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Forest Health Update for Acadia National Park

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. One-fourth of the 176 plots in Acadia are sampled each year. 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, square plots (15 x 15 m²). 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 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

Results and Findings

assessment of management goals.

Ecological integrity measurements suggest that the forests of Acadia are approaching mature stages of forest succession, but late-successional features, like medium to large snags, are still lacking on Mount Desert Island and the Schoodic Peninsula. 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 last 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 ratings (based on a ratio of CWD to live trees) varied across all of Acadia's subunits. Isle au Haut and the eastern section of Mount Desert Island (MDI) were rated Caution, but the park overall rated as Good. The western section of MDI had the highest CWD ratio. Snag abundance on the whole was more variable, and Isle au Haut was the only park unit in all of NETN to receive a Good rating. While all subunits of the park met the expected proportion of trees as snags, snags over 30 cm diameter at breast height (DBH) were scarce on eastern MDI and Schoodic, leading to a rating of Significant Concern for these two units.

Acadia continues to have the fewest invasive species of all NETN parks, with a mere three out of 176 plots containing indicator invasive exotic species. Invasive exotic species have the potential to impact



NETN forest monitoring crew member Evan Heck measures the DBH of a birch tree in one of Acadia's stands. NPS photo.



The Asian Longhorn Beetle has the potential to severely impact hardwoods such as sugar maples if the ever become common in the forests of the Northeast.

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. Acadia was the only park sampled in 2011 that was rated Good for this measurement.

As the growing 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. Damage from beech bark disease and balsam woolly adelgid were the only major tree condition issues reported at Acadia in 2011.

Tree condition in the park for 2011 was slightly better than or similar to the 4-year tree condition average (2008-2011) with impacts from deer browse appearing to be minimal, and no plots rating as Significant Concern. Plots that rated Caution were mostly due to the presence of balsam woolly adelgid, major damage from beech bark disease, isolated pockets of elevated insect feeding on hardwoods, and/or chlorosis (a condition in which leaves produce insufficient chlorophyll) of trees in marginal (e.g., forested swamp) habitats.

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 growth rates in Acadia are lower than the regional growth rates calculated from the U.S. Forest Service Forest Inventory and Analysis program. Lower growth rates are likely due, in part, to the higher proportion of late successional

plots in the park. While overall tree mortality is at acceptable levels, balsam fir and big tooth aspen both have elevated mortality rates. Higher mortality rates for balsam fir are likely influenced by the presence of balsam woolly adelgids. Big tooth aspen mortality could be the natural result of forest succession, and therefore is not a forest health concern. NETN is in the process of developing a tree regeneration metric for Acadia using data collected in late-successional forests and deer exclosures in the park, and this will be incorporated in future reports.

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.

Results from soil analysis suggest that forest soils in Acadia - which have high organic content, low pH, and low base saturation - are the most vulnerable of all NETN parks to acidification, despite receiving the lowest annual acid deposition rates in the network. Conversely, Acadia is also least vulnerable to N saturation and NO_3^- export due in part to high organic content.

Conclusions

As long as forest composition remains stable (e.g., no new invasive species, stable tree condition/forest pests, and continued regeneration), late-successional structure is expected to develop over time. Invasive species and forest pests are the major controllable threats to forest health. Continued vigilance and outreach are vital to preventing the spread of forest pests such as hemlock woolly adelgid, emerald ash borer, and Asian longhorned beetle. Ongoing exotic plant management and early detection efforts are equally important to maintain forest health in the park.

More Information

Name:

Kate Miller

NETN Plant Ecologist

Brain Mitchell

NETN Program Manager

Phone/Email:

207-288-8736

kathryn_miller@nps.gov

802-457-3368 ext. 37

brian_mitchell@nps.gov

Full Report online at:

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



Northeast Temperate Network

54 Elm Street, Woodstock, Vermont 05091
802-457-3368

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



