The Role of Nutrient and Carbon Reserve Status of Aspen Seedlings in Root-Soil Interactions

Jacob R. Gaster

Abstract

The boreal forest is one of the largest forest ecosystems in the world, covering 14.7 million km2 globally. The Canadian boreal forest has a wealth of natural resources, including coal, timber, and oil; as resource exploration and exploitation has expanded, anthropogenic disturbance in the boreal forest has increased as well. After resource extraction, Alberta regulations mandate that disturbed land be restored to ecosystems of 'equivalent productive capability'. Given the severity of such landscape-level disturbances, restoration can be a challenge. Towards improving boreal forest restoration, I examined the influence of aspen seedling nutrient and carbon reserve factors on the community development of important belowground mutualists, ectomycorrhizal fungi (EMF), in a reclamation context. Specifically, I examined (1) the ectomycorrhizal community composition on two aspen seedling (*Populus tremuloides* Michx.) feed types (high and standard), which had differing tissue carbon storage and nutrient levels, planted into two types of cover soils, a reclaimed forest floor and a peat-mineral soil mix. I also investigated (2) the relationship between carbon storage and the release of carbon compounds from the roots when exposed to environmental stressors common in the boreal forest; these compounds (root exudates) are important for the development of the ectomycorrhizal symbiosis. I found that (1) the abundance of EMF was influenced by feed type but not cover soil type, with high feed seedlings having increased colonization by EMF than standard feed seedlings. However, cover soil type

influenced the abundance of one EMF species at the site. I also found that (2) exudation was determined by the concentration of C reserves when seedlings were exposed to the same environmental conditions; when exposed to different conditions, factors specific to each stress had a greater influence on exudation. Based on these results, I propose that seedlings should undergo nutrient loading prior to outplanting to improve EMF recovery and that the mechanism behind increased EMF colonization of high feed seedlings may be related to exudation.