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Is the plumbing faulty in 'doghair' lodgepole pine trees?

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Self-thinning of overstocked lodgepole pine stands is delayed or slow on poor sites compared to good sites. Over-dense pines on poor sites also tend to show repression in height growth. Reasons for this poor growth have been hypothesized to be related to changes in the water conducting characteristics of the stem and branch wood in 'stagnant' stands. It is thought that they simply do not get enough water to support the normal good functioning of the leaves.

High density lodgepole pine stand

Working south of Hinton AB, we measured the hydraulic conductivity (ability of stems to conduct water) of dominant, co-dominant and suppressed trees (~43 years old) from poor and medium site types. We also measured the growth and leaf area of these trees.

Our findings showed:

- There are large differences in size and growth rates of trees between poor and medium sites and secondly among trees of different crown class.
- The stem sapwood from poor sites was capable of conducting considerably less water to than the same area of sapwood from medium sites. Also, there was a decrease in the proportion of earlywood in annual rings of the sapwood from poor sites; both points suggest a decline in ability to move water to the leaves on poor sites.
- Suppressed trees had reduced ability to transport water compared to dominant trees. Dominant trees, however, had proportionately larger amount of leaves in relation to their ability to transport water, compared to suppressed trees. Thus, a unit of leaves of suppressed trees actually had a better water supply than a unit of leaves of dominant trees. This offers an explanation for the poor self-thinning (slow rate of mortality) of suppressed trees in lodgepole pine.

Implications:

Conditions that slow growth of lodgepole pine (poor sites and competition from neighbours) result in a gradual decline in ability of the stem to conduct water to the crown but there is an even faster decline in leaf area. Therefore, the suppressed trees tend to remain alive, but trees barely grow and stands become 'stagnant'. Early thinning is therefore needed in overstocked poor sites to promote growth and stand development.

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Further Information:

Reid, D.E.B., Silins, U. and Lieffers, V.J. 2003. Stem sapwood permeability in relation to crown dominance and site quality in self-thinning fire-origin lodgepole pine stands. Tree Physiol. 23: 833-840

Reid, D.E.B., Lieffers, V.J., and Silins, U. 2004. Growth and crown efficiency of height repressed lodgepole pine: are suppressed trees more efficient? TREES Structure and Function in press

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