Preliminary Results for Above- and Below-Ground Bio-Sequestration of a Mature F1 Black Spruce Varying in Site and Family Productivity

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Worldwide, efforts to reduce atmospheric CO_2 are being explored both by reducing emissions and by sequestering carbon (C). Spruce (*Picea*) is the major component in many Canadian forest ecosystems and accounts for 1/3 of Canadian inventory. Black spruce (*Picea mariana*) is the most important softwood species to the forest and pulp and paper industry and accounts for 35% of reforestation in Canada. Below-ground forestry research is difficult, often neglected and sequestration information is severely lacking. Forestry, by tying up C in biomass, in soil and in products, may be an important avenue to increase biologically sequestered C. Although traditional forest genetics research has clearly shown tree genotypes can vary greatly in above-ground volume growth, it is not at all certain that these above-ground growth increases will result in overall increases in C sequestration. This is because trade-offs can exist between above- and below-ground C sinks. Such growth "strategies" can be genetically controlled. Thus, a genetically superior above-ground volume producing genotype may well divert less C below-ground compared to a slower above-ground volume producing genotype. In the early 1990's a series of studies were conducted to explore genetic variation in drought tolerance of mature black spruce (*Picea mariana* (Mill.) B.S.P.) trees from a 7 × 7 diallel on 3 sites of varying water holding capacities at the Petawawa Research Forest. A 2 x 2 subset with drought tolerant and intolerant families were examined with the former generating lower osmotic potential, higher turgor, and higher photosynthesis than the drought intolerant families. Thus there are important genetic and site component of varying productivity, which will be analyzed. The trees are now 30-years-old and we are investigating carbon allocation below ground, and above ground. Whole tree harvests were conducted; full tap root systems were displaced using air pressure so that root-to-shoot allocation patterns can be quantified for scaling. Soil cores were also examined for soil carbon and fine root production. The data will be used to estimate carbon fixation of a black spruce plantation and how much carbon is added to a system by planting black spruce. We will be presenting some of the preliminary results from this work.

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