VEGETATION DYNAMICS AFTER THE BAXTER PARK FIRE OF 1977

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Abstract

Fire is widely recognized as an important natural disturbance agent impacting ecosystems throughout the world. Post-fire vegetation dynamics and subsequent management implications substantially differ in each region. Because north central Maine is believed to have a long return interval fire regime (at least 800 years according to Lorimer [1977]), the threat of catastrophic fire in one's lifetime seems remote. However, with an apposite synergy of events, historical evidence supports that severe fires can and do occur in this region.

A series of interacting disturbance events occurred in Baxter State Park in Maine offering an excellent opportunity to study long-term changes in vegetation. In July of 1977, 1439 hectares in and adjacent to Baxter State Park experienced a severe forest fire. Much of the fire burned areas that were blown down in a 1974 windstorm; some of these areas were salvaged prior to the fire, while others were not. Sandra Hansen (1983) set up plots to represent the various stand conditions and measured vegetation composition and structure a year following the fire. The current study will re-establish these plots and document vegetation structure to improve our understanding of forest development after disturbance. Specific research objectives are to: 1) relocate the original plot markers, 2) describe post-fire vegetation development, and 3) evaluate the influence of pre-fire disturbances on the post-fire regeneration process.

Introduction

Previously viewed as an interruption to nature, fire's effect on forest stand development patterns has been recently credited with playing a key role in ecological processes. While wildland fire ecology is researched throughout many parts North America, it is relatively little studied in the northeastern United States and especially in the Acadian spruce-fir ecosystem where there is a relatively cool, humid climate and seemingly lengthy fire return intervals. Lorimer (1977) postulated a fire regime of at least 800 years for north central Maine. Subsequently, the natural role of fire has been downplayed in this region. Historical records and charcoal evidence indicate that fire activity in Maine does occur with the right combination of weather, fuel, and ignition. In addition, disturbances can interact to create the right conditions for large impacts.

In November of 1974, a synergy of events began with a severe windstorm affecting 2000 hectares in and around Baxter State Park. The wind damage resulted in a considerable fuel accumulation on and above the forest floor. Some blown down areas were salvaged while others were under stricter management constrains and left unsalvaged due to extensive litigation (Scee 1999). In the midst of this court battle two lightning strikes ignited forest fires on Baxter State Park lands in blown down area caused by the earlier windstorm. High winds and limited access made immediate suppression difficult. Over 1400 hectares burned during the next few days both in parklands and on adjoining Great Northern Paper Company lands (Bowen 1978).

Hansen set up plots a year after the fire that represented these six disturbance history categories: b and ba) burned standing; wb) windthrown/burned; wsb) windthrown/salvaged/ burned; u and ua) unburned; wu) windthrown/unburned; and wsu) windthrown/salvaged/ unburned. Two pre-disturbance stand types (second height class represented by the letter a) and each disturbance history category are represented by one stand if unburned and two stands if burned. Five plots were

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randomly located in the 12 stands representing the range of stand conditions and disturbance histories. In total, 60 plots were established.

Hansen placed rebar stakes as plot markers and measured vegetation and soil conditions on each of these plots during the summer of 1978. She found that organic matter depth decreased with an increase in disturbance, and burned plots had a higher soil pH. Results show 24 plant species in the unburned plots were not found in the burned area; notably these included some conifer species and several bryophytes. Eight new species appeared in the burned areas that were not present in the areas unaffected by the fire. The most notable of these were fungi. Bristly sarsaparilla (A*ralia hispida* Vent.) was remarkably common among the burned plots, forming a "sea" of vegetation the first few years following the fire (Kimball, A.J. June 1982, unpublished field notes).

The main objectives of this study are to relocate these permanent plots to track and describe vegetation composition and structure changes since 1978 and to evaluate the influence of the pre-fire stand conditions on the regeneration by comparing the plots within the fire (burned wind thrown areas, those still standing when the fire occurred, and those that were salvaged).

Plot Relocation

During the fall of 2002 and the spring of 2003, we searched for and located 54 out of the 60 rebar stakes. Due to inaccuracies and imprecision built into hand drawn maps, we devised a method to provide coordinate search points prior to field exploration. Ortho photos of the area were used to locate origins and landmarks. Using recorded azimuths, pacing distances, and clues alluded to in the site descriptions, expected locations of the plots were identified using GIS programs. The coordinates of these positions were downloaded into a GPS which directed searchers to expected locations of plots. A diameter spiral search method was then used to locate the actual plot. By establishing the spatial coordinates for these plot markers, future measurements for a continuation of this study can be facilitated.

Methods

Once each plot was located and laid out using the rebar stake as the southwest corner of a 10 m x 10 m square, vegetation was tallied during the months of July and August 2003 (the same time of year as in 1978). In the main plots, each tree was identified to species and measured at breast height (or tallied if below breast height). Height, live crown ratio, and canopy position were assessed for a subset of trees in the plot. Subplots, 1 m x 2 m, were nested in each of the four corners of the main plot for the purpose of examining forest floor components, herbaceous plants, and woody shrubs. In addition, a species list was compiled for all species found in the main plot. Dead and downed material (CWD) was examined in three plot sizes depending on diameter. Only the portion of each log that was actually in the plot was measured. Small and large end diameters and length were recorded, as well as decay class (1-4) assigned. Basic field methods were used to measure organic matter depth for each plot.

Table 1.—Some preliminary results showing average organic matter depth (OM) and dead and downed volume per hectare (CWD) for each disturbance type. Standard deviations (SD) are also recorded

Disturbance	OM (cm)	SD	CWD (m^3)	SD
b	9.1	4.6	2900.4	50.5
wb	5.5	2.4	991.3	74.8
wsb	3.7	2.3	411.7	14.1
u	15.0	4.8	496.1	54.7
wu	13.1	7.0	641.7	82.9
wsu	0.3	4.7	273.5	37.4

Results

Six disturbance history conditions are used as factors in the analyses. Preliminary results show that stands which were wind thrown and left unburned had the highest number of trees per hectare. Conifers, while present in all plots, were still more prominent on unburned sites. CWD volume was greatest in plots that were burned standing (Table 1). Organic matter depth decreased with an increase in disturbance (Table 1). The soil binding lichen, *Dibaeis baeomyces* L.f., was only found in the most disturbed plots (wb and wsb). To make comparisons among factors, multivariate statistical analyses will be accomplished using a variety of methods including: Detrended Correspondence Analysis, Cluster Analysis, or multiple regression techniques. Analyses will concentrate on identifying development patterns in the last 25 years and similarities and differences among disturbance history factors.

Discussion

Data collected in this study describe the current species composition and structure in each of the stand conditions. Differences between the stands are expected, especially between those that were standing or salvaged prior to the fire, as opposed to stands that were blown down in 1974. Differences in data collected in 1978 compared to 2003 may be significant. Conifer species may have increased at different rates depending on stand condition since 1978.

The Baxter Park Fire of 1977 is an example of a natural fire where the fire's behavior and impacts were modified by a previous disturbance event and human manipulation. The long-term impacts of such fires are important to consider. Sandra Hansen stated the purpose of this study was to "collect baseline data for long-term studies to see vegetation development after a fire and over time" (Hansen 1983). Wind and fire events will occur again in Maine, and some are likely to follow a similar sequence. The effects of these disturbances have been given relatively little attention historically. While the rest of the country has become focused on fire policy and management dilemmas, Maine and the Acadian spruce-fir ecosystem remain in a zone where fire effects are poorly documented.

This research will expand our knowledge about blowdown salvage, fire management, and fire ecology. It may help the park, the state, and other land owners to design future fire policy and make more informed decisions regarding fire suppression. Baxter State Park currently plans to suppress each fire with any measures necessary. They would like more information on the effects of fires, the effects of suppression, and forest development that occurs following a burn.

Literature Cited

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