ABSTRACT BOOK

IUFRO

Interconnecting Forests, Science and People

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All Division 7 (Forest Health) Meeting

56 - Modern approaches in evaluating ozone impacts on forests

K 2-4 (Konzerthaus Freiburg) Oral

IUFRO17-587 **A mechanistic modelling approach to link ozone susceptibility to constitutive and induced defenses**

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Abstract: Currently ozone damage is calculated either from its cumulative air concentration or (more mechanistically) by the number of molecules taken up. Usually, a threshold is considered that is independent on environmental or physiological conditions. However, this threshold is actually a variable defense barrier that depends on the physiological properties and the degree plants are stressed due to other environmental factors.

Here, a model is presented that accounts for three defense barriers: stomatal conductance, a resource-requiring constitutive defense mechanism, and a species-specific option to induce further detoxification processes. The induced defenses include the production of BVOCs which are known to increase membrane stability and trigger oxidative reactions that decrease the amount of aggressive ozone in and outside the leaf.

This is the first time processes of photosynthesis, ozone damage, and BVOC emissions are linked together in a physiologically plausible way. The sensitivity of the model to other environmental stresses that lead to stomatal closure and detoxification is demonstrated and the possibility to link it into models of leaf gas exchange is discussed.

BVOCs, ozone, detoxification, model development

K 2-4 (Konzerthaus Freiburg) Oral

IUFRO17-1927 **Epidemiological analysis: a new approach for forest protection against ozone**

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Abstract: Epidemiology is the study of how often diseases, injury and other health-related events occur in a defined population and why. The impact of surface ozone (O3) on vegetation is under-investigated at regional scale while huge areas are exposed to high surface O3 levels and its concentrations are expected to increase in the next future. Ozone effects on vegetation depend on the air concentrations but also on the O3 uptake through the stomata (Phytotoxic Ozone Dose). The majority of previous epidemiological assessments used ambient O3 exposure as a metric of injury. Epidemiology of O3 injury may be very helpful in particular when forests are investigated, as large trees require expensive experimental facilities for realistic O3 simulation and a few individuals can be usually investigated.

A standard for forest protection is considered biologically relevant when it translates into real-world forest impacts. Therefore, epidemiological investigations where large-scale biological responses (radial growth, crown defoliation, visible foliar O3 injury) are compared with ambient data in the field provide useful information for establishing the best standards and thresholds for forest protection from O3.

Unique in the world, the LIFE project MOTTLES combines field epidemiology with plant-responses to O3. MOTTLES addresses cross-border issues with ecosystem-based approaches and an innovative follow-up system at vulnerable sites for O3 injury. With the effort of set-up permanent monitoring stations in Europe, capable to return continuous hourly O3 concentrations and environmental parameters in real time, modelling stomatal O3 flux is possible. Epidemiological analyses allow disentangling and quantifying the contributions of different predictor variables to an overall plant effect. Based on flux-effect relationships, derivation of epidemiologically-based O3 critical levels represents a considerable progress in the development of methods for quantifying O3 effects on vegetation.

Critical levels, Epidemiology, Ozone, POD

K 2-4 (Konzerthaus Freiburg) Oral

IUFRO17-3511 **Assessing the potential impact of ozone on native vegetation: findings from the long-term pan-European monitoring program of ICP Forests**

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Abstract: The assessment of air pollution levels and effects on European forest ecosystems is the main goal of the UNECE ICP Forests program. Currently, ground level ozone is of primary interest due to its phytotoxicity and the exceedance of critical levels over large parts of Europe.
Within ICP Forests, monitoring of ozone concentrations and effects on vegetation have been carried out since 2000 according to standardized and quality assured methods on a number of intensive monitoring (Level II) sites purposively selected throughout Europe.
Ground-level ozone concentrations have been measured from April to September by passive sampling, a method proved to be particularly useful at remote sites. Effects on vegetation have been evaluated once a year through the assessment of ozone-like visible foliar symptoms, considered one of the most specific and easily detectable indicator for ozone impact.
Overall, data collected on 170 intensive monitoring Level II sites in 20 countries for 12 years reveal a downward temporal trend for both, ozone concentrations and frequency of ozone-symptomatic species. While a decreasing south-north gradient across Europe is obvious for ozone levels, a clear spatial pattern seems to be lacking for visible symptoms.
There is a great potential of the ICP Forests long-term dataset for understanding ecosystem status and trends in response to ozone. Further analyses are being undertaken to better clarify temporal and spatial patterns and to better identify relationships among ozone, other important environmental drivers, and the response of forest ecosystems.

Ozone in forest plots; foliar injury; ozone risk