



## Fine-root morphological traits may improve understanding of the vulnerability of *Fagus sylvatica* natural forests to late-fall unusual wildfire

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Extraordinary changes in alpine fire regimes have been often associated with heat waves, which are generally regarded as an indication of a changing climate that will lead to new fire regimes in the Alps. Fine roots function of absorbing water and nutrients is crucial to plant survival and their traits such as biomass, length, specific root length, production, death, and decomposition can inform how trees interact with their environments and provide ecological functions in response to exogenous stresses. After an unusual, late-fall wildfire in a European beech (*Fagus sylvatica* L.) forest in the pre-Alps of northern Italy, the response of fine roots (< 2 mm diameter) was analysed and appeared more evident when fine roots were further subdivided by diameter size and soil depth. The finest roots (0–0.3 mm diameter) were generally the most responsive to fire, with the effect more pronounced at the shallowest soil depth. While roots 0.3–1 mm in diameter had their length and biomass at the shallowest soil depth reduced by fire, fire stimulated more length and biomass at the deepest soil depth compared to the control. Fire elevated the total length of dead roots and their biomass immediately and this result persisted through the first spring, after which control and fire-impacted trees had similar fine root turnover. Our results add to the paucity of data concerning fire impacts on beech roots in a natural condition and provide the basis for understanding fine-root morphological traits approach to assess plant species vulnerability and resilience to unusual fire occurrence due to climate changes. Changes in disturbance regimes might be most realized by distribution of the finest of fine roots at differing soil depths, and the dynamics of these roots may provide the most resilience to disturbance.