Forest Disturbance in Minnesota:
Observations from USDA Forest Inventory and Analysis

presented by

David C. Wilson, Ph.D.

Department of Forest Resources

College of Food, Agricultural and Natural Resource Sciences

We examine disturbances observed by the United States Department of Agriculture (USDA) – Forest Service (FS) Forest Inventory and Analysis (FIA) program on permanent sample plots established on Minnesota's forest land. The FIA EVALIDator tool allows assessment of area disturbed for different 5-year groupings of sample plots. However, additional analysis is needed to provide the ecologically relevant disturbance return interval informed by the data. Additionally, validation of disturbance rates derived from EVALIDator summaries has not been conducted. Methodology for utilizing the FIA database for this kind of disturbance analysis are presented. These methods employ the statistical computing environment and language of R, combined with a variety of analytical, utility, and data visualization packages introduced in recent years. These advances in statistical computing enable a reproducible and detailed approach to estimating periodic disturbed area and return intervals across Minnesota's forest land. Methods presented are directly transferable (with a few adjustments) to analysis and reporting for disturbances observed by FIA, or other cyclic forest inventory efforts.

Validation of the methods and results is accomplished in two ways. First, a comparison is made using estimates of total forested area and total area disturbed taken from the FIA EVALIDator tool. We use estimates from the beginning, middle, and end of the observation period to help corroborate the observed trend in return interval. Second, we use the estimated disturbance return intervals for each forest cover type to project acres present in different cohorts observed by FIA. This second validation also tests the hypothesis that disturbance, either as discrete events or acting over time, is the primary causative agent of demographic change, ecological succession, and stand development in the forest.

Results of the analysis include observation of a dramatic reduction in return interval for disturbances across Minnesota over the 21 years of observation. This change in the frequency of events resulting in observable forest disturbance can be seen across all forest cover types, and for most disturbance categories. The trend is especially prevalent for insect damage, disease, wind events, drought, and fire.

David C. Wilson David was born in Minneapolis, Minnesota and spent time in both St. Paul and rural southeastern Minnesota while growing up. It was time spent outdoors, walking in the woods, learning about the different plants growing on prairie remnants and in the woods that originally sparked David's interest in natural history and natural resource management. David holds a BA in Biology from Carleton College and a MS in Geographic Information Systems Science from Saint Mary's University of Minnesota. He completed a PhD in Natural Resource Science and Management working under Alan Ek, former head of the Department of Forest Resources at the University of Minnesota in November of 2016. While at the U of M, David has worked as a Research Fellow and Research Associate for the Interagency Information Cooperative (IIC) project, to provide accessible data related to forest management for an array of cooperating agencies and institutions, including MNDNR and the US Forest Service. The goal of providing accessible data to inform forestry management has supported and guided David's research. This research applies aspects of computer science, GIS, field ecology, and statistics to inform and support forest management planning and native plant community mapping efforts in Minnesota. David's ultimate goal is to facilitate the use of more detailed, site specific, and quantifiable ecological data in forest and landscape management planning. David's research aims to achieve this goal by bridging gaps in our knowledge and understanding of the distribution, abundance, and successional state of native plant communities composing local and bio-regional ecosystems.