Total Biomass, C and N Partitioning and Growth Efficiency of Mature Pedigreed Black Spruce on a Dry and Wet Site

Major, John E.; Johnsen, Kurt H.; Barsi, Debby C.; Campbell, Moira; Malcolm, John

Worldwide, efforts to reduce atmospheric CO_2 are being explored both by reducing emissions and by sequestering more carbon (C). Total above and belowground biomass, C, and nitrogen (N) parameters were measured in plots of 32-year-old black spruce (*Picea mariana* (Mill.) B.S.P.) from four full-sib families studied previously for drought tolerance and differential productivity on a dry and wet site. Drought tolerant families had lower wood density than drought intolerant families on the wet site but there were no differences between drought tolerant and intolerant families on the dry site. Allometric analysis showed greater total stem dry mass per unit total belowground dry mass for drought tolerant than intolerant families and for wet than dry sites indicating a differential allocation of photosynthate dependent on both genotype and environment. Allometric analysis also showed greater total stem dry mass per unit total needle dry mass (growth efficiency) for drought tolerant than intolerant families and for wet than dry site. This indicates variation in growth efficiency caused by greater net photosynthesis (shown previously) and greater partitioning of biomass to stem relative to total roots. Thus significant increase in biomass and reallocation of biomass in mature spruce trees can be produced through genetic (breeding) and environmental (moisture) change.

Can Climate Change Exacerbate the Genetic Consequences of Forest Fragmentation? Effects of Drought Stress on Heterozygosity-Fitness Correlations in Pedunculate Oak

Vranckx, Guy; Jacquemyn, Hans; Mergeay, Joachim; Cox, Karen; Janssens, Pieter; Gielen, Bie; Muys, Bart; Honnay, Olivier

In small and spatially isolated forest fragments, increased homozygosity may directly affect individual tree fitness, through the expression of deleterious alleles that influence morphological and physiological traits. Climate change induced drought may exacerbate the detrimental genetic consequences of forest fragmentation because the fitness response to low levels of heterozygosity is generally thought to be more pronounced under environmental stress than under optimal conditions. To test this hypothesis, we performed a greenhouse experiment in which fitness traits of 6-months-old seedlings of Quercus robur, differing in multi-locus heterozygosity (MLH), were recorded during 3 months under both a well-watered and a drought stress treatment (50 seedlings per treatment). Heterozygosity-fitness correlations (HFC) were examined by correlating transpiration parameters and various growth traits of individual trees to their MLH and by studying their response to drought stress. We obtained weak, but significant effects of the MLH (= 3–11 %, $p < 0.05$) on several fitness traits. High atmospheric stress (e.g. high vapor pressure deficit (VPD) influenced the strength of the HFCs of the transpiration parameters, whereas only a limited effect of the irrigation treatment was observed. Considering ongoing climate change, increased VPD levels in the future may strengthen the negative fitness responses of trees to low MLH.