring. Beech bark disease was the main reason for the park's Caution rating for forest pests.

Continued vigilance and outreach are important for preventing the spread of forest pests such as hemlock woolly adelgid, winter moth, and emerald ash borer. Efforts to slow the spread of earthworms, such as cleaning tires on logging equipment before moving into uninvaded areas, are also recommended, particularly in hardwood stands dominated by sugar maple.

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 ecosystems worldwide. Early detection of invasive exotic plants is an important NETN vital sign that has been incorporated into several long-term monitoring protocols. In addition to ecosystem impacts, recent studies have even suggested that exotic shrub thickets can 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 has also found higher incidences of blacklegged ticks that are 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.

The park continues to have a low percentage of invasive plant species in study plots and once again rated Caution for this category. Continued efforts to eradicate invasive species, particularly in plantation stands slated for harvesting, are important for maintaining forest health. Eradication of exotic shrub species is especially important, as they are causing 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 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 locations of other NETN park study sites. The Google Earth 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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