

Relating blowdown to tree and stand level characteristics following a harvest inspired by an eastern spruce budworm, *Choristoneura fumiferana*, outbreak

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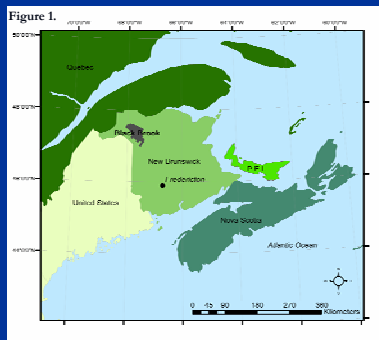
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Introduction

- Historically, the major disturbance in New Brunswick's forests has been caused by severe outbreaks of *Choristoneura fumiferana* Clem., eastern spruce budworm. About 4.7 million ha of New Brunswick's total 7.4 million ha contains budworm susceptible spruce (*Picea* spp.) and balsam fir (*Abies balsamea* (L.) Mill.) (MacLean, 2004).
- In 2002, we began testing implementation of harvest inspired by a spruce budworm outbreak, on 2600 ha of the Black Brook District, a 190 000 ha privately owned forest in northwestern New Brunswick. (Figure 1)
- Following harvest, based upon cutting only trees estimated to be killed by budworm, wind began to topple some of the residual trees. (Figure 2. – 24/08/2006)
- Blowdown is a major natural cause of damage to forests in North America (Mitchell, 1995, 1998; Dunham and Cameron, 2000), which is affected by a complex interaction between climate, topography, and stand, tree and soil factors (Mitchell et al., 2001).



Objectives

- Determine the amount of blowdown 2-3 years following a harvest inspired by a spruce budworm outbreak.
- Investigate the influence of tree and stand characteristics on the occurrence and type of blowdown.

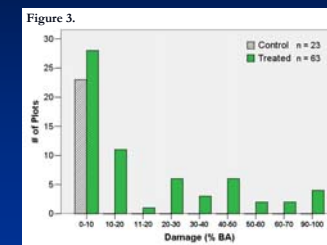
Methods

- In 2002 and 2003, 86 circular 0.05ha permanent sample plots were established every 350m on a grid in three adaptive management areas and one core reserve.
- The harvest method aimed at emulating the stand structure and landscape mosaic created by a spruce budworm outbreak, while the core reserve was left untouched.
- The harvest included 9 out of 10 balsam fir and 6 out of 10 spruce, based on mortality in spruce budworm outbreaks (MacLean, 1980, MacLean & Ostaff, 1989).
- Residual densities were 20-1020 trees/ha and residual basal areas were 1.2-25.0 m²/ha, depending upon the incidence of host species.
- From 2004 until 2006, all treated plots were remeasured for trees that were uprooted, broken at the stem (i.e., below the crown), or had experienced crown damage (loss of large branches or the top).

Results

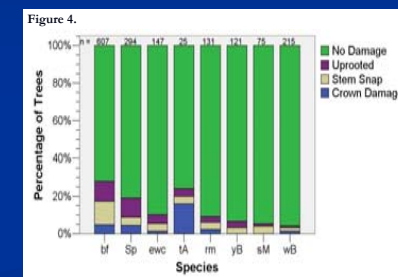
Blowdown in Treated vs. Control

- Control plots:** Mean 1% damage (SD 2%). Only 1 plot with blowdown >10%. 1.2% of 1645 trees were damaged by wind (Figure 3).
- Treated plots:** Among plots, basal area damaged ranged from 0-100% (mean 14.9%, SD 20.4%). 43% of plots had 0-10% damage, 29% had 11-30%, 28% had >30% wind damage. 20.3% of 1615 residual trees were damaged.
- Harvest did influence blowdown.



Differences among species

- Balsam fir was most damaged, at 29%, versus 25% for trembling aspen and 19% for spruce (Figure 4).
- Balsam fir and spruce sp. were most prone to uprooting at 10% each.
- Balsam fir had most stem snapping at 12%, while most others experienced 3-4%.
- Yellow birch, white birch, sugar maple and red maple were most resistant to damage, all less than 10% damage.

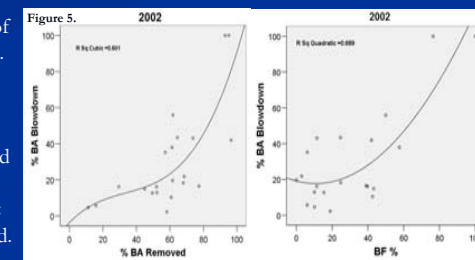


Relation to tree characteristics

- DBH, height, height to diameter ratio, exposure, and crown ratio were not significantly different among damage classes at the tree level.

Relation to stand characteristics

- Regressions revealed % of BA blowdown was positively related to % of BA removed and % balsam fir composition for plots harvested in 2002. (Figure 5)
- These plots have stabilized as very little blowdown occurred last year compared to other plots.
- Other stand level variables (eg. TOPEX, Avg DBH and Height) showed no significant relationship to % BA blowdown.
- Plots with heavy damage were spatially clustered indicating that specific wind events may have been responsible for the blowdown that occurred.



Discussion

- Harvesting based on natural disturbance aims to provide residual stand structures and landscape mosaic similar to that resulting from natural disturbance.
- Are trees that blow down more valuable as wood supply or forest habitat on the ground?
- Blowdown is determined by direct and interacting effects of weather, topography, tree characteristics and harvest intensity.
- Blowdown in the study area is not yet complete and will be examined further once the stands have stabilized.
- To function correctly, the blowdown must be factored into the harvest prescription.

References

Dunham, R.A., and Cameron, D.A. 2000. Crown, stem and wood properties of wind-damaged and undamaged Sitka spruce. For. Ecol. Manage. 135: 73-81.

MacLean, D.A. 1980. Vulnerability of fir-spruce stands during uncontrolled spruce budworm outbreaks: a review and discussion. For. Chron. 56: 213-221.

MacLean, D.A. 2004. Predicting forest insect disturbance regimes for use in emulating natural disturbance. In Emulating Natural Forest Landscape Disturbances – Concepts & Applications. Perera, A., Base, L., & Weber, M. (Eds.) Columbia Univ. Press NY. Pp. 69-82

MacLean, D.A. and Ostaff, D.P. 1989. Patterns of balsam fir mortality caused by an uncontrolled spruce budworm outbreak. Can. J. For. Res. 19: 1087-1095.

Mitchell, S. 1995. The windthrow triangle: a relative windthrow hazard assessment procedure for forest managers. For. Chron. 71: 446-450.

Mitchell, S. 1998. A diagnostic framework for windthrow risk estimation. For. Chron. 74: 100-105.

Mitchell, S., Hailmarim, T., and Kulis, Y. 2001. Empirical modeling of cutblock edge windthrow risk on Vancouver Island, Canada, using stand level information. For. Ecol. Manage. 154: 117-130.

Ruel, J.C. 1995. Understanding windthrow: silvicultural implications. For. Chron. 71: 434-445.