



Forest Health Monitoring Update for Acadia National Park

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

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 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.



Today's tree saplings and seedlings become the canopy trees of tomorrow.

Park management actions can continue to influence forest makeup and structure today. It is highly likely that in the near future, disturbances resulting from climate change and outbreaks of exotic pests and pathogens will play increasing roles in forest health and make-up.

Only a small percentage of plots were in late-successional forest in the park, and it was rated Caution for structural stage distribution. Over 15% of the plots are woodlands, which tend to occur in areas with exposed bedrock, and have more than 60% canopy cover due to the harsh growing conditions. Plots in woodlands are not expected to succeed into later successional forest and may be more sensitive to other stresses due to already stressed growing conditions.

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.

CWD in the park has alternated between Good and Caution over the last few years of reporting, primarily because the CWD ratio in the park is so close to the value that distinguishes Good from Caution. Considering that CWD volume does not typically differ significantly between cycles, the change from Good to Caution is more likely due to sample variability than an actual change. Acadia rated Caution for snag abundance in cycle 2, primarily due to a lack of snags greater than 30 cm in diameter.

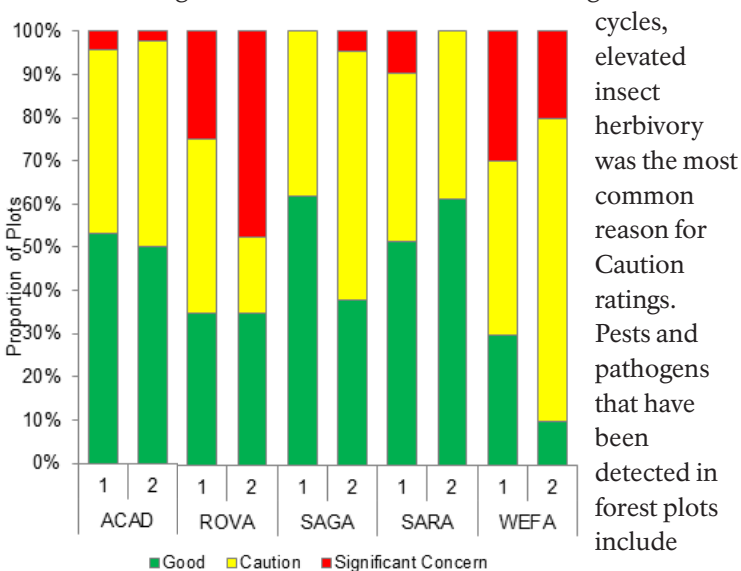
Tree Regeneration

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. Though not a problem at Acadia National Park, 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.

Forests across all park subunits and successional stages seem to have sufficient levels of regeneration, but patterns of regeneration reflect those of earlier stages of forest succession. Therefore, the park rated Good for the stocking index, and Caution for the sapling:small seedling ratio. As the park's forests mature and move towards more uneven-aged stands, NETN expects the sapling:seedling density ratios to approach those seen in old-growth and late-successional stands. There were no significant differences in the stocking index between cycles.

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, 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. In both



Acadia consistently ranks high when compared to some of the other network parks in regards to tree condition. The Roosevelt-Vanderbilt parks (ROVA) and Weir Farm NHS (WEFA) in particular have problems associated with Hemlock Woolly Adelgid, Emerald Ash Borer, and Elongate Hemlock Scale. The numbers 1 & 2 represent the two monitoring cycles in each park.

Balsam Woolly Adelgid and Beech Bark Disease. Hemlock Woolly Adelgid and Winter Moth has recently been detected on MDI, but has not been seen in park forests. It was first detected in New England in 2003 in Massachusetts, and has since spread throughout Coastal New England. If they cause repeated defoliation increased tree mortality can result either directly, or through increased susceptibility to other stressors (drought, secondary defoliators, fungal pathogens).

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. Acadia continues to have the lowest incidence of invasive exotic species of all NETN parks, with indicator invasive species occurring in only three plots in both cycles.

Conclusions

Ecological integrity metrics related to forest structure suggest that park forests are beginning to reach mature stages, but still lack late-successional structure such as CWD, medium to large snags, and a low sapling to seedling ratio. As long as forest composition remains stable with no new invasive species being introduced, a stable tree condition/forest pest mix, and continued tree regeneration, late-successional structure is expected to develop over time. Invasive species and forest pests are the major controllable threats to forest health and ongoing exotic plant management is vitally important to maintaining forest health. Continued vigilance and outreach are equally important to preventing the spread of forest pests such as hemlock woolly adelgid, winter moth, and emerald ash borer.

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 do a fly above all the park's forest plots through the use of Google Earth, which will also allow users to view locations of other NETN study sites within the park. The Google Earth Park Maps link is one of the leftmost menu items on NETN's homepage.

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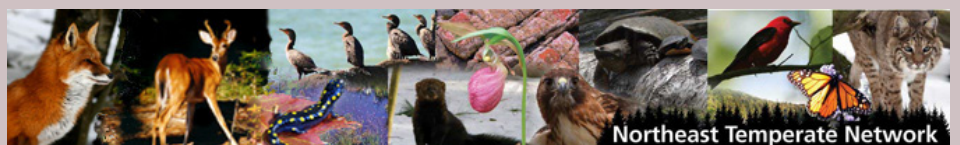
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Full Report online at:
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