EGU25-18995
EGU General Assembly 2025

XLA Petiole Index: A Novel Hydraulic Function Metric for Interpreting Drought-Induced Dieback in Mediterranean Ring-Porous Oak Forests

Michele Colangelo, Carmine Guadagno, Castellaneta Maria, Ripullone Francesco, and Borghetti Marco
University of Basilicata, Department of Agricultural Forest Food and Environmental Sciences, Potenza, Italy (michele.colangelo@unibas.it)

Climate-induced forest mortality is an increasing global phenomenon occurring at both regional and local scales, with implications for ecosystem functioning and the provision of essential ecosystem services. In recent years, the Italian peninsula has experienced widespread oak forest decline, with forests showing increased susceptibility to severe heat waves and prolonged droughts. Our study examined a drought-induced tree mortality episode in the Mediterranea region (Pollino National Park, Southern Italy) focusing on deciduous oak forest stands (*Quercus frainetto* Ten.). We employed a comprehensive approach, combining ecophysiological and dendro-ecological analyses to compare non-decaying (ND) and decaying (D) coexisting trees. Recent advancements in understanding the relationship between petiole xylem anatomy and leaf form and function have revealed a positive correlation between petiole vessel diameter and leaf size, both within and across species. Leaf petioles, serving as the singular entry point for water into the leaf venation system, offer a standardized basis for comparing xylem investment with downstream transpirational demands. To quantify this relationship, we employed a novel index derived from quantitative wood anatomy of petioles. This integrative trait characterizes leaf water transport function by measuring the ratio of cross-sectional xylem area (XA) at the petiole to the downstream leaf area, termed the XLA petiole Index. Our assessment of XLA petiole variation can provide evidence supporting a safety-efficiency trade-off in oak leaves, a crucial aspect of plant hydraulic strategy.