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Root grafts feed carbohydrates to neighbours in dense lodgepole pine stands

ERIN C. FRASER, VICTOR J. LIEFFERS, AND SIMON M. LANDHÄUSSER

Dense 'doghair' stands of lodgepole pine are known to be slow to self-thin and to differentiate in height and diameter classes, even after 50 or more years of growth. One would expect the smaller trees to eventually be killed by the overtopping dominant trees, but in these



stagnant sites the smaller trees can persist for decades. In these dense stands, root grafts linking the vascular systems of individual trees are very common. This leads to the question, do grafted trees share resources through the grafts? If so, suppressed trees may be able to tap into a communal pool of carbohydrate reserves supplied

mostly by the dominant trees in the stand. This would allow these overtopped trees to remain alive much longer than if they were not connected to their dominant neighbours.

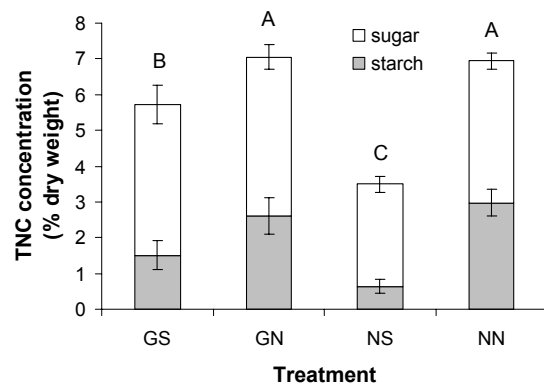
We tested if trees in inferior positions could gain resources from adjacent trees by a shading experiment.

In 10 different lodgepole pine stands (14-19 years old), we identified grafted pairs of trees. One of these two trees was shaded with plastic screening and its grafted partner was left unshaded. We also identified single ungrafted trees that were shaded or left as unshaded as controls. Trees were allowed to grow



over one growing season.

The shading treatment significantly reduced the carbohydrate reserves in single trees and lead to significant crown losses. Further shading would have likely resulted in tree death by the second growing season. Grafted shaded trees had substantially higher concentrations of carbohydrate reserves in their roots than the shaded single trees. The amount of carbohydrate transferred from the unshaded to the shaded tree was related to the size of the graft connecting the two trees. There was also greater retention of lower branches in shaded and grafted trees compared to shaded trees.



Total non-structural carbohydrate (TNC) concentrations (sugar + starch) in roots of: grafted shaded (GS), grafted non-shaded (GN), non-grafted shaded (NS) and non-grafted non-shaded (NN) trees. Bars with different letters are significantly different.

Implications: Intermediate or suppressed trees that are grafted to neighbours are likely to survive longer than ungrafted trees of similar size. Once a dense stand is heavily grafted (after about 10 years of growth), self-thinning is likely to be slow..

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Further Information:

Fraser, E.C, Lieffers, V.J. and Landhäusser, S.M. 2006. Carbohydrate transfer through root grafts to support shaded trees. *Tree Physiol.* In Press.

Fraser, E., Lieffers, V.J. and Landhäusser, S.M. 2005. Age, stand density and tree size as factors in root and basal grafting of lodgepole pine. *Can. J. Bot.* 83:983-988.

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Centre for Enhanced Forest Management, Dept. of Renewable Resources, U. of A., Edmonton, AB T6G 2H1

Victor.Lieffers@ualberta.ca