



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 33rd Task Force Meeting

The 33rd meeting of the Programme Task Force was held from 27-30 January in Riga, Latvia and hosted by the University of Latvia.

1. The meeting was attended by 62 participants from 22 countries, including Albania, Algeria, Belgium, Czech Republic, Estonia, Georgia, Germany, Iceland, Italy, Kosovo, Latvia, Lithuania, Norway, Poland, Romania, Russian Federation, Serbia, Slovakia, Spain, Sweden, Switzerland and United Kingdom. Participation included representatives of EMEP/MSW-West, EMEP/MSW-East and the Coordination Centre for Effects (CCE) of the ICP Modelling and Mapping.
2. Welcome addresses were given by Mr. Didzis Elferts, Dean of the Faculty of Biology, University of Latvia and Mrs. Silvija Nora Kalniņš of the Ministry of Environmental Protection and Regional Development of the Republic of Latvia, Deputy Director of the Department of Environmental Protection. Both highlighted the importance of the work of the ICP Vegetation and the LRTAP Convention, 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 2019 and reported on progress with items included in the biannual workplan of the LRTAP Convention for 2020 and 2021. Important activities and deliverables included:
 - Collaboration with EMEP/MSW-West on improving and validating the soil moisture index module in the EMEP model and improved ozone flux-based risk maps for soil moisture limited areas such as the Mediterranean and under future climate scenarios of other regions in Europe. Details were presented later by Mr. Ignacio González Fernández (Spain), a representative of CIEMAT, who are coordinating this work;
 - Progress with a review on the interactive impacts of ozone and nitrogen on vegetation. Initial analysis suggests that enhanced nitrogen supply does not significantly affect ozone impacts on crops, although species and indicator-specific interactions have been reported for (semi-)natural vegetation. Further details on the interactive impact of ozone and nitrogen on crops were presented later by Mr. Håkan Pleijel (Sweden);
 - Progress with parameterisation of the DO₃SE module in the EMEP model for (semi-) natural vegetation, for application in large scale modelling ('POD₁IAM'), as defined in Chapter 3 of the Modelling and Mapping Manual of the Convention (see paragraph 5 for further details). Mr. Harmens also highlighted the need for defining leaf area index and surface area parameters, required for calculating ozone fluxes when upscaling from leaf to canopy level. During the meeting, discussions on this topic

were held in the ozone sessions, as well as discussions on progress with new chapters for Scientific Background Document B, documenting new developments in ozone research and ozone critical level methodologies;

- A global risk assessment on the impacts of ozone on wheat production and yield in 2010 and 2030, using a current legislation scenario (ECLIPSE v5a). Production and yield losses are similar for 2010 and 2030 and highest losses are reported for India and China. Ozone pollution remains a problem in the future due to rising methane emissions and stable nitrogen oxides emissions (both precursors for ground-level ozone);
- The final draft report of the moss survey 2015/16 by the Moss Survey Coordination Centre in the Russian Federation was submitted to the ICP Vegetation Coordination Centre for final edits and review. Publication of the report is planned for March 2020. Temporal trends show a decline in cadmium and lead concentrations in mosses of 64% and 82% respectively across Europe between 1990 and 2015, but no change in mercury concentrations. For other metals, the decline varied between 18% (iron) and 56% (vanadium). The nitrogen concentration in mosses has not changed since 2005. Generally, the highest concentrations of nitrogen in mosses are found in and parts of France, central and south-eastern Europe. For further details, see paragraph 4;
- A joint workshop between ICP Forests and ICP Vegetation experts on ozone impacts on forest vegetation (12 April 2019, Birmensdorf, Switzerland).
- Outreach activities beyond the UNECE region, including: Ozone bean biomonitoring activities as part of the ICP Vegetation-Asia network; a stakeholder meeting held in Varanasi, India, back to back with 5th Asian Air Pollution Workshop; an ozone training workshop for African crops scientists; providing ozone injury factsheets for inclusion in a diagnostic field guide for plant health doctors in Africa as part of the Plantwise programme (<https://www.plantwise.org>);
- Update of the ICP Vegetation website (<https://icpvegetation.ceh.ac.uk>).

Mr. Harmens informed the Task Force that he is retiring on 30th April 2020. As lead country, the UK has agreed to hand over the position of chair of the Task Force to Ms. Felicity Hayes (ICP Vegetation Coordination Centre, UK) and for Ms. Katrina Sharps (ICP Vegetation Coordination Centre, UK) to take on the role of head of the Programme Centre from 1 April 2020.

4. Mr. Eiliv Steinnes (Norway) reported in more detail on the outcome of the 2015/16 moss survey for heavy metals in Europe and beyond. The first European moss survey was conducted in 1990 and has been repeated every five years since. Generally, the highest concentrations of heavy metals in mosses are found in south-eastern Europe (SEE) and Eastern Europe, Caucasus and Central Asia (EECCA region). High concentrations in those regions are due to a combination of high anthropogenic emissions and a high contribution from wind-blown dust with metals originating from the earth crust, as indicated by very high concentrations of especially aluminium, iron and vanadium.
5. Mr. David Simpson (EMEP/MS-Clear) provided further details on updating semi-natural vegetation calculations in the EMEP model and discussed any outstanding issues. He presented the first provisional maps of stomatal ozone fluxes for semi-natural vegetation, i.e. temperate grasslands and Mediterranean annual pastures. The DO₃SE module of the EMEP model was parameterised according to the latest parameters described in Chapter 3 of the Modelling and Mapping Manual of the LRTAP Convention. Outstanding issues include the high maximum stomatal conductance defined for Mediterranean annual pastures and the complex phenology functions described in the

manual (can they be simplified?). Ongoing activities in collaboration with the ICP Vegetation include: i) Updating the DO₃SE parameterisations in the EMEP model in line with those described in the Modelling and Mapping Manual; ii) Validation of soil moisture index applied in the EMEP model using soil moisture data measured at ICP Vegetation sites, particularly in the Mediterranean region; iii) Testing the application of a photosynthesis-based stomatal conductance model; iv) Improvement of global data for ozone flux modelling (e.g. growing seasons, multiple crop cycles, phenology parameters).

6. Mr. Ilia Ilyin (EMEP/MSC-East) compared moss survey data with the contribution of anthropogenic and secondary emission sources as modelled by EMEP for the heavy metals cadmium, lead and mercury. Correlations between normalised modelled deposition and concentrations in mosses are relatively high for cadmium and lead (correlation coefficient approximately 0.7) but low for mercury (correlation coefficient of 0.4). In many countries, similar temporal trends are observed for modelled total deposition and concentration in mosses for lead and cadmium, but trends deviate more in each other for mercury. Spatial correlations are more variable, with a correlation coefficient equal or higher than 0.4 only observed in eight, six and one country for cadmium, lead and mercury respectively. The spatial correlations don't improve by using a higher resolution of the EMEP model or by separating modelled wet and dry deposition. The effect of seasonal changes in heavy metal deposition and meteorology on metal concentrations in mosses requires further investigation. The modelled contribution of wind re-suspension to heavy metal deposition in SEE and EECCA region agree with the observed concentration of crustal elements such as aluminium and iron in mosses. To improve the evaluation of heavy metal pollution in the EMEP region, further collaboration between EMEP/MSC-East and ICP Vegetation is essential.
7. The next five 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 and copies of the presentations available on the ICP Vegetation web site (<http://icpvegetation.ceh.ac.uk>). In addition, about 25 posters were presented during the meeting, covering similar topics as the oral presentations.
8. 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 (2020-21) was agreed and adopted by the Task Force (see Annex II). Ms. Hayes (UK) drew attention to various workshops and conferences in 2020. The Task Force accepted an offer from Lithuania to host the 34th Task Force Meeting at the Institute of Forestry, Lithuanian Research Centre for Agriculture and Forestry in Girionys (Kaunas district) from 22 – 25 February 2021. The Task Force took note of a provisional offer from Albania to host the meeting in 2022.
9. On behalf of the Task Force, Ms. Hayes (UK) closed the meeting by thanking the University of Latvia for supporting and hosting the meeting. She particularly acknowledged the contributions from Mr. Guntis Tabors and his colleagues at the Faculty of Biology. Ms. Hayes acknowledged the UK Department for Environment, Food and Rural Affairs (Defra) and the United Nations Economic Commission for Europe (UNECE) for their continuous financial support of the ICP Vegetation Coordination Centre. Ms. Hayes thanked the participants of the ICP Vegetation for their valuable contributions to the programme. Finally, the Task Force thanked Mr. Harry Harmens for his leadership of and invaluable contributions to the ICP Vegetation over the last 16 years.

Annex I. Decisions and recommendations by the Task Force of the ICP Vegetation at its 33rd meeting, 27 – 30 January 2020, Riga, Latvia. Workplan items for 2020-2022 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 development of new chapters for Scientific Background Document B (SBD-B), associated with Chapter 3 of the Modelling and Mapping Manual of the LRTAP Convention. The table below provides an overview of the topics proposed for inclusion, who is taking the lead and who is going to contribute (subject to available funding). Topics highlighted in bold are ready for inclusion in SBD-B in 2020.

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), Victoria Bermejo (Spain)
<i>Interactive impacts of ozone and nitrogen on crops</i>	Håkan Pleijel (Sweden)	Coordination Centre (UK)
<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>	Lina Fusaro and Fausto Manes (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), Vicent Calatayud and Arnaud Carrara (Spain), Giacomo Gerosa and Riccardo Marzuoli (Italy), Lisa Emberson (UK), 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>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 the outcome of the joint expert workshop with ICP Forests ‘Assessing and estimating ozone impacts on forest vegetation – opportunities for improved co-operation’ (12th April 2019, Birmensdorf, Switzerland) and encouraged to continue the fruitful collaboration, especially regarding ozone impacts on forests.
- The TF took note of the roadmap for the review and revision of the empirical critical loads for nitrogen, presented by the Coordination Centre for Effects (CCE) of the ICP

Modelling and Mapping. The TF welcomed the opportunity for experts within the ICP Vegetation to contribute to the review and invited experts to participate in the review process. A thematic session on empirical studies about nitrogen effects on vegetation was proposed for the next TF meeting.

- The TF took note of the ongoing collaboration between ICP Vegetation and EMEP Task Forces and Centres and encouraged to continue such collaboration as described in further detail of the workplan of the ICP Vegetation (Annex II).
- The TF took note of the outreach activities of the ICP Vegetation and encouraged to continue such activities, especially in developing regions. The TF encouraged further collaboration with international scientific networks at the global scale.
- The Task Force welcomed the collaboration with the Agricultural Model Intercomparison and Improvement Project (AgMIP), initiated by Ms. Emberson (UK), to include ozone damage functions in crop growth models. The TF took note of the joint workshop scheduled for 7th February 2020 and encouraged ICP Vegetation participants to contribute experimental data.

MOSS SURVEY RELATED ACTIVITIES:

- The TF 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) by March 2020.
- The TF took note of the presentation by EMEP/MSC-East on the contribution of anthropogenic and secondary emissions sources to cadmium, mercury and lead deposition in the EMEP region, comparing modelled deposition and concentrations in mosses. The Task Force recommended to review the analysis and to continue further assessment of the suitability of mosses as biomonitors of heavy metals deposition in areas dominated by mineral soils, often found in SEE and the EECCA region. The contribution of wind-resuspension and/or soil contamination to heavy metal concentration in mosses requires further investigation in such regions. The TF recommended that a small group of experts reviews the 2015/16 data and makes recommendations about its application in the future.
- The TF reiterated the importance to participants of the 2020/21 moss survey to:
 - Sample mosses in agreement with the monitoring manual and recommended sampling in areas with a defined humus layer (where possible);
 - Conduct quality checks of data before submitting the final data to data management system (DMS), including data on moss reference material;
 - Make use of the many functionalities of the Data Management System, such as link to an App to upload metadata, conduct simple summary statistics and mapping of the data.
- The TF reiterated that quality checks of submitted data are responsibility of the data provider. Subsequently, the Moss Survey Coordination Centre is tasked to check data for outliers, discuss any country border effects with respective data providers and agree with the data providers on the final data to be included in the DMS.
- The TF invited the Moss Survey Coordination Centre to collate preliminary data on participation of countries in 2020/21 moss survey, bearing in the mind the call for data,

and to communicate the schedule for data submission and final reporting with participants as soon as possible.

- The TF recommended to include the option of quantile mapping (10 quantiles) in the DMS to improve the identification of hotspots in low deposition areas at the national level. The application of quantile mapping should also be explored across the EMEP region.
- The TF took note of offer from Norway to analyse POPs concentrations in mosses (at a cost) for countries that don't have the appropriate analytical facilities.
- The following countries plan to take part the pilot study on microplastics: Ireland, Switzerland, Germany (subject to approval), Italy (Toscana region).
- The TF recommended to continue to compare moss survey results with other environmental and surrounding vegetation data to assess factors affecting element concentrations in mosses.
- The TF discussed ideas for future developments, including:
 - New ways to look at the moss data, e.g. comparison with satellite available data;
 - Extend capabilities of the moss DMS;
 - Active moss biomonitoring (moss bags) in areas where mosses are not present, for example agricultural and urban areas.
 - Calculation of accurate background concentrations for elemental concentrations in mosses for each country, with the aim to calculate ratios on concentrations in moss and background concentrations for additional assessments of spatial patterns and temporal trends.

Annex II. Medium-term workplan (2020 – 2022) ICP Vegetation (updated 29th Jan. 2020)

Workplan items in *italics* are not specifically included in the biannual workplan (http://www.unece.org/fileadmin/DAM/env/documents/2019/AIR/EB/ECE_EB.AIR_2019_1-1916514E.pdf) of the LRTAP Convention for 2020 and 2021.

2020:

- Ozone flux-based risk maps adapted for soil moisture limited areas (*with EMEP/MSC-West*);
- Review on interactive impacts of ozone and nitrogen on crops
- Contribution to improve estimation of environmental benefits from decreasing ozone through mitigation of methane emissions (*in collaboration with various Convention bodies; HTAP workshop: 22-24 April 2020, Edinburgh, UK*)
- Call for data for moss survey 2020-21 on heavy metals, nitrogen and POPs
- *Review leaf area index and total surface area parameterisations in ozone flux-based modelling for upscaling from leaf to canopy level (with EMEP/MSC-West)*
- *Report on ozone impacts on crops in developing regions*
- *Joint workshop with Agricultural Model Intercomparison and Improvement Project (AgMIP) on inclusion of ozone damage functions in crop growth models*
- *Comparison of spatial patterns and temporal trends of heavy metals in mosses and EMEP-modelled deposition (with EMEP/MSC-East)*

2021:

- Review on interactive impacts of ozone and nitrogen on vegetation (excluding crops)
- Ozone flux-based risk assessment for vegetation at various air pollution scenarios (to support review of Gothenburg Protocol, *with EMEP/MSC-West, TFIAM, CIAM*)
- Test development and applications of photosynthesis-based flux-response models (*with EMEP/MSC-West*)
- Contribution to validation and revision of empirical critical loads for nitrogen (*with CCE, ICP Modelling and Mapping*)
- Call for data for moss survey 2020-21 on heavy metals, nitrogen and POPs
- *Workshop on epidemiological analysis of ozone and nitrogen impacts on forests (with ICP Forests)*
- *Development of ozone critical levels for forest trees based on the net annual increment (NAI)*

2022 (provisional):

- Review of critical levels of nitrogen oxides (NO_x) for vegetation
- Review of ozone pollution and climate change impacts on vegetation
- Joint workshop with ecosystem modellers on inclusion of ozone impacts

Selected ongoing annual activities:

- *Review and update Scientific Background Document B for Chapter 3 of Modelling and Mapping Manual of LRTAP Convention*
- *Outreach and networking activities in developing regions, linking with other international networks*

Annex III. Programme of the 33rd Task Force Meeting of the ICP Vegetation

Tuesday 28th January, 2020

Session 1: 9:00 – 10:45 Plenary Chair: Guntis Tabors

09:00 Welcome address:

Silvija Nora Kalniņš - Ministry of Environmental Protection and Regional Development of the Republic of Latvia, Deputy Director of the Department of Environmental Protection

Didzis Elferts - Dean Faculty of Biology

09:15 *Harry Harmens et al.* – Achievements of the ICP Vegetation in 2019 and future work plan.

09:40 *Eiliv Steinnes & Marina Frontasyeva* – An overview of the 2015 European moss survey and recommendations for the 2020 survey.

10:00 *David Simpson et al.* – Updated semi-natural vegetation calculations in EMEP MSC-W model.

10:20 *Iliia Ilyin* – Contribution of anthropogenic and secondary emission sources to heavy metal pollution in the EMEP region: Results of the model simulations and moss surveys.

10:40 General discussion

10:45 – 11:30 Coffee/tea and poster viewing (with authors at poster)

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

Session 2a: Ozone Chair: Viki Bermejo

11:30 *Håkan Pleijel et al.* – Does ozone sensitivity depend on nitrogen application rate and how is nitrogen efficiency affected by ozone in crops?

11:50 *Felicity Hayes et al.* – Impacts of ozone on growth and yield of tropical (African) crops.

12:10 *Ignacio González Fernández et al.* – Soil moisture modelling effects on dose-based ozone risk assessment under water-limited climatic conditions.

12:30 *Katrina Sharps et al.* – Mapping ozone impacts on crops at a range of scales: focusing on developing regions.

12:50 General discussion

Session 2b: Moss survey Chair: Pranvera Lazo

11:30 *Guntis Tabors et al.* – Heavy metal concentrations in moss (*Pleurozium schreberi*) and forest soils in Latvia.

11:50 *Zaida Kosonen* – Emissions in Switzerland in relation to the results of the Swiss moss monitoring - a time-series 1990-2015.

12:10 *Marina Frontasyeva* – Moss biomonitoring in Russia: Past, present and future.

12:30 *Claudia Stihl et al.* – Temporal trends of metals pollution in Romania studied by analysis of naturally growing moss samples.

12:50 General discussion

13:00 – 14.00 Lunch

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

Session 3a: Ozone

Chair: Ane Vollsnes

- 14:00 *Pierre Sicard, Valda Araminiene et al.* – Urban trees - Effective solutions to reduce increasing ozone levels in cities.
- 14:20 *Valda Araminiene et al.* – Air pollution removal by urban trees in Kaunas, Central Lithuania.
- 14:40 *Lina Fusaro et al.* – An integrated approach to assess the effects of particulate matter on functional traits of *Quercus ilex* L. in an urban area.
- 15:00 *Lina Fusaro et al.* – Discussion on chapter on ‘Ozone removal by vegetation in urban areas’ for Scientific Background Document B.
- 15:20 Short summary presentations on Chapters for Scientific Background Document B:
Yasutomo Hoshika et al. – Critical levels for ozone-sensitive clones of poplar.
Sabine Braun and Per Erik Karlsson – Improved phenology for ozone flux modelling in trees.

Session 3b: Moss survey

Chair: Marina Frontasyeva

- 14:00 *Alexander Uzhinskiy* – 1) How to manage your UNECE ICP Vegetation data; 2) UNECE ICP Vegetation data versus satellite image data.
- 14:30 *Stefano Loppi* – On the way of expressing bioaccumulation data: does the choice of the metric really determine the outcome?
- 14:50 *Winfried Schröder* – Relevance of site-specific and regional characteristics on element concentrations in moss specimens collected 1990-2015 across Germany.
- 15:10 General discussion

15:30 – 16.00 Coffee/tea and poster viewing

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

Session 4a: Ozone – Discussion session on updates for Chapter 3 of Modelling and Mapping Manual and new developments - Chapters for Scientific Background Document B

Chair: Felicity Hayes

- 16:00 Discussion on additional parameterisations required for large-scale modelling.
- 16:20 Short summary presentations and discussions on:
Felicity Hayes et al. – Guidelines for gap filling in data required for ozone flux modelling.
Victoria Bermejo et al. – Guidelines for assessing ozone-induced foliar damage and yield loss of horticultural crops.
Klaudia Borowiak et al. – Ozone-induced injury guidance for educational and awareness raising purposes.
Felicity Hayes et al. – Impacts of ozone on pasture quality.
Lisa Emberson, Harry Harmens et al. – Ozone flux-effect relationships and methodology for net annual increment (NAI) of trees.
Håkan Pleijel, Felicity Hayes et al. – Interactive impacts of ozone and nitrogen on vegetation
Valda Araminiene et al. – Ozone impacts on insects.

Session 4b: Moss survey**Chair: Mira Aničić Urošević**

- 16:00 *Yulia Koroleva et al.* – Trace elements atmospheric deposition study in Kaliningrad region.
- 16:20 *Omar Chaligava et al.* – Evaluation of air quality based on moss analyses using different analytical techniques: A case study in Georgia.
- 16:40 *Konstantin Vergel et al.* – Monitoring of atmospheric deposition of inorganic pollutants in Moscow region using terrestrial moss: preliminary results.
- 17:00 *Nikolajs Filipenoks et al.* – Geoecological assessment of the Great Moss Swamp (Bolshoye Mokhovoye swamp), accumulation of heavy metals in bioindicators (peat and moss), transboundary transfer of heavy metals through precipitation.
- 17:20 General discussion.

Wednesday 29th January, 2020**Session 5: 08:30 – 10:30 (Two parallel sessions: Ozone and Moss survey)****Session 5a: Ozone****Chair: Katrina Sharps**

- 08:30 *Stefanie Falk et al.* – Surface ozone concentrations in northern Scandinavia and implications on local vegetation: A case study.
- 08:50 *Ane Vollsnes et al.* – Responses to experimental ozone exposure in some native plant species from Northern Scandinavia.
- 09:10 *Valda Araminiene et al.* – Biogenic volatile organic compounds and insect dynamics under ozone pollution.
- 09:30 *B. Vazquez de Aldana, Victoria Bermejo et al.* – Endophytic fungi as tools to confer tolerance to ozone in wild and cultivated grass species.
- 09:50 *Melissa Chang-Espino et al.* – Effect of ozone on the isotopic signal of Mediterranean wheat.
- 10:10 *Andrea Vannini et al.* – Understanding the resistance of lichens (and mosses) to elevated ozone concentrations.

Session 5b: Moss survey**Chair: Stefano Loppi**

- 08:30 *Winfried Schröder* – Mapping percentile statistics of element concentrations in moss specimens collected 1990-2015 across Germany.
- 08:50 *Pranvera Lazo et al.* – The effects of anthropogenic factors to sea spray elements studied by moss biomonitoring in inland and coastal areas of Albania.
- 09:10 *Vladislav Svozilík et al.* – Air pollution mathematical modelling verification using biomonitoring.
- 09:30 *Mira Aničić Urošević* – How to overcome the lack of mosses in agricultural and urban areas? Moss bag biomonitoring for the ICP Vegetation moss surveys.
- 09:50 *Dellal Abdelkader et al.* – Chemical composition in heavy metals of PM_{2.5} aerosols in the city of Tiaret (Algeria).
- 10:10 General discussion

10:30 – 11:00 Coffee/tea and poster viewing

Session 6: 11:00 – 12:45 (Two parallel sessions: Ozone and Moss survey)

Session 6a: Empirical nitrogen critical loads + discussions on work plan for ozone
Chair: Felicity Hayes

- 11:00 *Christin Loran et al.* – Roadmap for the review and revision of empirical critical loads for nitrogen in Europe.
- 11:20 *Rocio Alonso, Ignacio González Fernández et al.* – Revision of effects of atmospheric deposition in Spanish ecosystems: suitability for proposing empirical critical loads.
- 11:40 *Sabine Braun et al.* – Nitrogen effects on forest vitality in Switzerland.
- 12:00 Discussion on contribution of ICP Vegetation to review and revision of empirical critical loads for nitrogen in Europe and ICP Vegetation as a forum for dissemination of nitrogen experimental work on (semi-)natural vegetation.
- 12:20 Discussion on ozone work plan items and feedback to plenary.

Session 6b: Moss survey **Chair: Zaida Kosonen**

- 11:00 *Stefano Loppi et al.* – Accumulation of microplastics in lichens from a landfill dumping site.
- 11:20 *Luca Paoli et al.* – Problems and possible solutions during repeated biomonitoring surveys around point sources of pollution.
- 11:40 *Stefano Loppi, Stefan Fränzle et al.* – Linking results on chitin-based biomonitoring to each other: ants, lichens vs. grafted chitin - environmental analytics in another manner.
- 12:00 *Fabrizio Monaci et al.* – Bryophytes and lichens for monitoring atmospheric mercury: recent insights, challenges and opportunities.
- 12:20 General discussion and feedback to plenary.

12:45 – 13.45 Lunch

Session 7: 13:45 – 15:30 Final plenary session **Chair: Felicity Hayes**

- Reporting back from ozone (Felicity Hayes) and moss survey (Zaida Kosonen) sessions: decisions and actions
- Medium-term work plan ICP Vegetation 2020 – 2022 and beyond
- Decisions and recommendations of the 33rd Task Force Meeting
- 34th ICP Vegetation Task Force Meeting;
- Other business.

15:30 – 16:00 Coffee/tea and taking down posters

16:00 Walking tour Riga

19:00 Conference Dinner

Thursday 30th January, 2020

Excursion to Bauska Castle and Rundale Palace tour.

LIST OF POSTERS

GENERAL

Author(s)	Title
Nadia, B. et al.	Remote sensing and ground based assessment of distribution of land cover parameters in the catchment area of Wadi el K'sob M'sila (Algeria)

OZONE

Author(s)	Title
Hayes, F. et al.	Ozone flux-effect relationships for tropical crops
Hoshika, Y. et al.	Monitoring ozone injury for seTTing new critical LEvelS: A novel long-term monitoring strategy to produce new critical levels for forest protection against O ₃
Melece, I.	Bioindication studies of ground- level ozone in Latvia
Mills, G., Sharps, K., et al.	Ozone pollution compromises efforts to increase crop production
Neiryneck, J.	Long-term trends in ozone concentrations, indices and fluxes above a suburban mixed forest.
Yadav, P. et al.	Response of nutraceutical crop <i>Amaranthus hypochondriacus</i> cultivars to ozone stress

MOSS SURVEY

Author(s)	Title
Bekteshi, L. et al.	The study of crustal and lithogenic elements in atmospheric deposition of Albania evaluated by moss biomonitoring
Borowiak K. et al.	Differences between accumulation of trace elements in plants collected in Poznan (Poland) and Brno (Czech Republic)
Bukharina I.L. et al	Moss monitoring in the study of the accumulation of trace elements in the Udmurt Republic, Russia
Cakaj A. et al.	Heavy metals accumulation in plants collected from different sites in Pristina, Kosovo.
Ene, A. et al.	Nuclear and related techniques used for the assessment of heavy metals in crops
Ene, A. et al.	Study of the impact of metallurgical industry on metal accumulation in plant tissues and health risk assessment
Gorelova S.V. et al.	The effect of atmospheric deposition on soil pollution
Gretarsdottir, J. et al.	Monitoring of heavy metals and sulphur in moss (<i>Hylocomium splendens</i>) in Iceland 1990-2015. Effects from industry and volcanic activity.
Ievinsh, G. et al.	Coastal wetland plant species as models in heavy metal and nitrogen accumulation studies
Ilic, M. et al.	<i>Hypnum cupressiforme</i> -notes on ecology and distribution patterns (a case study in Serbia).
Isak, N. et al.	Moss biomonitoring of trace metal deposition in south of Albania.
Kaupe, D	Effects of vegetation variability on the amount of biologically active nitrogen in the soil.
Lisiak M. et al.	Bioaccumulation of heavy metals in plants in relation to land use - a case study
Madadzada A.I. et al.	The moss technique and neutron activation analysis for trace element atmospheric deposition study in Goygol district, Azerbaijan
Maňkovská, B., Borovská, J.	Spatial and time trends of accumulation of heavy metals and nitrogen in mosses in Slovakia
Omarova N. et al.	Mosses as bioindicators of trace elements in the environment of Central Kazakhstan
Qarri, F. et al.	The study of anthropogenic elements in atmospheric deposition of Albania evaluated by moss biomonitoring
Radulescu, C. et al.	Seasonal variability of particulate matter composition and microclimate in cultural heritage area
Vladislav, S. et al.	Evaluation of air pollution mathematical modelling using by various methods