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What is the effect of wind on newly thinned 'doghair' pine stands?

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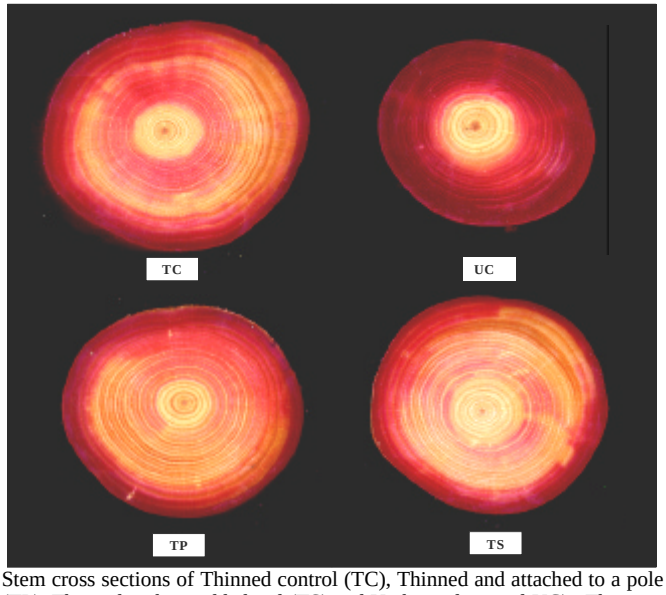
Fire origin lodgepole pine stands often regenerate at stem densities that have been described as 'thick as the hair on a dog'; starting densities are sometimes over 100,000 stem/ha. If these stands remain unthinned for several decades, the pine stems become very tall relative to their diameter (high slenderness coefficient (SC)).

In this study, we asked the question: Are these tall and slender stems vulnerable to damage from the wind following thinning down to typical densities suggested for plantation establishment? We hypothesized that extreme bending of stems during gusts of wind will damage the ability of the xylem to conduct water to the crown thereby reducing growth release.

We selected 'doghair' pine (~20 years old, 4 m tall, 1.1 SC, 20-40,000 st/ha) near Swan Hills, Alberta and thinned 9 plots (25 × 25 m) to 2500 st/ha. In each plot we identified control trees (TC), trees staked with a pole to reduce sway (TP) and trees where we worsened the sway by adding a sail to the top of tree (a 4 L plastic milk jug) (TS). We also identified unthinned control trees (UC), in adjacent unthinned areas.

After 4 years, the unthinned stems were taller and had higher SC relative to the trees from the thinned plot, especially those with an added sail. We left the trees grow for 4 more years, then cut selected sample trees for measurements (basic dimensions, leaf area and stem hydraulic conductivity).

Thus, the slenderness coefficient was reduced in trees with higher post thinning wind / bending stress. Relative to unthinnned trees, the thinned trees had greater proportion of earlywood than latewood in their annual rings, reduced ability to conduct water through their stems, and reduced crown water supply relative to the amount of foliage that they carried. The thinned trees, however, added larger annual rings than the unthinned trees.



Stem cross sections of Thinned control (TC), Thinned and attached to a pole (TP), Thinned with an added sail (TS) and Unthinned control UC). Thinning was done 4 years earlier. Each stem had about 6 years of heartwood. A red dye stained the sapwood that is capable of conducting water. Note that in the two o'clock position of the TS tree, recent annual rings are still experiencing xylem damage.

Conclusions:

Slenderness coefficient is at least partially related to wind exposure. Secondly, following thinning, the increased bending associated with the open stand condition was usually not sufficient to break or uproot these 4m tall trees, but it did cause damage to the xylem that reduces flow of water to the foliage. This may explain the reduced level of release response following thinning in some stands. This study indicates that thinning should be done early in 'dog hair' stands. If thinning is delayed, it will likely be appropriate to thin in two steps, first with mechanical strip cuts, followed by hand thinning after the residual trees have adjusted to the more open environment.

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Further Information:

Liu, X., Silins, U., Lieffers, V.J. and Man, R.Z. 2003. Wind, bending and thinning, affect the hydraulic conductivity of conifer stems. Can. J. For. Res. 33: 1295-1203.

http://www.rr.ualberta.ca/research/EFM.htm

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