



Achievements of the ICP Vegetation progress with 2019-2020 work plan

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Changes ICP Vegetation per 1 April 2020



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Task Force meeting 2020 - Latvia

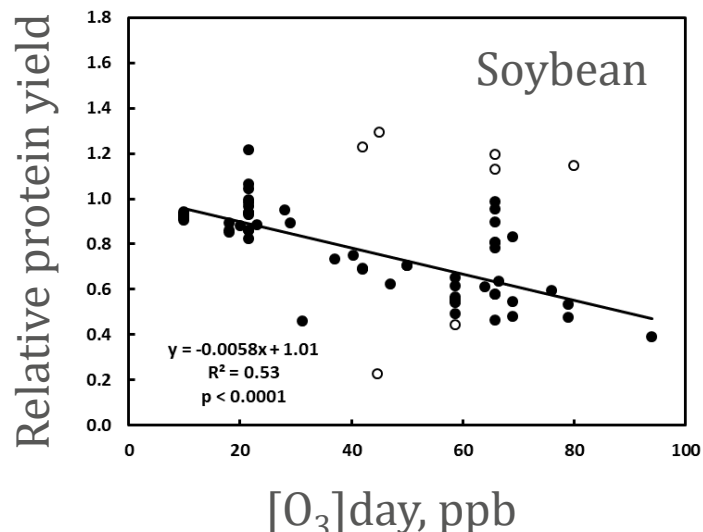
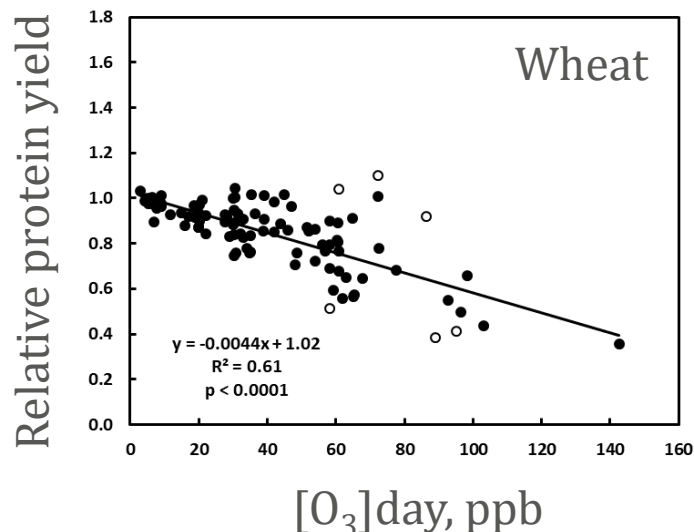


Hosted by the University of Latvia. 27-30 January 2020
Attended by 62 participants from 22 countries

Overview of the achievements in 2019, and discussion of draft workplan for 2020-2022.

Interactive impacts O₃ and N (1)

- ❑ **Crops** – Currently no clear evidence for a need to adapt ozone CLs for N availability
 - Sufficient data for wheat only (89 data points from 29 data sets): N application did not affect response of grain yield, grain protein concentration and grain protein yield to ozone
 - Protein yield (accounting for seed yield and protein content) is affected by ozone in wheat and soybean – ↓nitrogen use efficiency



Interactive impacts O₃ and N (2)

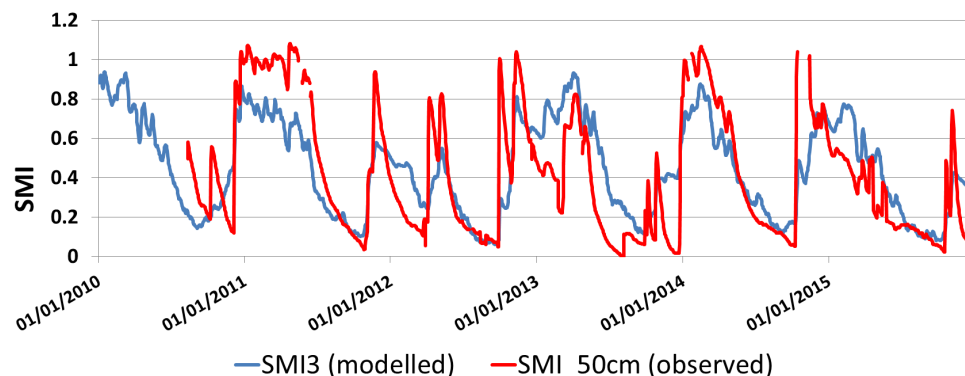
- ❑ **Semi-Natural vegetation** - Negative O₃ effect on photosynthesis, stomatal conductance, growth and biomass production not affected by N
- ❑ **Mediterranean vegetation** - Interactions are species and parameter-specific and non-linear:
 - Combined O₃ and N can induce shifts in species abundance in annual pasture (potential biodiversity changes; [Calveto-Sogo et al., 2016](#))
 - Exposure to O₃ reduced fertilization effect of N in annual pasture (biomass, seed production, photosynthetic N use efficiency)

Modelling ozone flux in soil moisture limited areas

- ❑ Coordination: CIEMAT, Spain. Collaboration: EMEP/MSC-West, ICP Forests
- ❑ **Aim:** Improving large scale flux-based risk assessment applications
- ❑ **Output:** Ozone flux maps adapted for SML areas (2020)

Improving and validating soil moisture index (SMI) EMEP model:

- EMEP/MSC-W modelled SMI data compared with site-specific soil moisture data in Spain and Italy (also Sweden & Switzerland)
- Case study holm oak site in Spain (2010 – 2015):
 - SMI mimics well seasonal and inter-annual variations
 - SMI slightly over-estimates soil moisture on average
 - SMI less accurate in spring and summer



Chapter 3 modelling and mapping manual

<https://icpvegetation.ceh.ac.uk/get-involved/manuals/mapping-manual>

III. MAPPING CRITICAL LEVELS FOR VEGETATION



- Preparing for review of the Gothenburg Protocol
- Reviewing and re-introducing parameterisations related to leaf area index for upscaling to canopy level and large scale modelling (e.g. EMEP, IAM)
- David Simpson (EMEP/MSW) is including parameterisation for (semi-) natural vegetation in the EMEP model for calculating POD_1IAM

Scientific Background Document B

<https://icpvegetation.ceh.ac.uk/get-involved/manuals/mapping-manual>

New Chapters now available:

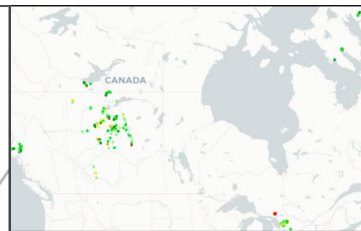
- Guidelines for gap filling in ozone flux modelling data
- Interactive impacts of ozone and nitrogen on vegetation

Upcoming Chapters:

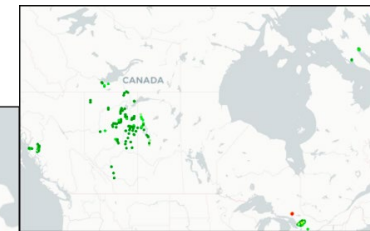
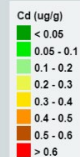
- Improved phenology for ozone flux modelling in trees
- Ozone removal by vegetation in urban areas
- Impacts of ozone on pasture quality'

Moss survey 2015/16

- ❑ North-West to South-East gradient in Europe
- ❑ High concentrations in (south-)east due to anthropogenic sources and high wind-resuspension?
- ❑ Final report for 2015/2016 now available



Cadmium



Lead



Moss survey 2020-2022

Next survey 2020-2022:

Call for data issued (HM, N, POPs)

Include pilot study on mosses as biomonitors of microplastics as indication of atmospheric deposition rates

Monitoring manual: **English and Russian**

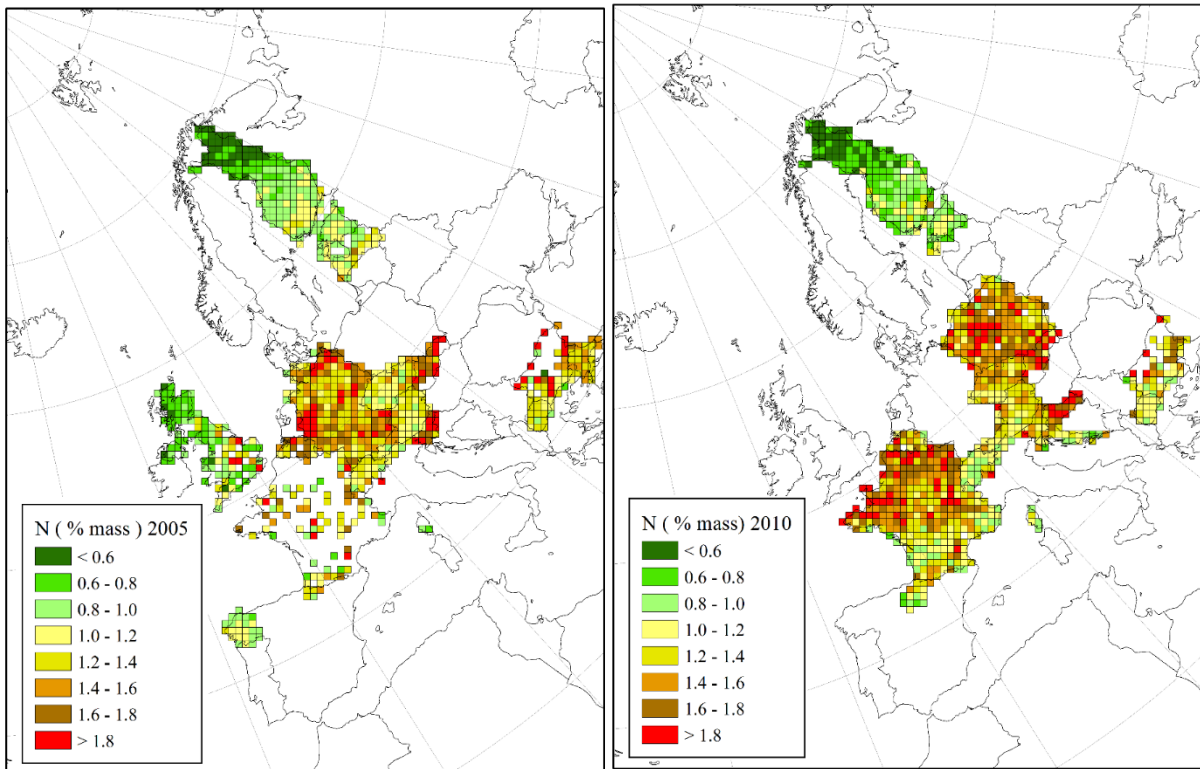
<https://icpvegetation.ceh.ac.uk/get-involved/manuals/moss-survey>

Countries already participating in moss survey 2020-2022

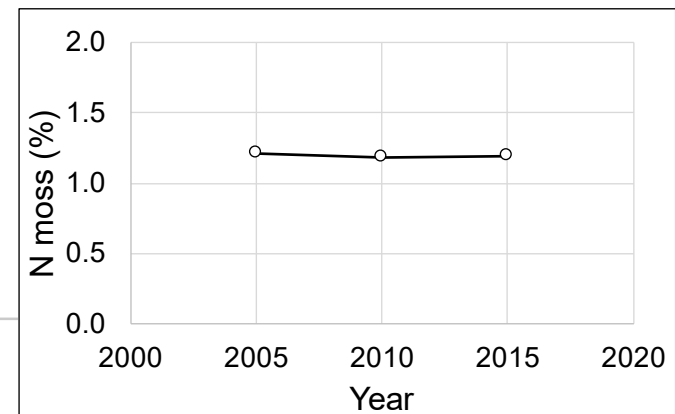
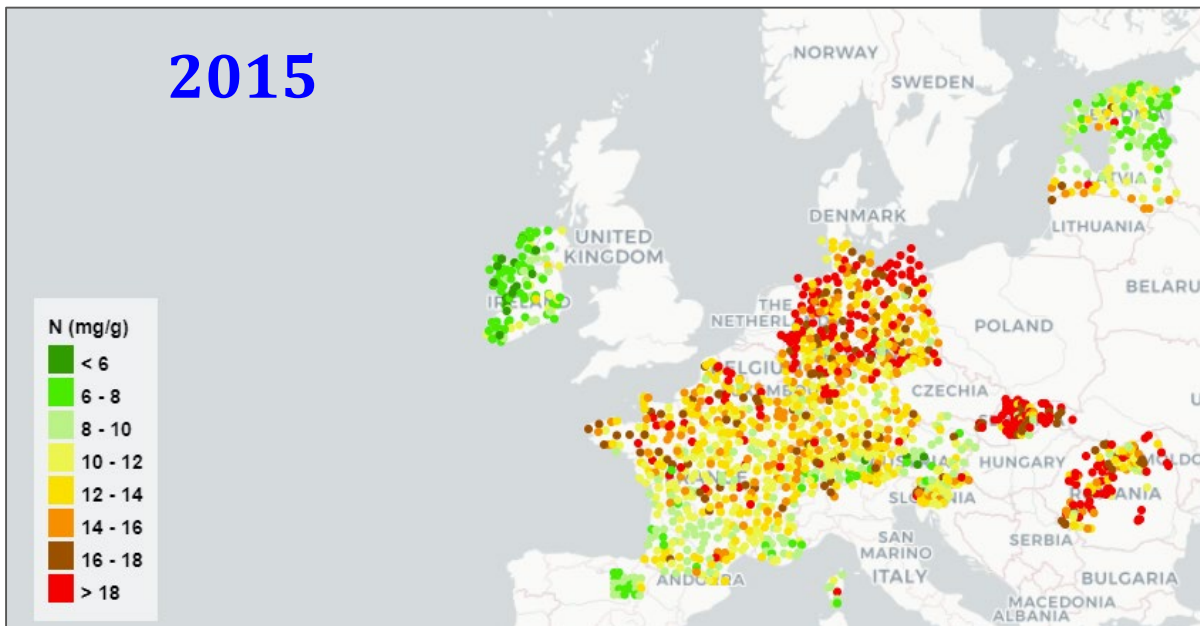
Albania	Germany	Kazakhstan	Russia	Vietnam
Armenia	Greece	Latvia	Slovakia	
Georgia	Italy	North Macedonia	Sweden	

N in moss

- ☐ Every 5 years since 2005
- ☐ Concentrations lowest in northern/western Europe, highest in Central Europe
- ☐ No significant decline between 2005 - 2015



2015

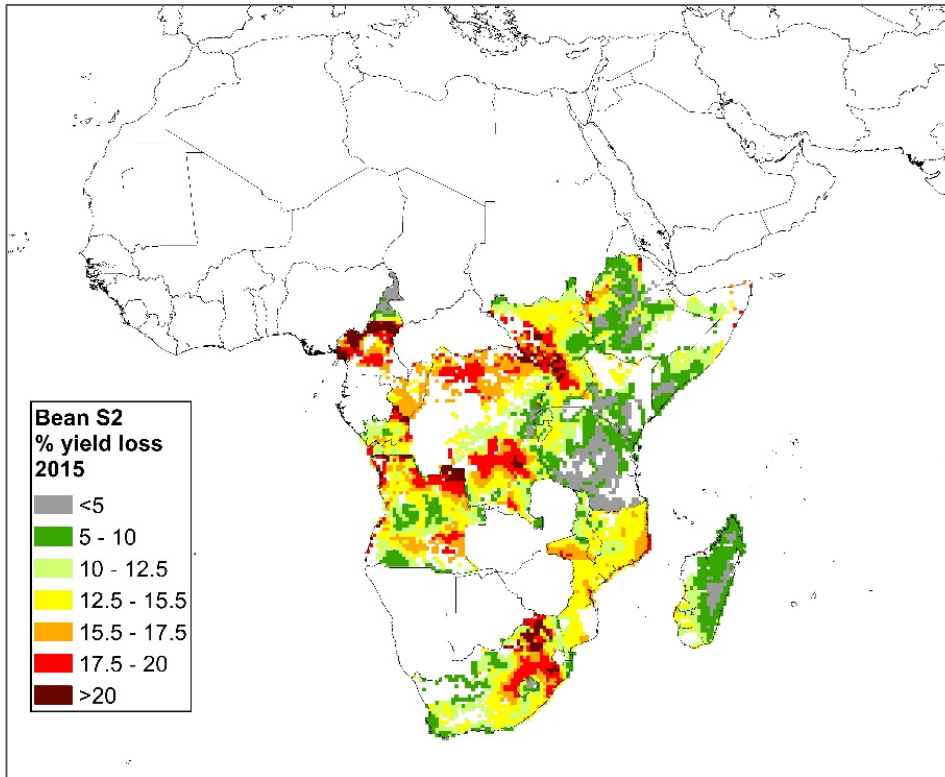


Outreach activities

- ❑ Bean biomonitoring ongoing in India, Pakistan, Hong Kong, Vietnam, Malaysia
- ❑ 24 – 26 Sept 2019: Ozone training workshop for African crop scientists, Bangor, UK
- ❑ Ozone injury factsheets to be included in 'knowledge bank' in Plantwise programme ('Lose less, feed more' - <https://www.plantwise.org>)
- ❑ 5 – 7 Nov 2019: Fifth Asian Air Pollution workshop and stakeholder meeting, Varanasi, India



Maps of predicted impacts on yield



- % yield loss for common beans
- Modelled ozone flux data (for 2015) from EMEP MSC-W.
- >20% estimated yield loss for some areas.



Sharps et al., (under review)

Yield benefit from air filtration

Crop	China (17-65 ppb)	India (33-56 ppb)	Thailand (25 ppb)	Malaysia (32 ppb)	Egypt (25-56 ppb)
Broad bean					39-41%
Cowpea					0-13%
Maize	9%	4-31%			
Mustard		7-19%			
Palak		27%			
Poplar	4%				
Rice	2%	17-22%	6-17%	0-6%	
Soybean	0-9%	30%	16-18%		51%
Wheat	2-25%	13-26%			61%

Data from a range of published studies 2004-2019

Work plan 2020-21

- ❑ Ozone flux-based risk maps soil moisture limited areas (EMEP/MSC-W) (20)
- ❑ Review interactive impacts of ozone and nitrogen on vegetation (20)
- ❑ Contribution to improve estimation environmental benefits of decreasing ozone through mitigation of methane emissions (various Convention bodies; HTAP workshop: 22-24 April 2020, Edinburgh, UK) (20)
- ❑ Ozone flux-based risk assessment for vegetation at various air pollution scenarios (EMEP/MSC-West, TFIAM, CIAM) (21)
- ❑ Test development and applications of photosynthesis-based flux-response models (EMEP/MSC-West) (21)
- ❑ Contribution to validation and revision of empirical critical loads for N (CCE, ICP Modelling and Mapping) (21) Call for data HM, N, POPs concentrations in mosses (final report 2024)
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Other ICP Vegetation activities

- ❑ Report on ozone impacts on crops in developing regions (2020)
- ❑ Joint workshop with Agricultural Model Intercomparison and Improvement Project (AGMIP) on inclusion of ozone damage functions in crop growth models (2020)
- ❑ Comparison of spatial patterns and temporal trends of heavy metals in mosses and EMEP-modelled deposition (with EMEP/MSC-East)

Air pollution & plants conference, Paphos, Cyprus, May 2021:

- CaperMed (Committee of Air Pollution Effects Research on Med. Ecosystems)
- 3rd Ozone and Plants Conference (co-organised by ICP Vegetation)
- 30th Int. Conf. IUFRO Research Group on '*Air pollution and climate change*'

<http://cyprus2021.com/>

ICP Vegetation

ABOUT US

OUR SCIENCE

GET INVOLVED

DATA AND MAPS

EVENTS

PUBLICATIONS

- AIMS
- COORDINATION
- PARTICIPATION

- OZONE INJURY
- MANUALS
- OUTREACH

- TASK FORCE MEETINGS & WORKSHOPS

- OZONE
- HEAVY METALS
- NITROGEN
- POPS

- DATA (MOSS)
- MAPS (MOSS)

- ANNUAL REPORTS
- CLRTAP REPORTS
- THEMATIC REPORTS
- JOURNAL ARTICLES
- FACTSHEETS

Thank you

ICP Vegetation have been preparing for the upcoming review of the Gothenburg Protocol by reviewing and re-introducing parameterisations to allow large scale modelling of impacts of ozone on crops and semi-natural vegetation.

Updates to scientific knowledge suggest that ozone critical levels do not need to be modified to account for nitrogen availability in crops. However, reductions in nitrogen use efficiency can occur with increasing ozone pollution.

The results from the previous moss survey (2015/16) are now published. There is a call for data from a 2020-2022 (extended sampling year due to Covid-19). Some countries have already indicated their participation, with some also participating in a pilot study to investigate the presence of microplastics in mosses.

Outreach activities continue, to raise awareness and to share skills and expertise.