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All Division 7 (Forest Health) Meeting

146 - Climate change and air pollution impacts on forest health status and productivity

Rolf Böhme Saal (Konzerthaus Freiburg)

IUFRO17-1404 **Biogenic Organic Aerosol as an indicator of the forest abiotic stress**

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Abstract: Volatile organic compounds (VOCs) have a substantial impact on the oxidant balance of the lower layers of the atmosphere. As result, they affect tree growth and ecosystem performance. Also, VOCs play significant role in new particle formation process and they change physicochemical properties of the existing particles. Wherein, such ecosystem like forest are the main source of the biogenic VOCs and in the global scale their emissions higher than anthropogenic VOCs. Thus, we investigated the changes of the physicochemical properties of the aerosol particles in forest environment. The measurements were performed applying a Scanning Mobility Particle Sizer, an Aerodynamic Particle Spectrometer and an Aerosol Chemical Speciation Monitor. During measurement campaign, it was observed new particle formation phenomena. Fresh nucleated particles were characterized by low oxidation level and high particle number concentration of the nucleation mode. Wherein, the polydisperse coagulation process was much higher than the condensation growth of the nucleated particles. Also, we determined that the nucleation process of the aerosol particle was related with the trees abiotic stress, which was observed by temperature increase. The analyse of the aerosol mass spectra showed that the methanol (CH3OH, m/z 33), acetone (C3H6O2, m/z 59), methyl-ethyle-ketone (C4H8O, m/z 73) and salicyl-aldehyde (C7H8O2, m/z 123) emissions were identified as heat related. Meanwhile, methanol, acetone and methyl emissions showed great dependency of heat and light. They showed high correlation (>0.9) with one another. However, the salicyl-aldehyde could be assigned to heat stress marker. Thus, we can conclude that biogenic organic aerosol particles can be an indicator of the abiotic stress of the forest and that could to expand understanding of the forest ecosystem. The study is based on the results from national project supported by Lithuanian Council of Research "FOREstRESS" (SIT- 3/2015).

forest health, abiotic stress, organic aerosol

Rolf Böhme Saal (Konzerthaus Freiburg)

IUFRO17-1036 **Change in Sulphur pools in forest ecosystems following the reduction of atmospheric SO2**

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Abstract: Due to the reduction in sulphur emissions from transport and industry, atmospheric sulphur dioxide (SO2) concentrations and sulphur deposition in Europe decreased significantly in the last decades. Sulphur is an essential plant nutrient needed for the production of certain amino acids. Its compound sulphate is the principal anion in soil solution and a driver of base cation and aluminium leaching from soils. However, few studies have examined changes in sulphur pools in forest ecosystems as a response to reduction of dry and wet S deposition. Within the monitoring framework of ICP Forests (International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests) sulphur compounds in soil, soil solution, biomass and deposition have been measured many years across Europe, allowing for the evaluation of sulphur pools and dynamics. In this study, we quantified the change in sulphur pools (forest floor, mineral soil, soil solution, tree biomass and litterfall) between 2007 and 2014 across Europe, focusing on ecosystems dominated by European beech, Norway spruce and Scots pine. Results show how the magnitude of decline in S deposition and atmospheric SO2 concentration as well as climate, species and soil characteristics moderate sulphur cycling in forest ecosystems, while the absolute effect can differ due to site-specific aspects like management or understory vegetation. The results inform our understanding regarding the long-term effects of elevated SO2 concentrations and deposition and help to evaluate the time scales and magnitude at which the main forest ecosystem compartments react to changes in sulphur exposure. Eventually, consequences for forest ecosystems in countries with ongoing sulphur emissions to the atmosphere may be predicted. On the other hand, the results may be used to improve predictions of forests likely to become deficient in S.

air quality, sulphate, trend analysis, ICP Forests

Rolf Böhme Saal (Konzerthaus Freiburg)

IUFRO17-2344 **Forest ecosystem status in the Romanian LTER sites under the air pollution and climate change stress**

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Abstract: The research carried out in the Retezat and Bucegi-Piatra Craiului mountain forests (Southern Carpathians) provides scientific support for Romanian long-term ecosystems research (LTER) and is of multi- and transdisciplinary nature. It includes monitoring and evaluation of forests ecosystems status under air pollution and climate change effects. During the last period 2009-2016, forests in the Retezat LTER site were moderately affected by excessive drought, high temperatures, air pollution and other natural stress factors, resulting in 12,1 - 16.7% of trees as damaged (crown defoliation greater than 25%). In Bucegi - Piatra Craiului LTER site the percentage of damaged trees decreased from22.5% (2009) to 16.7% (2016). European beech (Fagus sylvatica) was the least affected species, with 8.0-10.2% of trees in defoliation classes 2-4 in Retezat and 11.3 % (2009)- 8.1% (2016) in Bucegi - Piatra Craiului site, while Norway spruce (Picea abies) were much more stressed (12.9 - 21.2%) both in Retezat and Bucegi - Piatra Craiului (27.7 - 22.7%), Mountains. The elevated intensity of damage caused the annual volume growth losses for the entire research forest areas up to 25.0%. The nutritional status of trees was within limits of normal values, without any apparent influence on tree physiology. Soil acidity was typical for the types of geological materials found in the Retezat and Bucegi-Piatra Craiului Mountains indicating a slow negative effects of atmospheric acidic deposition. High diversity and evenness specific to the stand type's structures and local climate conditions were observed within the herbaceous layer, indicating that biodiversity of the vascular plant communities was not compromised.

LTER, forest status, soil, biodiversity, growth