CENTRE FOR ENHANCED FOREST MANAGEMENT

ADVANCES IN FORESTRY RESEARCH

DEPARTMENT OF RENEWABLE RESOURCES

EFM RESEARCH NOTE 03/2005

Factors controlling the number and vigour of aspen suckers

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In boreal mixedwood forests, the number and vigour of aspen suckers following disturbance is a major factor controlling stand re-development. Frequently, there are more suckers than might be desirable if the objective is to promote conifers; alternatively, if an aspen stand is desired, there may be too few suckers to develop a fully stocked aspen stand. There are many interacting factors controlling aspen suckering. In this note we briefly outline our understanding of the factors that control the density and vigour of aspen regeneration, based upon the literature and our ongoing research program in aspen reproduction.

Availability of aspen roots capable of suckering is the primary factor (Figure 1). Suckering commonly occurs on shallow roots between 0.5 to 2 cm in diameter. These roots may not be present in sufficient numbers if parent stands are declining due to old age, disease, and/or the development of understory shrubs and grasses. Numbers of viable roots may also be reduced if they are heavily damaged by logging machinery or killed by waterlogged soils following overstory removal.

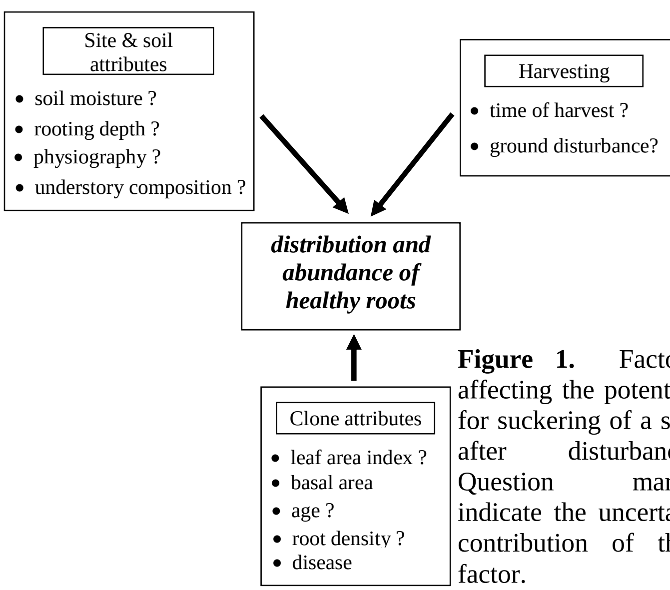

Figure 1. Factors affecting the potential for suckering of a site after disturbance. Question marks indicate the uncertain contribution of that factor.

Root system of a mature and healthy aspen stand

Stimulus for **sucker bud development** on roots (Figure 2) is primarily related to the interruption of transport of the hormone auxin from above-ground structures to the root system when a stand is cut or burned. Auxin inhibits bud development. In contrast, cytokinins promote bud and shoot development. Cytokinins are produced in the roots and normally are transported to the above-ground structures. Removal of the above-ground stem also promotes suckering because the cytokinins accumulate in the roots.

Sucker buds (arrows) on aspen roots

Retention or partial removal of stems from a clone were found to reduce the number of sucker buds, while moderate levels of root wounding were found to promote sucker bud initiation. There is still uncertainty on the effect of soil temperature, season of disturbance, soil nutrient and moisture content on sucker bud initiation.

Current research on suckering in aspen root systems indicates that soil temperature might have only a limited effect on sucker bud initiation but a significant effect on the expansion and growth of sucker buds.

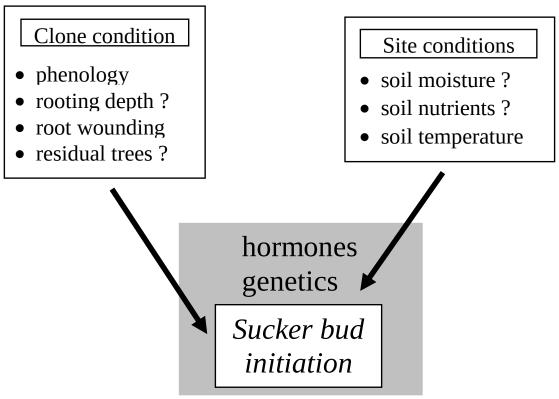

Figure 2. Factors affecting sucker bud initiation. Question marks indicate the uncertain contribution of a factor and arrows running through the highlighted band indicate that those factors may directly influence sucker bud initiation or may be mediated by genetics or the activity of hormones.

Growth of suckers following bud initiation determines the success of suckers (Figure 3). First, the growing suckers need to penetrate the soil and litter layers before they reach the surface to start photosynthesis. Compacted soils, dense mats of roots from other species and thick layers of litter (such as from *Calamagrostis canadensis*) are all barriers that influence the growth and number of suckers reaching the surface. Root carbohydrate reserves in the parent root system supply the sucker with energy while its photosynthetic rates are still low.

Aspen root suckers

Once above ground, high light and soil nutrient status, warm soil temperatures and moderate levels of moisture promote the growth of the emerging suckers. These conditions are largely influenced by the microsite and the level of competition. After two years, the emerged suckers exert significant apical dominance on the existing root system and suppress new suckering. Some evidence suggests that higher sucker densities and leaf area may promote long-term stand growth by better maintaining the vigour of the parent root system.

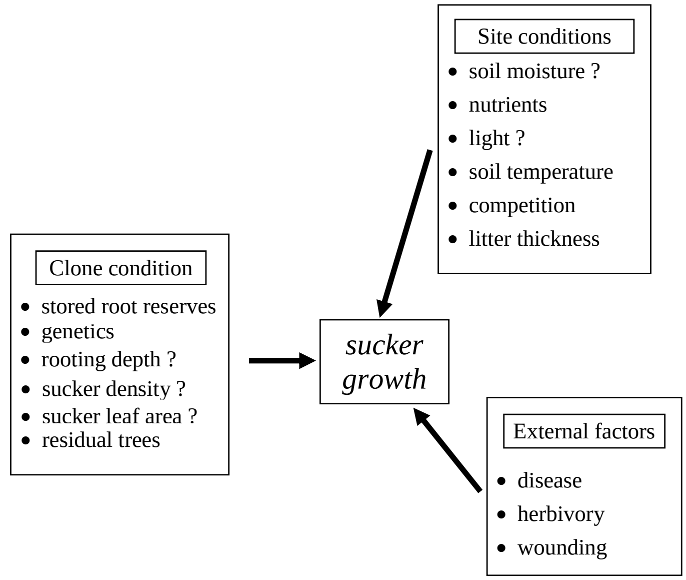

Figure 3. Factors affecting sucker growth. Question marks indicate the uncertain contribution of that factor.

Well regenerating aspen stand after salvage logging in Manitoba

Funding was provided by CanFor and Forest Renewal BC and Ainsworth Lumber Inc., Alberta Pacific Forest Industries Inc., Daishowa Marubeni International Ltd., Footner Forest Products, Louisiana Pacific Canada Ltd., Millar Western Industries Ltd., Slave Lake Pulp Corporation, Weyerhaeuser Canada Ltd and the Natural Sciences and Engineering Research Council of Canada (NSERC).

Further Information:

Frey, B. R., Lieffers, V. J., Landhäusser, S. M., Comeau P. G. and Greenway K. J. 2002. An analysis of sucker regeneration of trembling aspen. Can. J. For. Res. 33: 1169-1179.

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