



CONVENTION ON LONG-RANGE TRANSBOUNDARY AIR POLLUTION (LRTAP)

WORKING GROUP ON EFFECTS (WGE)

INTERNATIONAL COOPERATIVE PROGRAMME ON EFFECTS OF AIR POLLUTION ON NATURAL VEGETATION AND CROPS (ICP VEGETATION)

Minutes of the 32nd Task Force Meeting

The 32nd meeting of the Programme Task Force was held from 18 – 21 February 2019 in Targoviste, Romania. The meeting was hosted by Valahia University of Targoviste, Romania.

1. The meeting was attended by 79 participants from 31 countries, including Albania, Belarus, Belgium, Bulgaria, Cameroon, Canada, China (including Hong Kong), Czech Republic, Georgia, Germany, Greece, Ireland, Italy, Kazakhstan, Kosovo, Latvia, Lithuania, Moldova, Nigeria, Norway, Poland, Romania, Russian Federation, Serbia, Spain, Sweden, Switzerland, Syria, Tajikistan, Ukraine and United Kingdom. Participation included a representative of EMEP/MSC-West.
2. Welcome addresses were given by Mr. Cristinel Mortici, Dean Faculty of Sciences and Arts, Valahia University of Targoviste and Mrs. Dorela Mirica, a representative of the Environmental Protection Agency, Dambovita County. Both highlighted the importance of the work of the ICP Vegetation and the need for international collaboration to mitigate air pollution and its impacts on the environment.
3. Mr. Harry Harmens (UK), Chair of ICP Vegetation, gave an overview of the activities and achievements of the ICP Vegetation in 2018. Important activities and deliverables included:
 - Collaboration with EMEP/MSC-West on i) Improving and validating the soil moisture index module in the EMEP model; ii) Paper ‘Closing the global yield gap: Quantification and co-benefits for multi-stress tolerance’, showing which regions are most at risk from adverse ozone impacts for the staple crops maize, rice, soybean and wheat (Mills et al., 2018. *Global Change Biology* 24: 4869–4893). The same regions are often also at risk from adverse impacts of pests and diseases, heat stress and to a lesser extent nutrient stress and low rainfall.
 - An update of Scientific Background Document A (supporting information for Chapter 3 of the Modelling and Mapping Manual of the LRTAP Convention) with a chapter on ‘Flux model parameterisation for selected (semi-)natural vegetation species and associated flux effect relationships’ (see <https://icpvegetation.ceh.ac.uk/get-involved/manuals/mapping-manual>);
 - Advice provided to the European Commission and its Member States on the implementation of monitoring air pollution impacts on ecosystems (Art. 9 and optional indicators in Annex V) as part of the National Emission Ceilings Directive (Directive (EU) 2016/2284);
 - Contributions to a report (ETC/ACM 2018/15) from the European Topic Centre on Air Pollution and Climate Change Mitigation - European Environment Agency, reporting on the ‘Long-term evolution of the impact of ozone air pollution on agricultural yields in Europe – A modelling analysis for the 1990 – 2010 period’

https://acm.eionet.europa.eu/reports/EIONET_Rep_ETCACM_2018_15_O3impactTrends);

- Ozone bean biomonitoring activities in the ICP Vegetation-Asia network in Cambodia, China (including Hong Kong), India, Indonesia, Malaysia, Myanmar, Pakistan, Thailand and Vietnam;
- Data submission for the 2015/16 moss survey on heavy metals (35 countries), nitrogen (12 countries) and persistent organic pollutants (POPs; 8 countries). Nine countries from Eastern Europe, Caucasus and Central Asia (EECCA region) and eight countries from South-Eastern Europe (SEE) have submitted data. Data included submissions from 14 countries receiving Official Development Assistance (ODA). The final draft of the report is being prepared for publication planned in April 2019;
- Update of the ICP Vegetation website, see <https://icpvegetation.ceh.ac.uk>

Mr. Harmens also reported on progress with the workplan items for 2019 and proposed some workplan items for 2020/21 for further consideration by the Task Force during the meeting. In addition, he drew attention to the mandate of the ICP Vegetation, adopted by the Executive Body of the LRTAP Convention at their 38th meeting in December 2018 (subject to minor editorial changes by the Secretariat of the LRTAP Convention).

4. Ms. Marina Frontasyeva (Russian Federation), Chair Moss Survey Coordination Centre, reported in more detail on the outcome of the 2015/16 moss survey in Europe and beyond. For the priority metals lead and cadmium, concentrations in mosses have declined across Europe by 81% and 64% respectively since 1990, whereas no significant change was found in the concentration of mercury in mosses since 1995 (decline by 2%). Generally, the highest concentrations of heavy metals in mosses are found in SEE and the EECCA region. High concentrations were due to a combination of high emissions from anthropogenic sources and a high contribution from wind-blown dust with metals originating from the earth crust. Generally, the highest concentrations of nitrogen in mosses are found in Central Europe and parts of France.
5. Ms. Klaudia Borowiak (Poland) introduced some students from Poznan University of Life Sciences who are keen to develop new or further biomonitoring activities for ozone and heavy metals in their own countries, including Cameroon, Kosovo, Syria and Ukraine.
6. The next six sessions consisted of two parallel sessions considering the ozone and moss survey sub-programmes. The topics of oral presentations and discussions in these parallel sessions are provided in Annex III. For further details on the content of the oral presentations we refer to the book of abstracts available on the ICP Vegetation web site (<http://icpvegetation.ceh.ac.uk>). In addition, over 30 posters were presented during the meeting, covering similar topics as the oral presentations.
7. In the final plenary session, a summary of the parallel sessions was provided, and conclusions and recommendations were presented, discussed and adopted by the Task Force as described in Annex I. An updated medium-term workplan (2019-21) was provisionally agreed and adopted by the Task Force (see Annex II), with some items requiring further discussions with other LRTAP Convention bodies to be finalised for the Convention's biannual workplan for 2010 and 2021. Mr. Harmens (UK) drew attention to various workshops and conferences in 2019. The Task Force accepted an offer from Latvia to host the 33rd Task Force Meeting of the ICP Vegetation in Riga (27 – 30 January 2020).
8. On behalf of the Task Force, Mr. Harmens (UK) closed the meeting by thanking Romania and Valahia University of Targoviste for supporting and hosting the meeting. He particularly acknowledged the contributions from Mrs. Claudia Stihi, Mrs. Cristiana

Radulescu and their colleagues at Valahia University of Targoviste. Mr. Harmens acknowledged the UK Department for Environment, Food and Rural Affairs (Defra), the United Nations Economic Commission for Europe (UNECE) and the Natural Environment Research Council (NERC) for their continuous financial support of the ICP Vegetation Programme Coordination Centre. Mr. Harmens thanked the participants of the ICP Vegetation for their valuable contributions to the programme. Finally, the Task Force thanked Mrs. Lotti Thöni (Switzerland, who will be retiring) and Mrs. Blanka Mankovska (Slovakia, who sadly passed away in February 2019) for their invaluable contributions to the ICP Vegetation over the years.

Annex I.

Decisions and recommendations by the Task Force of the ICP Vegetation as agreed at its 32nd meeting, 18-21 February, Targoviste, Romania. Workplan items for 2019-2021 are included in Annex II.

OZONE RELATED ACTIVITIES:

- The Task Force (TF) took note of progress with the workplan item on ‘Improving and validating soil moisture index in the EMEP model’ and acknowledged the efforts of CIEMAT (Madrid, Spain) to coordinate this work in collaboration with EMEP/MSC-West.
- The TF took note of progress with the Scientific Background Document A (SBD-A), associated with Chapter 3 of the Modelling and Mapping Manual of the LRTAP Convention. A new Chapter 6 titled ‘(Semi-)natural vegetation – Flux model parameterization for selected (semi-)natural vegetation species and associated flux-effect relationships’ was included in October 2018. The development of new chapters for Scientific Background Document B (SBD-B) was discussed regarding new areas of research and development. The table below provides an overview of the topics to be included, who is taking the lead and who is going to contribute.

Topic	Lead	Contributions
<i>Guidelines for gap filling in data required for ozone flux modelling</i>	Felicity Hayes (Coordination Centre, UK)	Kirsti Ashworth (UK), Sabine Braun (Switzerland), Giacomo Gerosa (Italy)
<i>Guidelines for assessing ozone-induced foliar damage and yield loss of horticultural crops</i>	Ignacio González Fernández and Victoria Bermejo (Spain)	Vicent Calatayud (Spain), Giacomo Gerosa and Riccardo Marzuoli (Italy)
<i>Impacts of ozone on pasture quality</i>	Felicity Hayes (Coordination Centre, UK), Ignacio González Fernández (Spain)	
<i>Ozone flux-effect relationships and methodology for net annual increment (NAI) of trees</i>	Lisa Emberson (UK)	Sabine Braun (Switzerland), Per Erik Karlsson (Sweden)
<i>Ozone removal by vegetation in urban areas</i>	Elisabetta Salvatori (Italy)	Rocio Alonso (Spain), Pierre Sicard (France), Giacomo Gerosa (Italy)
<i>Validation of soil moisture index used in EMEP model</i>	Ignacio González Fernández (Spain)	Sabine Braun (Switzerland), Giacomo Gerosa and Riccardo Marzuoli (Italy), Vicent Calatayud and Arnaud Carrara (Spain), Per Erik Karlsson (Sweden) David Simpson (Sweden, EMEP/MSC-West)
<i>Ozone-induced injury guidance for educational and awareness raising purposes</i>	Klaudia Borowiak (Poland)	Felicity Hayes (UK), Felix Leung (Hong Kong, China), Vicent Calatayud and Victoria Bermejo (Spain)
<i>Critical levels for ozone-sensitive clones of poplar</i>	Yasutomo Hoshika (Italy)	Vicent Calatayud (Spain), Riccardo Marzuoli (Italy), Pierre Sicard (France)
<i>Interactive impacts of ozone and nitrogen on vegetation</i>	Håkan Pleijel (Sweden)	Coordination Centre (UK), Rocio Alonso and Victoria Bermejo (Spain)
<i>Ozone impacts on insects</i>	Valda Araminiene (Lithuania)	Coordination Centre (UK)
<i>Improved phenology for ozone flux modelling in trees</i>	Sabine Braun (Switzerland)	Per Erik Karlsson (Sweden)

- The TF took note of a joint expert workshop with ICP Forests ‘Assessing and estimating ozone impacts on forest vegetation – opportunities for improved co-operation’. The workshop is by invitation only and will be held on 12th April at the Swiss Federal Research Institute WSL in Birmensdorf, Switzerland.

- Several ICP Vegetation experts advised their ministries on the selection of sites, ozone flux calculations and foliar damage assessments as requirement for assessing air pollution impacts on ecosystems as part of the EU National Emission Ceilings Directive (NECD). The TF encouraged experts from all EU Member States to engage actively in this process, provide advice on the submission of data to the European Environment Agency and report on progress at the next TF meeting. The Task Force acknowledged the difficulty of consistent ozone foliar damage assessments on crops at sites where different cultivars are used each year and where crop rotation is common practice. Guidelines for injury assessments on trees should be further discussed at the joint ICP Vegetation – ICP Forests workshop on 12th April 2019. The Task Force acknowledged the need for expert knowledge to identify ozone-induced foliar injury in the field, hence EU Member States are encouraged to enlist the help of ICP Vegetation or ICP Forests experts.
- The TF welcomed the participation of the ICP Vegetation-Asia network in the bean biomonitoring study (with a focus on foliar injury assessments) and took note of the revised bean biomonitoring protocol and the protocol on gardens for sensitive ozone species (SOS). The TF recommended to explore the possibility of establishing an ozone biomonitoring network in Africa.
- The TF took note of the position paper submitted by Lisa Emberson (UK) on ideas for future work to improve ozone risk and damage assessments for crops and forest tree species and to support the work of other scientific communities, including:
 - a) Further development of the photosynthesis-based flux models and effect relationships to better inform the development of land surface exchange schemes likely to be used in the next generation of Earth System Models;
 - b) The development of crop growth models that include ozone damage functions using ICP vegetation knowledge, data and expertise (in collaboration with the Agricultural Model Intercomparison and Improvement Project - AgMIP);
 - c) The development of Net Annual Increment (NAI) methods for forest trees to enable ozone-induced damage estimates for Europe using UNECE LRTAP Convention risk assessment methods.

The Task Force welcomed the collaboration with the AgMIP community and encouraged Lisa Emberson to organise a joint workshop with ICP Vegetation crop experts regarding the incorporation of ozone damage functions in crop growth models. The Task Force: i) Endorsed the use of ICP Vegetation data in the AgMIP community; ii) Encouraged ICP Vegetation participants to make further suitable data available to the AgMIP community; iii) To identify and make available data for further development of photosynthesis-based ozone flux-effect relationships (and for comparison with existing empirical-based stomatal ozone flux-effect relationships). A data template will be provided by Lisa Emberson.

The Task Force recommended to discuss the development of the NAI method further at the joint ICP Vegetation – ICP Forests workshop on 12th April 2019 in Switzerland.

- The Task Force welcomed a potential review of nitrogen empirical loads for vegetation based on new data that has become available since the last review in 2010. Such a review should be conducted in collaboration with other ICPs such as ICP Modelling and Mapping and ICP Forests. The Programme Coordination Centre will discuss this topic further with other ICPs. The Task Force recommended to focus its efforts on reviewing data from experimental studies and would welcome presentations on this topic in future ICP Vegetation Task Force meetings. In addition, the Task Force recommended to review new

data (if available) regarding critical levels of NO_x for vegetation. Currently critical levels for NO_x are based on a review of data up to the early 1990s.

MOSS SURVEY RELATED ACTIVITIES:

- The Task Force requested that the Moss Survey Coordination Centre publishes the final report of the 2015/16 moss survey on heavy metals, nitrogen and persistent organic pollutants (POPs) as soon as possible, aiming for publication by April 2019 at the latest. An expert from Norway agreed to help with the final processing and reporting of the POPs data.
- The Task Force recommended that a small group of experts with long-term experience of moss biomonitoring methods reviews the 2015/16 data and makes recommendations about its application in the future, especially in areas which lack a humic soil layer.
- The Task Force requested that the ICP Vegetation Programme Coordination Centre (PCC) prepares and issues a call for data on heavy metals, nitrogen and POPs concentrations in mosses for 2020/21. The PCC agreed to send a call for data to all national moss survey experts.
- The Task Force recommended that the moss monitoring manual for 2020/21 is finalised by a small editorial group based on comments received from national experts. A summary of the application of the data management system should be included and the manual will be finalised in April 2019.
- The Task Force welcomed the development of a smart phone App by the Moss Survey Coordination Centre that enables automatic recording of site coordinates, other site details and recording of the moss species from a list of commonly sampled species at the time of sampling. This data can be transferred directly to the data management system, preventing errors due to a manual upload of data. The Task Force encouraged participants to download the App (ICP moss) from Google play (at the moment available for android phones only), test it and provide feedback, so it can be applied in the 2020/21 survey.
- The Task Force recommended that moss experts from EU Member States contact national experts/contacts to promote and offer the inclusion of data on current and historic nitrogen concentrations in mosses as part of reporting ecosystem monitoring data required for the National Emission Ceilings Directive (Directive (EU) 2016/2284, Art. 9 and Annex V).
- The Task Force recommended to conduct a pilot study on using mosses as potential biomonitors of microplastics in the 2020/21 survey. The pilot study should be conducted according to a protocol to be developed by April 2019 under the leadership of the Irish representative.

Annex II. Medium-term workplan (2019 – 2021) ICP Vegetation (updated 20th Feb. 2019)

Workplan items in *italics* for 2019 are not included in the biannual workplan (<http://www.unece.org/fileadmin/DAM/env/documents/2017/AIR/EB/ E ECE EB.AIR.2017.1.pdf>) of the LRTAP Convention.

2019:

- Ozone flux-based risk maps for current and future air pollution emission scenarios (in collaboration with EMEP/MSC-West);
- Improving and validating soil moisture index in the EMEP model (in collaboration with EMEP/MSC-West; Lead institute: CIEMAT, Madrid, Spain);
- Final report of the 2015/16 survey on concentrations of heavy metals, nitrogen and persistent organic pollutants (POPs) in mosses (Lead institute: JINR, Dubna, Russian Federation).
- Monitoring manual for the 2020/21 survey on concentration of heavy metals, nitrogen and POPs in mosses (Lead institute: JINR, Dubna, Russian Federation).
- *Report on networking activities in developing regions, including first season field evidence of ozone impacts;*
- *Report on ecosystem monitoring activities of ICP Vegetation participants as a requirement for the EU National Emission Ceilings Directive (Directive 2016/2284) and provide technical support to EU Member States on the implementation of ecosystem monitoring requirements;*
- *Report on joint ICP Vegetation – ICP Forests workshop (12th April, Switzerland).*

2020:

- Ozone flux-based risk maps adapted for soil moisture limited areas (in collaboration with EMEP/MSC-West);
- Report on ozone impacts in developing regions (risk assessment, evidence, policy);
- Report on the state of knowledge of interactive impacts of ozone and nitrogen on vegetation (Lead institute: University of Gothenburg, Sweden);
- Contribute to a potential review of nitrogen impacts (including NO_x) on vegetation (with a focus on experimental data) and potential need for updating empirical critical loads for nitrogen and critical levels for NO_x (with ICP Modelling & Mapping and other ICPs) (*To be confirmed, depending on the outcome of discussions with other ICPs. This work might continue into 2021*);
- Provide technical support to EU Member States on the implementation of ecosystem monitoring under the EU National Emission Ceilings Directive (Directive 2016/2284);
- Joint workshop with the Agricultural Model Intercomparison and Improvement Project on the inclusion of ozone damage functions in crop growth models (*to be confirmed*);
- Progress report on the 2020/21 moss survey on heavy metals, nitrogen and POPs;
- Comparison of trends in heavy metal concentration in mosses and trends in EMEP-modelled deposition for Cd, Hg and Pb between 1990 and 2015 (*to be confirmed*).

2021:

- Review of ozone pollution and climate change impacts on vegetation;
- Report on the development and applications of photosynthesis-based flux-response models (*to be confirmed*);
- Review of experimental data on nitrogen impacts on vegetation (*to be confirmed*);
- Progress report on the 2020/21 moss survey on heavy metals, nitrogen and POPs.

Annex III. Programme of the 32nd Task Force Meeting of the ICP Vegetation

Tuesday 19th February, 2019

Session 1: 9:00 – 10:45 Plenary Chair: Claudia Stihl

- 09:00 Welcome address
Cristinel Mortici – Dean of Faculty of Sciences and Arts, Valahia University of Targoviste.
Dorela Mirica – Delegate of Environmental Protection Agency, Dambovită County.
- 09:20 *Harry Harmens et al.* – Achievements of the ICP Vegetation in 2018 and future workplan (2019-2021).
- 09:45 *Marina Frontasyeva et al.* – Merits and drawbacks of passive moss biomonitoring used to study atmospheric deposition: Results of moss survey 2015/16.
- 10:05 *Klaudia Borowiak et al.* – Air monitoring system in selected countries and possibilities to start air biomonitoring of ozone and heavy metals.
- 10:35 General discussion

10:45 – 11:30 Poster viewing (with authors at poster)

Session 2: 11:30 – 13:00 (Two parallel sessions: Ozone and Moss survey)

Session 2a: Ozone – Ozone flux modelling and the role of soil moisture Chair: Rocio Alonso

- 11:30 *David Simpson* – Modelling ozone fluxes with the EMEP MSC-W Model – Status and future development.
- 11:50 *Ignacio González Fernández et al.* – Modelling the influence of soil moisture on ozone dose under water-limited climatic conditions.
- 12:10 *Gina Mills, Katrina Sharps et al.* – Closing the global ozone yield gap: Quantification and co-benefits for multi-stress tolerance.
- 12:30 *Harry Harmens et al.* – Can deficit irrigation mitigate impacts of ozone on wheat yield?
- 12:50 General discussion

Session 2b: Moss survey – Trends Chair: Marina Frontasyeva

- 11:30 *Konstantin Vergel et al.* – Moss biomonitoring in Russia: overview of the 2015/2016 moss survey.
- 11:50 *Gergana Hristozova et al.* – Atmospheric deposition trends in Bulgaria over a 20-year period of participation in the European moss survey programme (1995/6-2015/6).
- 12:10 *Pranvera Lazo et al.* – The metal atmospheric deposition in Albania (2010 – 2015 moss survey).
- 12:30 *Zaida Kosonen et al.* – Anthropogenic vs. geogenic origin of elements in Swiss moss samples between 1995 and 2015.
- 12:50 General discussion

Session 3: 14:00 – 15:30 (Two parallel sessions: Ozone and Moss survey)

Session 3a: Ozone – Impacts on food production Chair: Katrina Sharps

- 14:00 *Håkan Pleijel et al.* – Ozone impact on wheat in Europe, Asia and North America - a comparison.
- 14:20 *Jérôme Schneuwly et al.* – Estimation of ozone induced yield losses of wheat and potato in Switzerland using the DO₃SE model.
- 14:40 *Felicity Hayes et al.* – Dose-response relationships for African crops.
- 15:00 Some short poster presentations and general discussion. For list of ozone poster presentations, see final page.

- Session 3b:** **Moss survey – Biomonitoring with mosses and lichens** **Chair: Cristiana Radulescu**
- 14:00 *Julian Aherne et al.* – Moss as a biomonitor of atmospheric microplastic deposition.
- 14:20 *Stefano Loppi* – Mosses and lichens as bioaccumulators of airborne elements: What do we really measure? In addition, are these biomonitors suitable in environmental forensics?
- 14:40 *Carmen Iacoban et al.* – Nitrogen deposition in Romania. Levels determined within ICP Vegetation and ICP Forests.
- 15:00 *Luca Paoli et al.* – Air pollution still limits epiphytic recolonization: Heavy metals and ecophysiological parameters in threatened forest macrolichens of Central Europe.
- 15:20 General discussion

Session 4: **16:00 – 17:30 (Two parallel sessions: Ozone and Moss survey)**

Session 4a: **Ozone – Discussion session (1)** **Chair: Felicity Hayes**

- 16:00 Sabine Braun – Uncertainty analysis of ozone flux with phenological models.
- 16:20 General discussion on new developments, future ozone work and outreach activities including:
- Monitoring ozone impacts on vegetation, including contributions of EU Member States to National Emission Ceilings Directive;
 - Photosynthesis-based DO3SE model, incorporation of ozone impacts in crop growth models, damage functions for trees in terrestrial biosphere models;
 - New ozone research (e.g. pasture quality, impacts on pollination, ozone removal by vegetation in urban areas, BVOCs);
 - Outreach activities;
 - Interactions with climate change.
- Some short poster presentations were included here on relevant subjects mentioned above. For a list of ozone poster presentations, see final page.

Session 4b: **Moss survey – Results of recent surveys** **Chair: Hilde Uggerud**

- 16:00 *Inga Zinicovscaia et al.* – Moss biomonitoring of atmospheric deposition study of minor and trace elements in the Republic of Moldova.
- 16:20 *Omar Chaligava et al.* – Atmospheric deposition study of major and trace elements in Georgia based on moss analysis.
- 16:40 *Chrysoula Betsou et al.* – Mosses as biomonitors of trace elements in Greece.
- 17:00 *Petr Jancik* – Air pollution management projects using mathematical modelling and special monitoring methods.
- 17:20 General discussion.

Wednesday 20th February, 2019

Session 5: **08:30 – 10:30 (Two parallel sessions: Ozone and Moss survey)**

Session 5a: **Ozone – Interactions with nitrogen** **Chair: Håkan Pleijel**

- 08:30 *Håkan Pleijel* – Introduction and progress with data collation literature?
- 08:40 *Yasutomo Hoshika et al.* – Nutritional availability changes ozone dose-response relationships in poplars.
- 09:00 *Rocio Alonso et al.* – Sensitivity of Mediterranean mountain top herbaceous communities to ozone and nitrogen deposition.
- 09:20 *Victoria Bermejo et al.* – Ozone and nitrogen effects on fungal wheat diseases.
- 09:40 General discussion on new chapters for Scientific Background Document B, further developments regarding ozone critical levels and potential contributions to review of empirical nitrogen critical loads (with ICP Modelling & Mapping) and NO_x critical levels.

- Session 5b: Mosses – Preparations 2020 survey** **Chair: Harry Harmens**
- 08:30 *Alexander Uzhinkiy et al.* – Is it possible to predict heavy metal atmospheric deposition and when it could be useful?
- 08:50 *Alexander Uzhinkiy et al.* – Mobile application for ICP Vegetation moss sampling sites management.
- 09:10 Discussion on above presentations and preparations for 2020 moss survey:
- Amendments to moss survey biomonitoring protocol;
 - Call for data, data submission and participation;
 - Monitoring in Eastern Europe and beyond (background sites, inclusion of nitrogen, confounding factors);
 - Schedule 2020 survey (learn from past experiences);
 - Reporting back decisions & recommendations, future workplan.
- Session 6: 11:00 – 13:00 (Two parallel sessions: Ozone and Moss survey)**
- Session 6a: Ozone – Discussion session (2)** **Chair: Felicity Hayes**
- 11:00 *Felix Leung et al.* – Ozone garden: An experiment to examine the harmful effects of urban air pollution on ecosystems in South China.
- 11:20 *Valda Araminiene et al.* – Trends and inter-relationships of ground-level ozone metrics and forest health in Lithuania.
- 11:40 Final general discussions (see session 4a) and feedback to plenary, including future workplan.
- Session 6b: Moss survey – Biomonitoring studies** **Chair: Julian Aherne**
- 11:00 *Guntis Tabors et al.* – Spatial distribution of heavy metal pollution in moss (*Pleurozium schreberi*) and in soil O horizon in Latvia
- 11:20 *Stefan Fränzle et al.* – Chitin adsorption in environmental monitoring: not an alternative to moss monitoring but a method providing (lots of) bonus material/information.
- 11:40 *Nikolina Gribacheva et al.* – Heavy metal deposition monitoring in a mountain area with local emitters: a case study from Bulgaria.
- 12:00 *Oldřich Motyka* – Proper imputation of sub-limit and missing values in biomonitoring studies.
- 12:20 *Fabrizio Monaci et al.* – Native and transplanted aquatic moss (*Platyhypnidium riparioides*) for assessing long-term metal(loid) impacts from abandoned mines.
- 12:40 General discussion and feedback to plenary.
- Session 7: 14:00 – 15:30 Final plenary session** **Chair: Harry Harmens**
- Reporting back from ozone and moss survey sessions;
 - Medium-term work plan ICP Vegetation 2019 – 2021 and beyond;
 - Decisions and recommendations of the 32nd Task Force Meeting;
 - 33rd ICP Vegetation Task Force Meeting;
 - Other business.
- 16:00** Visit to Chindia Tower and the Royal Court of Targoviste (15 minutes' walk from the International Conference Center)

Thursday 21st February, 2019

Excursion to Bran and Peles Castles in the Carpathians Mountains.

LIST OF POSTERS

OZONE

Author(s)	Title
Araminiene, V. et al.	Ozone impacts on insects
Ashworth, K. et al.	Ozone impacts on respiration and photosynthesis rates in three contrasting forest ecosystems
Calatayud, V. et al.	Project ELEMENTAL: Ozone fluxes in Mediterranean vegetation
Dell'Orso, A., Alonso, R. et al.	DNA integrity and ecophysiological responses of Spanish populations of <i>Ulmus glabra</i> to increasing ozone levels
Eghdami, H. et al.	Time series (1998-2015) of ozone flux on forest in Rhineland Palatinate (Germany)
Fusaro L., Salvatori E. et al.	Modelling ozone uptake by urban and peri-urban forest: A case-study in the Metropolitan city of Rome, Italy
<i>Hayes, F. et al.</i>	<i>Evidence of impacts of ozone on ecosystem services of grasslands</i>
Leung, F.P.K et al.	Quantifying the impact of present-day and future tropospheric ozone on crop productivity at global and regional scale using JULES-CROP
Neiryneck, J. & Verstraeten, A.	Ozone deposition over a mixed suburban temperate forest
Paoletti, E., Hoshika, Y. et al.	Towards the definition of epidemiologically-based stomatal-flux critical levels for forest protection against ozone: the MOTTLES approach
Roberts, H.	Do biogenic VOCs protect plant productivity under multiple environmental stress?
<i>Sharps, K. et al.</i>	<i>Smart-phone app for recording incidences of ozone injury on vegetation</i>
<i>Tai, A. et al.</i>	<i>Estimating the impacts of ozone pollution and climate change on terrestrial ecosystem productivity using an offline ecophysiological model</i>

Short presentations were given for posters in the ozone sessions except for those in italics.

MOSS SURVEY

Author(s)	Title
Aleksiyenak, Y., Frontasyeva, M.V. et al.	Data interpretation from Belarussian moss surveys using different statistical approaches
Aničić Urošević, M. et al.	Assessment of anomalies in distribution of rare earth elements across Serbia using moss biomonitoring
Bekteshi, L., Lazo, P. et al.	Assesment of air quality in Albania based on atmospheric deposition of trace elements in coastal and inland areas
Budka A. et al.	Heavy metal accumulation in <i>Taraxacum officinale</i> L. at urban areas
Bukharina, I.L., Frontasyeva, M.V. et al.	Moss monitoring of trace elements in the Republic of Udmurtia, Russia
Dalelova A.M, Omarova N.M., Frontasyeva M.V.	Investigation atmospheric deposition of heavy metals in north and west region of the Republic of Kazakhstan using the method of moss-biomonitoring
El Shall, A., Bellini, E. et al.	Intracellular response to cadmium in the moss <i>Leptodictyum riparium</i>
Ene, A., Stih, C. et al.	Nuclear and atomic techniques used for heavy metal pollution investigations in agroecosystems
Frontasyeva M.V., Abdusamadzoda, D. et al.	Air pollution study in different regions of Tajikistan using the moss biomonitoring techniques, NAA and AAS
Gorelova S.V., Frontasyeva M.V. et al.	Trends of atmospheric deposition in Central Russia: Tula region (2015-2016)
Koroleva, Y., Bakhruz, B. et al.	PAHs measurements in moss <i>Pleurozium schreberi</i> in Kaliningrad region
Krakovská, A. et al.	Identification of the pollution sources by moss biomonitoring in the Upper Silesia region
Madadzada, A., Frontasyeva, M.V. et al.	Atmospheric deposition of trace elements in Guba region (Azerbaijan)
Marku, E. & Nuro, A.	Preliminary study of some organic pollutants in moss and pine needles in Tirana region, Albania
Mehrabova, M.A. et al.	Biomonitoring of air pollution in Azerbaijan
Moraru, S.S., Ene, A. et al.	Relation between land use, industrial activity and metal accumulation in plants
Movsisyan N., Tepanosyan, G. et al.	Estimation of atmospheric fallout radionuclides activity using mosses: Armenia
Nuhuyeva, Sh.S. et al.	Biomonitoring of atmosphere air in important ecotourism regions of Azerbaijan
Qarri, F. et al.	Biomonitoring of toxic metal air pollution using mosses in Albania
Radulescu C. et al.	Microclimatic monitoring and environmental impact assessment on heritage materials of Tropaeum Traiani Monument, Adamclisi
Stih, C. et al.	Moss biomonitoring in Romania as integrated in European surveys: continuity, extending and perspectives
Štrbová, K. et al.	Missing values in biomonitoring data: Example from biomonitoring survey in Belarus
Svozilik, V. et al.	Verification of the air pollution mathematical modelling results using special monitoring and analytical methods