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A mechanistic understanding of ozone impact on forest ecosystems

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Changes in air chemistry and subsequent physical changes in the environment have a profound effect on the classic "disease triangle". Environmental factors alter ecosystem health and host susceptibility to biotic and abiotic factors. Plant response to various disease-causing stressors can be changed through introducing ozone (O_3) into the system. These effects are variable, depending on the timing, intensity and order of the exposure. It is well known that O_3 may produce on a plant functional alterations even without, before the onset of, or in addition, to macroscopic effects. Plants are able to respond to O_3: several potential mechanisms comprehending exclusion, tolerance, compensation and repair may work simultaneously to create a complex signaling network. These include changes in photosynthesis, cellular redox homeostasis, perception by apoplastic proteins, oxidative damage to membranes, hormonal regulation of the lesion formation, modulation of osmoprotectants and activation of enzymatic and non-enzymatic antioxidant systems. Within a single species, differences in structural, functional and transcriptional traits may play important roles in adaptation/acclimation to environments characterized by high oxidative pressure. Functional traits can predict plant behavior in its natural environment and have been correlated to the degree of tolerance to oxidative stress. The science to accurately describe how O_3 (alone and/or in combination with other biotic/abiotic stressors) affects plants and ecosystems in a changing climate is of paramount importance to guide political decision making. Diagnosis based on plant sampling and physiochemical analysis using traditional laboratory methods can be precise, but have a number of limitations as they are commonly time-consuming, destructive, and expensive. An alternative approach to monitoring ecosystem functions includes the development of new technologies, advancing computational capacity and improving methodological approaches to environnemental monitoring.

Keywords: global change, abiotic stress, plant response, disease triangle, O_3, oxidative burst, signaling network

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