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Forest Health Update for Weir Farm NHS

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 National Scenic Trail. Forest Vegetation is considered a high-priority vital sign and as such, 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 participating NETN forested ecosystems.

Methods

The forest health monitoring program tracks a representative suite of site and vegetation measurements in a network of randomly located, permanent forest plots that are sampled every 4 years. As of the 2011 monitoring season, the network has resurveyed half of the forest plots. Most tree, stand, and diversity measurements are made within the fixed-area, 20 x 20 m² plots. Coarse woody debris 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 just adjacent to the plot. 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 website. The website also offers the chance to do a fly over above all the park's forest plots using Google Earth, which will also allow users to view ground-level photos of each plot with NETN's new photo-browser (Google Earth Park Maps link is on the leftmost menu items on NETN's homepage).

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 a rank of Good, Caution, or Significant Concern to each. “Good” represents acceptable or desired conditions; “Caution” indicates a problem may exist; “Significant concern” indicates undesired conditions that 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. Nonetheless, 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 Findings

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 forms of wildlife, fungi, and insects. Large-diameter snags provide habitat for a greater number of vertebrate species and persist longer than smaller-diameter snags. Whereas thoughtful land management can maintain or enhance snag and CWD quality and availability, certain forestry and land management practices can reduce these important forest features. Weir Farm rated Caution in this category due to lower than expected proportion of snags of all sizes, and an almost a complete lack of medium to large snags.

The NETN forest monitoring crew also tracks tree condition and keeps an eye out for forest pests. 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 can be related to any





The exotic-invasive hemlock woolly adelgid has been detected in one of Weir Farm NHS's forest monitoring plots. Cornell Funghi photo.

combination of soil chemistry, climate stress, pathogens, or other factors. 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 exotics is an important NETN vital sign that has been

incorporated into several long-term monitoring protocols. Several species of exotic pests 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. Other forest pests can cause problems that are not quite as severe, and/or may already be widespread in the NETN region. These NETN "Priority 2" pests are balsam woolly adelgid, beech bark disease, butternut canker, and elongate hemlock scale. Of the three plots that rated Significant Concern for tree condition in the park, one was due to hemlock woolly adelgid and the two others were the result of elevated insect feeding damage and multiple trees with necrotic (dead/dying) leaves.

Indicator invasive exotic plant species are more pervasive throughout southern NETN parks, with every park averaging over three indicator invasive exotic species per plot. While indicator invasive exotics are a widespread problem at Weir Farm NHS, percent cover and diversity of indicator invasive exotics is still much lower than that of native species.

Tree regeneration looks at the quantity and composition of regeneration in the forest understory, which will impact future canopy structure and composition in the future. Regeneration can be affected by a variety of factors - including invasive species, acid deposition, and climate change. Results for Weir Farm NHS indicate extensive impacts from deer browsing. The average deer browse index was 3.8 (out of 5), and 60% of the plots were rated Significant Concern due to low stocking index values.

Tree growth and mortality rates are important indicators of tree health and vitality. Tree growth rates can decline in response to environmental factors or human-caused stress, and tree mortality is often preceded by some years of reduced tree growth. Decreased growth or elevated mortality rate in trees of a particular species can indicate a unique health problem for that species; while altered vital rates for multiple species across a region may

indicate a regional environmental stress, such as acid deposition. Weir Farm NHS had the lowest overall growth rate of all NETN parks. However, this is based on only five plots, and can be influenced by just a few measurement errors. If the park continues to have a low growth rate after multiple sample cycles, then there may be a forest health issue that will require further investigation. In fact average growth rates were lower for all NETN parks than U.S. Forest Inventory and Analysis (FIA) average growth rates, while average mortality rates tended to be slightly higher in NETN parks than FIA sites. A closer look at the distribution of plots across structural stages suggests that growth rates in NETN parks are based on a higher proportion of late-successional stands. Trees in late-successional stands naturally tend to have slower growth rates and slightly higher mortality rates than trees in mature stands, and this may explain at least some of the differences in growth and mortality rates. Species composition may also explain some of the differences, and may be examined in future reports as more data are available.

NETN monitors soil chemistry to understand the effects of atmospheric deposition on forest health, which is a special concern for forests in the northeast that tend to have thin soils with low soil buffering capacity. Acid deposition occurs when emissions from the combustion of fossil fuels and industrial processes react with water and oxygen in the atmosphere to produce acidic anions of sulfur (S) and nitrogen (N), and then fall to earth in dry or wet form. Acid deposition has also dramatically increased inputs of N and S to forested ecosystems in the northeast, and concern has arisen that excess N may "saturate" forest soils, causing excess nitrification and N leaching and exacerbating the effects of acidification. All of these impacts can reduce plant growth and increase susceptibility of trees to other stresses. Soil plots in the park were relatively evenly spread from a high risk of acidification to a low risk.

Conclusions

Forest health in Weir Farm NHS appears to be impacted by a number of factors - including white-tailed deer, forest pests, invasive exotic species, and lack of dead wood in the form of snags and coarse woody debris. Coarse woody debris and snag abundance are expected to increase over time as the park's second-growth forests mature. Management efforts to improve 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.

More Information

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Full Report online at:

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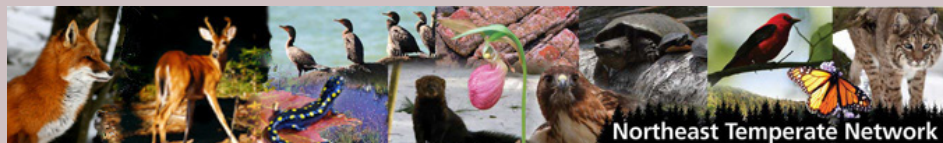
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