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Ozone and Plants

By Elena Paoletti, Deputy Coordinator of IUFRO Research Group 7.01.00 Impacts of air pollution and climate change on forest ecosystems (http://www.iufro.org/science/divisions/division-7/70000/70100/)

The *Ozone and Plants* conference was held on 18-21 May 2014 in Beijing, China. It was hosted by the Chinese Academy of Sciences, on behalf of the IUFRO Research Group 7.01.00 "Impacts of Air Pollution and Climate Change on Forest Ecosystems" and the ICP Vegetation (http://icpvegetation.ceh.ac.uk). In the course of the conference a special session was organized by the Task Force on Hemispheric Transport of Air Pollution on behalf of UNECE (http://htap.org). The conference was attended by 102 experts from 17 countries with a total of 48 oral presentations and 40 posters.

Photo provided by Elena Paoletti

Welcoming addresses were delivered by the Ministry of Environmental Protection of China (Dr. Guangming Duan), the Chinese Academy of Sciences (Dr. Xiaonan Duan), the Coordinator of IUFRO RG 7.01.00 (Dr. Andrzej Bytnerowicz), the ICP Vegetation (Dr. Harry Harmens) and the Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences (Prof. Yonglong Lu).

Five keynote speakers introduced ozone distribution and impacts in China (Zhaozhong Feng), ozone pollution in East Asia (Hajime Akimoto), micrometeorological measurements of ozone fluxes (Stanislaw Cieslik), signaling processes induced by ozone (Jaakko Kangasjärvi), and ozone risk assessment (Lisa Emberson). The conference was an important opportunity to summarize the most updated scientific knowledge about ozone atmospheric chemistry and exchanges with the biosphere; ozone monitoring, modeling and risk assessment; and plant and ecosystem responses to ozone exposure.

Ozone was confirmed to be a serious air pollution problem - particularly in Asia - adversely affecting crops, forest trees and ecosystem health. A strong focus of the conference was on ozone effects on crop yield quality and quantity. Given the continuous and fast rise of the world population, pressure on food is expected to dramatically increase. Methods for assessing yield quality and approaches for improving yield quantity as a mitigation option in ozone-polluted environments were discussed, with an emphasis on breeding for more tolerant cultivars, especially for the two world's most important food crops, rice and wheat. Ozone toxicity mechanisms and dose-response relationships were presented and discussed.

Effects of ozone on ecosystem services, provided by forests and grasslands, such as carbon sequestration, control of the water cycle, and biodiversity conservation in the current and expected future climate were also addressed.

Many contributions reported results obtained in the field (e.g., by applying the antiozonant ethylenediurea, in ozone free-air fumigation (O3-FACE) experiments, in open-top chambers (OTCs), by micrometeorological approaches, and by epidemiological investigations), which is an important innovation relative to the prevalent laboratory studies of the past. These various approaches allow for investigating many different factors concurrently affected together with ozone. The tendency was to investigate mature plants in long-term experiments at ecosystem level, by focusing on the carbon, nitrogen and water cycles, and applying non-destructive techniques, such as sap-flow, eddy-covariance, and minirhizotron.

There is also an increased cross-disciplinary collaboration, involving experts with different backgrounds (ecophysiologists, biochemists, molecular biologists, atmospheric chemists, soil scientists, risk assessment experts, modelers, and statisticians).

The conference identified a need to:

Set-up coordinated surface ozone monitoring programs across the world to validate modeled surface ozone concentrations and deposition. Collate further existing field-based evidence for the impacts of ambient ozone on vegetation.

Establish more free-air ozone exposure facilities to quantify the adverse impact of ozone on vegetation under field conditions.

Further develop ozone dose-response relationships and critical levels for vegetation, in particular under Asian conditions and using Asian species and cultivars.

Include sensitivity for ozone in crop breeding programs to mitigate the threat of ozone pollution to food security.

Communicate to stakeholders - such as crop breeders, farmers and policy makers - the severity of the threat of ozone pollution to food security, carbon sequestration and other ecosystem services affecting human wellbeing.

Find a full report at: http://www.iufro.org/science/divisions/division-7/70000/70100/activities/