

Impacts of windstorm and salvage harvest on regeneration and biodiversity in the Northern Forest

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Overview

The goal of this research is to evaluate ecological responses of northern forests to windstorm and salvage harvest to inform future management of our natural resources. Data collection and analyses are organized under two objectives:

Objective 1: Quantify the individual and cumulative effects of wind disturbance and salvage harvest on forest composition and structure. We are measuring species composition and biomass of remnant canopy trees, abundance of coarse woody debris (CWD), and tree recruitment levels by species and density.

Objective 2: Quantify the effects of wind disturbance with and without salvage harvest on stand-level biodiversity. Specifically, we are comparing species richness and diversity of understory vegetation and ground-dwelling arthropods across sites.

Methods.

Objective 1: We collected data on tree species composition and biomass of remnant canopy trees, abundance of coarse woody debris and recruitment of seedlings and saplings by species and density for each site. U.S. Forest Service Forest Inventory Analysis (FIA; U.S. Forest Service 2007) protocols served as a guide for forest composition and structure data collection. We exhaustively sampled standing canopy trees, collected CWD density, biomass, species, and decay class data along three transects radiating from the center of each site, and sampled tree seedlings and saplings at four five-meter diameter plots per site, recording species and density.

Objective 2: We have collected, cleaned and are currently analyzing herbaceous plant and carabid beetle biodiversity data.

Herbaceous vegetation surveys during the 2013 and 2014 growing season include species and percent cover of every plant within eight one-meter diameter plots per site. Preliminary results indicate within site differences in herbaceous plant community composition between the 2013 and 2014 growing seasons, suggesting an early dynamic response to windstorm and salvage harvest treatments. In addition to calculating species richness and diversity we will analyze site plant communities by functional guild.

We collected arthropods from eight pitfall traps per site during the 2013 and 2014 growing season and via four Berlese funnel traps per site in 2014. We identified arthropods to order. We are identifying Coleoptera to genus and Carabids to species

for analysis. We are currently comparing differences in insect and plant populations between treatments using non-metric multi-dimensional scaling. We will also consider differences in populations of specific species between treatments. Using overall regression or ordination, we will partition species' response due to spatial and environmental variables.

Accomplishments to date

Field-based data and sample collections are complete. Identification of arthropod specimens is 90% complete. All data sets have been verified and prepared for analysis. Sarah is currently learning to code for statistical analysis in R, and she is collaborating with Dr. Timothy, from L'Université du Québec à Montréal, to analyze the data sets. Additionally, Sarah mentored three undergraduate interns during the Spring 2016 semester, two of which are conducting independent research related to Sarah's dissertation topic.

Relevance

Outcomes of this research will contribute to the expansion and consistency of sustainable forest management in New England. Our research findings may prompt forest managers to explicitly plan for post-disturbance management in anticipation of more frequent windstorm events. This advanced planning would allow for management decisions more in line with overall forestry goals than the exigency of a sudden disturbance might afford. Additionally, herbaceous plant and ground-dwelling arthropod biodiversity results of this project will add clarity to our understanding of ecological mechanisms that maintain biodiversity.

Products and outcomes

We plan to submit two or three manuscripts to peer-reviewed journals for publication this fall. We were also invited, with Kimberly Wallin and Eduardo Rodriguez, to contribute a chapter to a book on the impacts of windstorms and salvage harvest. The publisher has accepted our abstract for the book chapter. Finally, we will host workshops to share what we have learned through this research to landowners and forest managers in Chittenden County, VT and beyond.

Proposed future steps

We plan to finish identifying Coleoptera genera and Carabid species this summer. In the next three months we also anticipate completing statistical analysis of biodiversity and regeneration data using CWD volume as a proxy for windstorm and salvage harvest treatments. Manuscripts for publication will be submitted this fall, and public workshops will be held in late fall. Sarah plans to present and defend her Ph.D. dissertation research by the end of 2016.