



Draft Minutes

10th UNECE/ICP-Forests & FutMon Intercalibration Course on the Assessment of Ozone Visible Injury

FutMon Action C1-O3-24(ES)

21-24 September 2009, Budapest & Mátrafüred (Hungary)

prepared by

Marcus Schaub ^a and Vicent Calatayud ^b

^a *Swiss Federal Research Institute WSL, Birmensdorf, Switzerland*

^b *Fundación CEAM, Paterna, Spain*

Host: Judit Sitkey

ERTI-Hungarian Forest Research Institute, Budapest

Participants:

Austria (Ferdinand Kristöfel); Cyprus (Marios Menelaou, Konstantinos Rovnias); Czech Republic (Vaclav Burianek, Radek Novotny); France (Laurence Dalstein, Nicolas Vas); Germany (Willy Werner); Greece (Constantinos Kaoukis, Constantina Tsagari); Hungary (Judit Sitkey); Italy (Filippo Bussotti, Fabiana Cristofolini, Rosanna Desotgiu, Silvia Ferlazzo, Marco Ferretti, Elena Gottardini, Martina Pollastrini); Japan (Aoki Masatoshi); Romania (Stefan Neagu, Diana-Maria Silaghi); Slovakia (Hana Pavlendová, František Máliš); Slovenia (Matej Rupel); Spain (Vicent Calatayud); Switzerland (Marcus Schaub, Pierre Vollenweider)

Monday, 21 September 2009

Morning: Opening of the meeting and introductory statements

- Welcome by the NFC representative of Hungary. A total of 28 participants from 14 countries attended the meeting.
- Introduction to the course program by Judit Sitkey.
- Marcus Schaub welcomed the participants and exposed the objectives, methods and tools related to air quality and visible injury assessment under FutMon project. A field manual to carry out such activities has been developed and is available under FutMon webpage (<http://www.futmon.org>). Guidelines for measuring air pollutants with passive samplers and continuous analyzers were discussed. Methods for setting up the plots for visible injury assessment were commented. Data quality objectives and limits have partially been established and will be implemented along the next months. Submission forms for data collected under FutMon have also been revised. In order to facilitate the flow of information between coordinators and the very experts of the beneficiaries/countries conducting the air pollutant measurements and visible injury activities, the following web page has been developed: <http://www.ozoneeffects.org>. It contains updated information on intercalibration activities, field forms, links to pages containing reference materials on ozone injury (<http://www.ozone.wsl.ch> and <http://www.ozoneinjury.org>) and scientific literature, as well as files to help with data submission (e.g. plant species codes). A new online tool (web album) allows the exchange of pictorial information and will be implemented as an open source discussion platform for the assessment of ozone visible injury: <http://gallery.me.com/marcusschaub#100288>. Beneficiaries/countries will be required to submit pictures of ozone injury of all those plants that show visible symptoms. Pictures will be revised by independent experts that will provide advice and ensure a harmonized assessment of the symptoms throughout Europe. If needed, surveys on difficult or interesting species using additional tools such as microscopy or controlled fumigation studies will be launched. Complementary, a Google discussion group has been established at http://groups.google.ch/group/ozone_effects.
- Marco Ferretti stressed the importance of Quality Assurance (QA) and quality control (QC) for the FutMon project. In “Action C1-QAC-15(IT): Objectives and expectations”, M. Ferretti provided an overview of the actions taken by the different working groups. For air quality and visible injury assessment, the first intercomparison of passive samplers which has been carried out by CEAM under FutMon, revealed important results for QA/QC. This intercomparison should be conducted on a regular basis in the future. The attendance of the Intercalibration Course on the Assessment of Ozone Visible will be mandatory as it helps assessing the differences among countries as well as sources of errors. Data quality requirements will have to be identified before 30 April 2010.

- Vicent Calatayud presented the results of the intercomparison of passive samplers (O₃, SO₂, NO₂, NH₃ ongoing) carried out under FutMon Action C1-O3-24(ES). Results of two exposure periods are available. The objectives were to assess the variability between a.) brand names, b.) countries, and c.) replicates including possible effects due to shelters. With few exceptions, countries are using commercial passive samplers that are not analyzed by the country itself. Coefficient of variation between replicates was ≤ 10% for most of the cases. For ozone, exposure of passive samplers without adequate shelters was identified to be the most important cause of variation (i.e. overestimation). Shelters have to be used to ensure comparability among brands. It was decided that countries and brand names would be kept anonymous in external reports, but used for internal QA/QC within the group only.
- Vicent Calatayud reported the changes in the data submission forms for air quality and visible injury, which will be available at the end of 2009 and should be used starting for the 2007 data submission. Pre-formatted Excel files will be posted at http://www.ozoneeffects.org/index_EN. These files will provide examples and will help in processing the data and adjusting the format of the final submission forms. Another Excel file with species code names is already available at http://www.ozoneeffects.org/index_EN. Changes with regard to previous forms include: a.) the submission of replicates separately for passive samplers, b.) hourly data for continuous analyzers, c.) the lowest altitude within a 2.5 and 5 km radius from the site of ozone measurements, and d.) new forms for co-located passive samplers and blanks.

Afternoon: Countries' presentations and photo exercise

- **Cyprus:** Konstantinos Rovanias presented the activities related with ozone in Cyprus. Concentrations from passive samplers and active samplers are relatively high, especially during the summer period. Plants with ozone symptoms have been found in the past at humid areas (e.g. *Ailanthus altissima*, *Robinia pseudoacacia*, *Sambucus nigra* and *Alnus orientalis*), but not in 2009. The poplar clone Oxford was also asymptomatic this year. Ozone monitoring will be continued in the future.
- **Slovakia:** Hana Pavlendová and František Máliš reported the status of monitoring for ozone effects on intensive monitoring plots in Slovakia. In 2009, ozone and other pollutants were measured using passive samplers (O₃ and NH₃ at 8 plots, NO₂ and SO₂ at 2 plots). The use of a new type of shelter improved the quality of ozone data. Symptoms were observed on the LESS, while never on main tree species in the canopy (MTS). Future plans include continuing with the monitoring of ozone levels and visible injury assessment at all eight level II plots, an intensification at core plots, but a reduction of the measurements of other pollutants due to the low levels measured during 2009.
- **Japan:** Aoki Masatoshi presented results from several studies and field observations in Japan regarding ozone injury. Recently, the concentrations of

ozone and peroxides have become high in middle May, especially in south-west Japan, due to air mass transferred from China.

- **Greece:** Constantina Tsagari and Constantinos Kaoukis presented results from Greece. Ozone concentrations were measured and ozone-induced visible injury was assessed at two sites. Pictures of the species showed different types of symptoms from biotic and abiotic causes. Ozone-like injury was identified in *Fagus sylvatica*. In *Cistus incanus*, observed symptoms were most likely not due to ozone.
- **Romania:** Stefan Neagu and Diana-Maria Silaghi presented results from Romania under FutMon. Ozone is measured with passive samplers at 4 sites and at 1 site with a continuous analyzer. They also participate in the FutMon passive sampler intercomparison exercise. ICAS analyzes the passive samplers by ion chromatography. Romania considered the use of 2 replicate filters to be sufficient. In case of dubious cases these data are rejected. The use of portable ozone analyzers with low power requirements as used by Romania are a valuable alternative to passive samplers.
- **Germany:** Willy Werner presented the status report of ozone measurements and assessment of ozone visible injury in Germany under the FutMon project. Ozone measurements with passive samplers were done on 42 plots with measurements of 3 parallel samplers per plot on 12 plots. Out of a total of 36 plots investigated for ozone visible injury, only at 5 plots ozone injury was detected on leaves (or needles). Validation of samplers is ongoing. Parallel active and passive ozone measurements are realized in year 2009 on 8 plots across 5 different federal states. Investigation of vegetation (LESS) is done on 15 plots, and injury was found in 4 plots. W. Werner suggested ring-tests for active monitors. However, due to nationally regulations and quality standards (certificates), this suggestion was declined.
- **Italy:** Elena Gottardini, Fabiana Cristofolini, Antonella Cristofori and Marco Ferretti showed results from the ozone monitoring network in Trentino (Italy) with 15 level I plots, including 6 plots of observation of visible injury. The measured variability of ozone concentrations within different grids (1 x 1 km grid, 15 x 15 km grid) lead to very different AOT40 estimates even within the same EMEP grid cell. Ongoing studies also focus on morphological and physiological responses of *Viburnum lantana* to O₃.

Filippo Bussotti, Rosanna Desotgiu, Martina Pollastrini and Chiara Cascio presented a study on the interaction of ozone and high light radiation with particular focus on beech. In beech leaves, symptoms become evident during late season when the capacity to cope with the excess of excitation declines. The onset of symptoms is more likely dependent from the physiological state of the leaf rather than from the flux. Symptoms are enhanced by the presence of ozone, but they are intrinsically caused by high light. It was suggested to consider the extensive reddening not as ozone symptoms (code 2), and to consider the more doubtful manifestations (red stippling, bronzing in beech leaves) as “unknown” (code 4). In their opinion, the

north facing forest edges should not be excluded when establishing the LESS (see Figure 3 a and b, ICP-Forests Manual, Part B).

- **Photo exercise:** Participants were asked to assess 55 standard pictures of symptoms, caused by ozone or other causes. The evaluation will be analyzed and used as one of different indicators for QA, i.e. variation among the different countries' and experts' assessments.

Tuesday, 22 September 2009

Morning: Discussion of the photo exercise, fresh material exercise, and final conclusions.

- **Photo exercise:** Comments on the photo exercise. The most problematic pictures were discussed. Results demonstrate that the agreement with a reference (control), in general increased for countries that have already participated in the previous courses.
- **Fresh material exercise:** The participants assessed 20 samples of fresh leaves collected from the field and from Open Top chambers. They decided whether the symptoms were due to ozone or due to any other biotic or abiotic agent. Each of the samples was commented and discussed in plenum.
- **Discussion and final conclusions:** Following issues have been discussed and suggestions made to be implemented for the FutMon field protocol, becoming effective in 2010:
 - **Change of passive samplers:** Given the difficulties of the countries to follow a common calendar for changing the passive samplers, synchronic changes will not be mandatory. However, it is strongly recommended that for ozone passive sampler changes always take place during even weeks (2, 4, 6, ...).
 - **Number of replicates:** The question of the use of three replicates was raised as some countries are using only 1 or 2 replicates for passive samplers to reduce the costs. The intercomparison of passive samplers and the use of 3 replicates of different brands in the FutMon project will contribute towards a better understanding of the precision of the different brands under different climatic conditions. Based on the findings of the intercomparison, respective changes for the number of replicates and confidence interval will be considered in the FutMon field protocol. However, the minimum number of 2 replicates for each brand and each country remains mandatory. Data for ozone measurements based on one passive sampler replicate will not be considered.
 - **Main Tree Species (MTS):** Based on the assessment of MTS during the previous years, results show very little ozone effects in the canopy of mature trees. This may be due to a.) differing micrometeorological conditions and b.) time of sampling (June-July) together with foliar analysis sampling. Also, due to the low number of samples (5 trees), any results may not be representative for the very

objectives of the program. For the future, the assessment of ozone visible symptoms within the canopy of MTS will be optional. MTS assessments can be restricted to plots where interesting results have been obtained so far and, for these cases, it would be interesting to adjust the sampling date to the most appropriate data for ozone symptoms observation and even to increase the number of sampled trees.

- **Light Exposed Sampling Sight (LESS):** Due to the high diversity of species composition for herbaceous species and due to little knowledge on ozone induced symptom development for herbaceous species, it has been suggested to assess woody species (minimum height yet to be defined) only to reduce the error on a.) correct identification of species, and b.) correct identification of symptoms. It is also proposed to reduce the sampling error to 10% only (20% will be omitted). For LESS of 100 m and longer, the number of quadrates will be 33. Table 4 of the FutMon Field Protocol/ICP-Forests Manual and reporting forms will be revised accordingly. This measure is expected to increase QA as it decreases the error as outlined above (a. and b.).
- **Location of the LESS:** For establishing the LESS, the transect should start at the forest edge, closest to the meteorological field station (passive samplers) and may also include north facing forest edges.
- **OTS form:** Observation of symptoms outside the quadrates (OTS form) is mandatory. A list of symptomatic species may be provided and divided for woody and herbaceous species. The data submission forms will be revised accordingly.
- **2010 Intercalibration Course in Valencia (Spain):** Vicent Calatayud proposed Valencia (Spain) for the Intercalibration Course. The proposal was accepted.

Wednesday, 23 September 2009

- **Field exercise:** The participants applied the method for assessing visible injury along a forest edge (LESS). Vegetation was sampled by using 2 x 1 quadrates randomly distributed along a 300 m transect. All woody plants inside the quadrates were examined and assessed for ozone injury. Complementary observations on other species of this area were also carried out. The exercise was concluded with discussing and explaining the various symptom expressions being found on different species.

Thursday, 24 September 2009

- Excursion to the National Park of Hortobágy.
- Closure of the course