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Forest Health Update for Morristown 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 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 NETN forested ecosystems.

Methods

The forest health monitoring program tracks a representative suite of site and vegetation measurements in an extensive 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, and “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. 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.

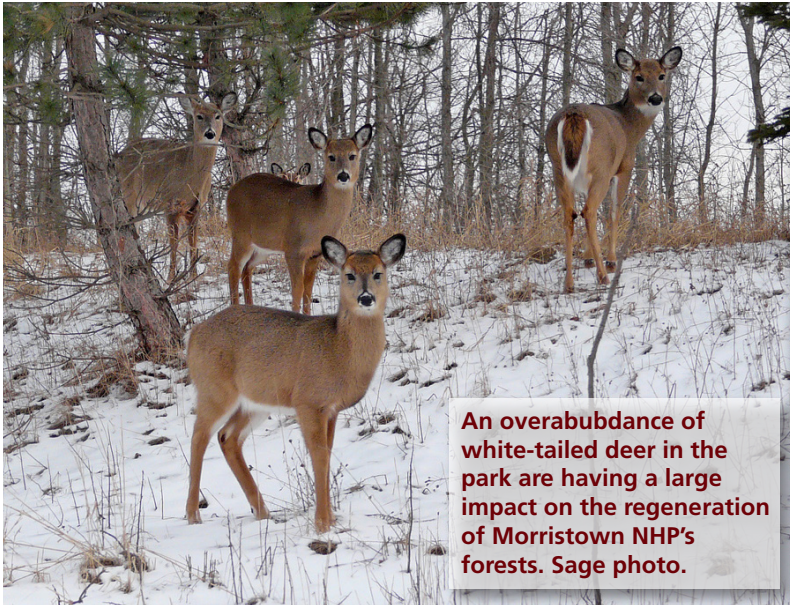
Results and Findings

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. CWD and snag abundance were well below expected levels in Morristown NHP, leading respectively to Caution and Significant Concern ratings for the park.

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. Invasive exotic species are pervasive throughout Morristown, averaging over five indicator invasive exotic species per plot and comprising most of the plant cover in the understory of successional forests, and are likely causing great impacts to forest condition. However, there is a sizeable difference between mature and successional forests in the park, with successional stands having significantly higher cover of indicator invasive exotics. Invasive plant management will require considerably



Exotic invasive plants, such as Japanese barberry, are dominant in the understory of many of Morristown's forest plots. NPS photo.



An overabundance of white-tailed deer in the park are having a large impact on the regeneration of Morristown NHP's forests. Sage photo.

more effort in successional stands, but may be necessary to prevent further invasion into mature stands.

As the season progresses, most trees develop minor foliage problems. However, more extensive damage to canopy foliage may be indicative of tree health problems within a species or across a region, and could be related to any combination of soil chemistry, climate stress, pathogens, or other stressors. In particular, exotic pests and pathogens have the potential to severely impact forest tree composition as well as structure and function. 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. Tree condition in Morristown for 2011 was slightly better than or similar to the 4-year tree (2008-2011) condition average, and no plots were rated Significant Concern for the year. Plots that rated Caution were mostly the result of slightly elevated insect damage or leaf loss, or presence of minor beech bark disease impacts.

Tree growth rates are lower than the regional growth rates calculated from a regional Forest Service analysis, but the higher proportion of late successional stands in the park may be influencing the lower growth rates in the park. Overall tree mortality is within accepted ranges, and is lowest for oak species. The mortality rate for white ash may be of concern if this high rate is maintained over multiple sample periods.

Tree regeneration looks at the quantity and composition of regeneration in the forest understory, which will impact future canopy structure and composition. Regeneration can be affected by a variety of factors - including invasive species, acid

deposition, and climate change. Tree regeneration is well below levels required to restock the forest in the future, and is especially low in successional stands. Extensive deer browse impacts are evident by the fact that only two of 28 plots were rated Good in the park for regeneration, and one of these plots is located in a deer enclosure. While seedling densities are higher in the mature stands, regeneration is still at extremely low levels. Additionally, both mature and successional stands average over 4 (out of 5) on the deer browse index, which means that browse lines are present in many of the plots, and high impacts are evident in nearly all of the plots.

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 analysis in Morristown showed acidification risk is low in its well-buffered soils, despite receiving the highest S and N deposition rates. Soils in the park also appear to be relatively rich.

Conclusions

A high density of white-tailed deer and invasive exotic species are significantly impacting forest health in Morristown NHP and management action will be necessary to improve forest condition. Invasive exotic species are pervasive throughout the park and especially abundant in successional stands. Regeneration densities are well below levels required to restock the future forest, and have been for some time as evidenced by the lower than expected density of trees in the 10-30 cm size classes. It is important that the park continue to move forward on its white-tailed deer management plan, which also includes plans for invasive species control. In areas where seed sources are absent, planting of native herbaceous and shrub species may be necessary to restore diversity in the understory.

More Information

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Full Report online at:

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

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