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DFoR - Identifying drivers of forest resilience under climate change

Drought is one of the most widespread abiotic disturbance agents affecting forests, causing profound effects on ecosystem functioning and carbon (C) balance. The frequency, duration, and severity of drought and heat stress are expected to increase in the future with additional consequences on the productivity, functioning, distribution and ecosystem services of forests worldwide. Yet, the underlying mechanisms of drought-related tree decline and mortality are still largely unknown. Hence, ground-based data combined with remote sensing analyses are becoming essential to better quantify tree vulnerability and predict regional forest losses. Therefore, this project aims to: 1) test the effect of drought and climate warming on tree resilience and xylem structure at intraindividual, intra- specific level, 2) disentangle the photosynthetic and hydraulic responses together with the C balance in trees experiencing drought; 3) identify predictors of drought-induced effects on trees at multiple spatial scales, upscaling results from individual to landscape. These aims will be achieved by: 1) analysing growth and wood anatomical traits of high-resilient vs low-resilient trees; 2) evaluating the corresponding yearto-year changes in intrinsic water-use efficiency and (C) storage derived from C-isotope discrimination and nonstructural carbohydrates concentration; 3) analysing satellite derived data and their links to wood traits. Analyses will be carried out on spruce trees, the most economic valuable conifer, in pure and mixed forests across environmental gradients in Italy. This will be the first project integrating cutting edge wood anatomical and isotope analyses with remote sensing observations, from individuals to stands across time and space. The data generated will be used to improve forest modelling. DFoR will be crucial to better forecast the future of forests and to define adaptive and sustainable management strategies to cope with incoming climate change scenarios.