

FO₃X (Free air O₃ eXposure): an experimental infrastructure for realistic experiments in Mediterranean Europe

E. Marra ^{(1)*}, E. Paoletti ^(1,2), B.B. Moura ^(1,2), J. Manzini ^(1,3), A. Viviano ^(1,3), L. Lazzara ⁽¹⁾, Y. Hoshika ^(1,2)

(1) IRET-CNR, Via Madonna del Piano 10, Sesto Fiorentino (FI), Italy.

(2) NBFC, Palermo (PA), Italy.

(3) DAGRI-UNIFI, Piazzale delle Cascine 18, 50144 (FI), Italy.

*Corresponding author: elena.marra@cnr.it

Abstract

Tropospheric ozone (O₃) is a secondary pollutant gas that causes a significant adverse effect on forest tree species. Damage to vegetation occurs when O₃ enters the stomata following gas exchanges during photosynthesis. Ozone-induced stomatal sluggishness, i.e., a delay in stomatal responses to fluctuating stimuli, can potentially change forests' carbon and water balance. In particular, the O₃-induced stomatal sluggishness becomes more critical in water-limited environments such as Mediterranean Europe, where stomatal regulation of water losses under low soil water availability is critical. Free-air controlled exposure (FACE) facilities are considered an ideal tool that can provide realistic estimates of tree response to O₃ under real-world conditions. Since 2015, the last generation of the O₃ FACE facility has been available at the CNR experimental garden in central Italy (FO₃X - Free air O₃ eXposure), a unique facility in Europe within an AnaEE (Analysis and Experimentation on Ecosystems) European research platform. This facility permits the exposure of plants to three levels of O₃ concentrations (ambient, 1.5- and 2.0-times ambient concentration, denoted as AA, 1.5×AA and 2.0×AA, respectively), with main environmental variables continuously monitored. Twenty-nine plant species were fumigated at FO₃X to assess the effects of only O₃ or combined with other stressors on plant attributes (drought, nitrogen) evaluated O₃ damages. In this presentation, we will introduce our FACE facility from a future perspective, and recent experimental results about O₃ critical levels (CLs) to estimate the cumulative O₃ stomatal flux (F_{st}) at a level that causes direct injury to vegetation (i.e. a 4% decrease in biomass) will be summarized.