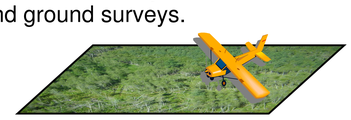
From Detection Monitoring to Evaluation Monitoring — assessing northern white-cedar crown dieback in Maine and Michigan

Forest Health Monitoring

Detection Monitoring

…evaluates the status and change in the condition of forested ecosystems through analysis of data collected from nationally standardized aerial and ground surveys.

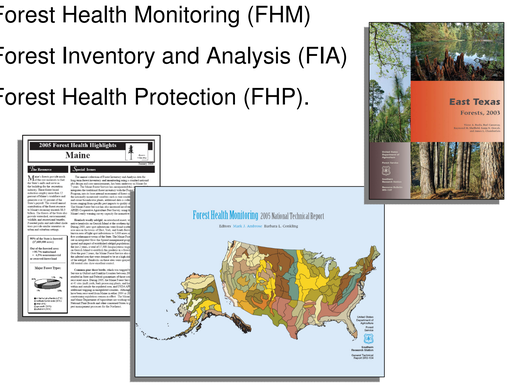


Unusual or deteriorating forest health conditions are identified through the detection monitoring and reporting efforts of three primary U.S. Forest Service Programs

…Forest Health Monitoring (FHM)

…Forest Inventory and Analysis (FIA)

…Forest Health Protection (FHP).



Evaluation Monitoring

…seeks to determine the extent, severity, and cause of any deteriorating forest conditions observed through Detection Monitoring.

FHM funds Evaluation Monitoring (EM) projects under two broad categories. **Base EM Projects** investigate and explain general forest health issues or concerns. **Fire Plan EM Projects** investigate and explain the extent, severity, and cause of a fire-related phenomenon. Funding selection criteria include

…linkage to Detection Monitoring
…geographic impact
…biological impact
…political importance
…feasibility of successful project completion within 1 to 3 years.

Listings and descriptions of EM projects funded since 2004 are posted on-line **http://fhm.fs.fed.us/em/funded/proposals_base.shtm**.

Evaluation Monitoring Project NE-EM-07-01

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Discovery

FIA assesses a suite of crown-condition variables on its nationwide network of Phase 3 inventory ground plots.[1] One of these variables, crown dieback, is a measure of recent mortality of branches with fine twigs, which begins at the terminal portion of a branch and proceeds toward the trunk. Crown dieback serves as an early indicator of loss of vigor and growth potential and when severe enough, tree mortality may result.

Crown dieback data collected by FIA between 2000 and 2004 were summarized as part of the 2006 National FHM report.[2] Through this work, spatial clusters of plots with crown dieback of 10% or more were discovered among several of the plot-level averages of northern white-cedar in Maine and northern Michigan (fig. 1). These elevated averages for northern white-cedar were not necessarily accompanied by elevated averages among the hardwoods and other softwoods on the same plots.

Such levels of dieback were of concern because conifers often do not exhibit crown dieback unless the tree, and in particular its root system, is under serious stress.

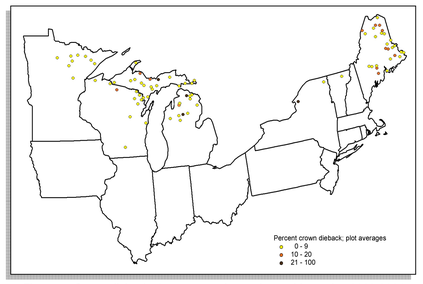

Figure 1. Crown dieback plot averages for northern white-cedar, 2000-2004 FIA assessment. Plot locations are approximate.

Assessment

Northern white-cedar (*Thuja occidentalis* L.) is a species relatively free from serious injury by insect and disease pathogens; therefore, the reasons for the elevated levels of dieback were unclear. A two-year FHM EM project was initiated in 2007 to (1) verify the apparent elevated levels of crown dieback among northern white-cedar in Maine and Michigan and (2) identify potential cause-effect relationships. [3]

During the summer of 2007, field visits were made to 18 FIA Phase 3 plots (fig. 2) to examine the individual tree crown conditions and observe the stand-level growing conditions of northern white-cedar. Of the 18 plots visited, 13 had an average crown dieback ≥ 10% at the previous FIA assessment (the "poor plots"). Crown conditions ranged from very good to very poor. Many trees on the poor plots had died since the last FIA assessment. Leaning or fallen trees were common, as were trees with exposed roots and "pistol butts".

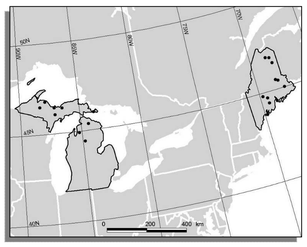

Figure 2. Approximate locations of the 18 plots visited in Michigan and Maine for the EM project.

Stand-level growing conditions ranged from peat swamps and bogs to dry upland sites. Through observations made during the field visits we were able to identify the likely causes of the high crown dieback averages for some plots. Of the five poor plots visited in Michigan, three were impacted by high water levels and one was damaged by a localized wind event. Of the eight poor plots visited in Maine, one was visibly impacted by high water levels and two were damaged by wind.

In addition to the field visits, we obtained data from all FHM and FIA Detection Monitoring plots measured in Maine and Michigan between 1990 and 2005. We also gathered winter precipitation, winter temperature, and soil drainage data for each plot in order to determine (1) if the crown dieback level of northern white-cedar was significantly higher than that of other species, (2) if there had been a change over time in the average level of cedar crown dieback, and (3) what, if any, plot-level stand conditions were associated with the plot-level cedar crown dieback averages.

Conclusions

Based on the data from the FHM and FIA Detection Monitoring plots, we discovered that depending upon measurement year, northern white-cedar average crown dieback was higher than the average dieback for other softwoods and lower than or equal to the average dieback for hardwoods. Using repeated measures of a subset of northern white-cedar trees assessed by both FHM and FIA, we did not detect an increase in individual-tree average crown dieback between 1990 and 2005. At the plot-level, we were unable to find a significant association between average crown dieback and stand size, winter precipitation, winter temperature, and soil drainage. Based on our field observations, there was not an apparent insect or disease problem and we conclude that the high levels of crown dieback were associated with local stand factors such as disturbance and water levels.

The Detection Monitoring → EM process allows for a wide range of potential forest health problems to be examined so that serious problems are not overlooked. In this instance, the EM project negated a suspected forest health problem discovered through Detection Monitoring, but this should not be considered any less important than if a significant forest health problem had been confirmed.

Literature Referenced

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See Also

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