CENTRE FOR ENHANCED FOREST MANAGEMENT

ADVANCES IN FORESTRY RESEARCH

DEPARTMENT OF RENEWABLE RESOURCES

EFM RESEARCH NOTE 01/2005

What types of lodgepole pine stands are prone to root grafting?

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

Root grafting occurs when the roots of different trees overlap. Pressure builds up between the overlapping roots as they increase in diameter and eventually the two roots fuse together and share xylem and phloem tissues. Previous research has indicated that grafted trees are able to transfer substances such as water and carbohydrates across grafts. Also, other studies have suggested that the rate of graft formation is increased by factors that increase root contact among trees (i.e.: close inter-tree spacing and shallow soils). Logically, if trees are able to share resources across grafts, then growth rates of dominants may be suppressed and mortality rates of suppressed trees could be reduced. Also, in heavily grafted stands, treatments applied to one tree may also directly affect their grafted neighbours. For instance, herbicides could be transferred through root grafts and injure or kill non-target trees. Also, the removal of a significant number of trees through pre-commercial thinning could burden the residual trees with a very large grafted root system to support, and this may reduce post-thinning growth rates.

The objectives of this study were to investigate the prevalence of root grafting in lodgepole pine stands and to determine whether stand characteristics affect the rate of root graft formation.

This study was conducted in pure fire-origin lodgepole pine stands near Swan Hills and Hinton, Alberta. Trees in the study areas ranged from 0.1-12.5 m in height, 0.17-13.3 cm in diameter and 2-46 years of age. Plot tree densities ranged from 8,118 - 335,994 stems per hectare. Forty plots, each containing 10 trees, were randomly selected. Each plot area was hydraulically excavated to a depth of ~30 cm so that all lateral roots were exposed. Following excavation, the root systems were examined and various root and tree measurements were made.

Our results indicate:

- The number of grafts per m^2 increased with tree density, stem diameter and plot age.
- The proportion of grafted trees increased with increasing tree age; 21% of trees less than 15 years of age were grafted and this increased to 73% by age class 26-30.

- The proportion of grafted trees increased when trees were close together. Of trees at least 15 years of age, 63% of those less than 10 cm from another tree were grafted.
- Overall, 32% of trees in our study area were grafted. However, if only trees that were at least 15 years of age are included, the rate of grafting increased to 46%.

Implications for management:

Root grafts will be very common in virtually any high-density lodgepole pine stand after 15 years of age. This implies that pre-commercial thinning needs to be carried out early to suppress the development of grafts.

On-going research will determine:

1) if root grafts transfer sufficient resources between trees to affect stand development and 2) if root grafts affect post-thinning growth responses.

Funding was provided by Weldwood of Canada, West Fraser Mills, Weyerhaeuser Company and the Natural Sciences and Engineering Research Council of Canada (NSERC).

Further Information:

A manuscript has been submitted and is currently under review.

http://www.rr2.ualberta.ca/research/EFM/

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

Victor.Lieffers@ualberta.ca