# Effects of Blow-Down and Fuel Reduction Activity on Forest Succession Pathways in Northern Minnesota

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## Introduction

On July 4th, 1999 an unprecedented windstorm accompanied by heavy rains in the Gunflint Corridor of the Superior National Forest resulted in damage to 150,000 acres of National Forest lands and 325,000 acres within the Boundary Waters Canoe and Wilderness Area. Immediately following the blow-down event the primary concern of USDA Forest Service personnel was for the safety of individuals within the BWCAW and Gunflint Corridor. Once the safety of the public from the immediate effects of the storm was assured, the Forest Service commenced work on an Environmental Impact Statement (USDA Forest Service 2000) to evaluate the effects of fuel reduction treatments (e.g., salvage harvests, mechanical crushing, and prescribed burns) on forest ecosystems.

Our objective is to quantify the effects of post-blow down treatments on forest succession. *Our hypothesis is "the future stand structure of salvaged and non-salvaged stands will be the same".* Analyses are being conducted on data collected from 21 stands in each of which we installed 16 permanent sample plots. We present the post-blow down condition for 6 stands; 3 stands from each of two cover types: jack pine and aspen-birch. We then compare post-blow down shrub composition with post-salvage shrub composition from 2 stands within the aspen-birch type.

## Methods

Plots were located in areas where severe blow down had occurred and which have the greatest likelihood of being salvaged within the next two years (USDA Forest Service 2000).

Tree level data: species, number of stems $ha^{-1}$, condition (uprooted, snapped off with height to nearest meter, lean (< 45 degrees, > 45 degrees), damaged standing, or no damage. All damage categories are combined in Fig. 1. Plot size 8 m radius, 200 $m^2$, 0.02 ha. Plots spaced at 40 m intervals. Shrub level data: number of stems per species. Plot size 1.78 m radius, 10 $m^2$, 0.001 ha. Plots spaced at 40 m intervals and nested within tree plots. Woody stems were considered to be shrubs and included tree species if they were less them 2.5 cm dbh. Results are reported for stands on which salvage operations during the winter of 1999-2000 were undertaken. The harvesting equipment used were mechanical feller bunchers and grapple skidders.

## Results

Data for the 5 most frequently occurring tree species and 7 most frequently occurring shrub species are presented. The dominant tree species in the jack pine cover type were jack pine and black spruce, and in the aspen-birch cover type balsam fir, paper birch and aspen (Fig. 1). Dominant shrub species in the jack pine cover type were alder and blueberry, and in the aspen-birch type blueberry, alder, and hazel (Fig. 2). Dominant tree species in the shrub layer of the jack pine type were aspen and in the aspen-birch type aspen and balsam fir (Fig. 2). The aspen, jack pine, and paper birch were the tree species most affected by the blow down in each cover

type (Fig. 3). Balsam fir and black spruce frequently occupied lower canopy positions and were the species least damaged from the blow down. The two sites in the aspen-birch cover type differed in relief with the Rudy site having steeper conditions than the North Poplar site. They also contrast in disturbance intensity. Eighty percent of the post-blow down shrub density was present following the salvage operation in the North Poplar site and the relative percentage of shrub species varied little. Disturbance from salvage on the Rudy site was more intense. Shrub density was reduced by 93% and there was an obvious change in the relative percentage of shrub species present. The percentage of aspen in the shrub layer was greatly reduced, and northern bush honeysuckle and blueberry were no longer present in the plots re-measured (Fig. 4).

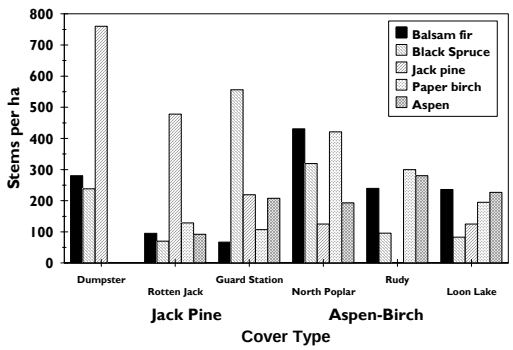


Fig. 1. Tree density by species, stand, and cover type

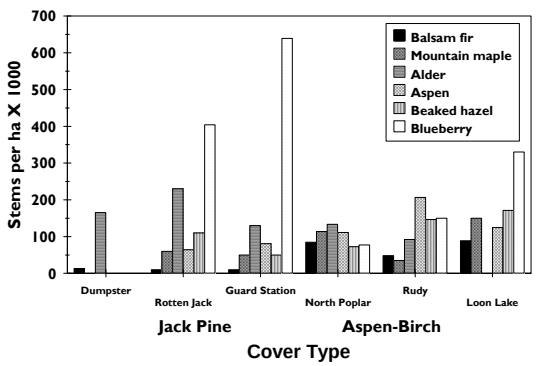


Fig. 2. Shrub density by species, stand, and cover type.

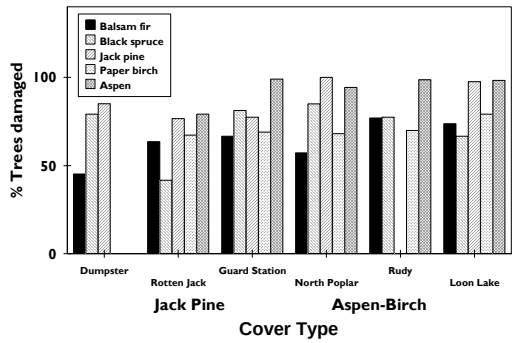


Fig 3. Percent damage (breakage, wind throw) by tree species from 6 stands in two cover types (jack pine, aspen-birch).

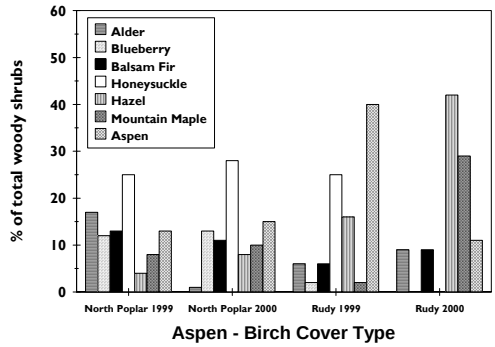


Fig. 4. Post blow down and post salvage percent shrub composition by species for two aspen stands. [Note: alder includes *Alnus crispa* and *A. rugosa*; blueberry includes *Vaccinium angustifolium* and *V. myrtilloides*]

## Discussion

Inferences from our preliminary analyses are limited. Left undisturbed both the jack pine and aspen-birch cover types would have a greater presence of balsam fir and black spruce through the presence of trees surviving the blow-down (Fig. 3). Salvage logging will change expected stand trajectories through the harvest of residual trees, reduction in the amount and percent species composition of advance regeneration (Fig. 4), and changes in the regeneration substrate

caused by harvesting equipment (e.g., removal of duff layer, soil compaction). This combination of evidence suggests *rejection of our hypothesis. Salvage operations will affect future stand structure.* This is consistent with survey results from Ontario where the relative percentage of conifer species in stands harvested was less than stands of fire origin (Carleton and MacLellan 1994). The presence of desired conifer species can be maintained through planting or direct seeding programs following fuel reduction (salvage, mechanical, prescribed burn) prescriptions (USDA Forest Service 2000).

## Literature Cited

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