Geophysical Research Abstracts
Vol. 13, EGU2011-133, 2011
EGU General Assembly 2011

Physiological traits sustaining tree growth under climate change in the Mediterranean

Tamir Klein (1), Giovanni Di Matteo (2), Eyal Rotenberg (1), Shabtai Cohen (3), and Dan Yakir (1)

(1) Department of Environmental Sciences and Energy Research, Weizmann Institute of Science, Rehovot, Israel (tamir.klein@weizmann.ac.il), (2) CRA-PLF Research Unit for Wood Production Outside forests, Agricultural and Forestry Experiment Center, Rome, Italy, (3) Institute of Soil, Water and Environmental Sciences, Volcani Center ARO, Rishon Lezion, Israel

The combination of tree longevity with a fast rate of climatic changes stresses the importance of physiological tree adaptation, also in favor of long-term genetic adaptation. This includes traits which promote growth while still conferring resistance to the warming and drying conditions. Here we tested genotypes (ecotypes) of the Mediterranean forest tree Pinus halepensis growing under 3 contrasting climate types. The distinctive responses of the 5 different ecotypes were used for the association between physiological parameters and field performance. Significant differences in tree-ring δ13C which were consistent with climate (-23‰ under meso-Mediterranean climate, -21‰ under thermo-Mediterranean, and -19‰ under semi-arid) were not always reflected in field performance. Southern ecotypes were more conservative in their gas exchange than Northern ecotypes (gs of 0.01 and 0.03 mol H2O m-2 s-1 respectively) and were also able to minimize water losses per carbon uptake. Large differences between ecotypes were in the timing and length of the growth season, with 2 Northern ecotypes extending growth beyond the rainy season, and in xylem sensitivity to embolism (PLC ranging between 0 and 70% at the same site). We therefore defined intrinsic water use efficiency, growth retention, and xylem resistance as the major traits contributing to the overall climate adaptation. Our analysis suggests that 2 of these 3 traits are both sufficient and obligatory to sustain tree growth under climate change. These results provide insights to be implemented not only via ecotype selection but in predictions of future forest function and forestry planning across different regions and tree species.