**IALE-NA 2023 Meeting**
**19–23 March 2023**
**Riverside, California, USA**

**Abstract Submission for Presentation (due 16 December 2022)**

**Topic Selection**

Organized Symposium: *Remote Sensing of Landscape Change and Disturbance*

**Title**

Forest disturbance detection and tracking in the U.S. Upper Great Lakes through a synthesis of meteorology and remotely sensed phenology

**Authors**

Matthew Garcia, University of Wisconsin–Madison; Brian R. Sturtevant, USFS Northern Research Station; Therese M. Poland, USFS Northern Research Station; Barry T. Wilson, USFS Northern Research Station; Stephen J. Burr, USFS Region 9; Susan J. Crocker, USFS Northern Research Station; Ryan P. Hanavan, USFS Research & Development; Andrew Liebhold, USFS Northern Research Station; Philip A. Townsend, University of Wisconsin–Madison.

**Abstract (limited to 300 words)**

Recent and current methods in remote sensing for land cover change detection have enabled semi-automated mapping of forest disturbances, but such methods are generally not sensitive enough to detect and attribute disturbances at moderate scales and intensities that are often associated with forest insects and diseases. In this presentation, we demonstrate a proof-of-concept application for detecting and classifying moderate, non-stand-replacing forest disturbances associated with such agents that may be slow to build. The primary goal of this application is to identify and track invasive insect and pathogen species that can cause disturbed conditions at local scales and often in small pockets scattered over large areas, especially in mixed forest regions. Our computational framework first combines weather and climate observations with moderate-resolution satellite images (USGS/NASA Landsat and ESA Sentinel-2) over more than 35 years to determine local patterns of forest phenology and to determine causal mechanisms for phenological variability on interannual, seasonal, and sub-seasonal scales. We then identify both small and large departures from the demonstrated historical patterns that we combine with US Forest Service and partner datasets to determine the locations, severity, and likely causes of forest disturbance events. Here we present preliminary results of our methodological development in the Upper Great Lakes region, demonstrating the sensitivity of our phenology-based approach to detecting moderate disturbance types while still identifying the more severe and prominent forest disturbance events on the landscape. These results will inform system improvements as we expand the application of this method to a larger portion of the USFS Northeast Region. Success in these areas may offer an economical, large-scale approach based on remote sensing analyses to monitor invasive species and forest health on a consistent basis across jurisdictional boundaries in a region that is vulnerable to degradation in forest structure, health, and ecological function.