Achievements of the ICP Vegetation and future work plan

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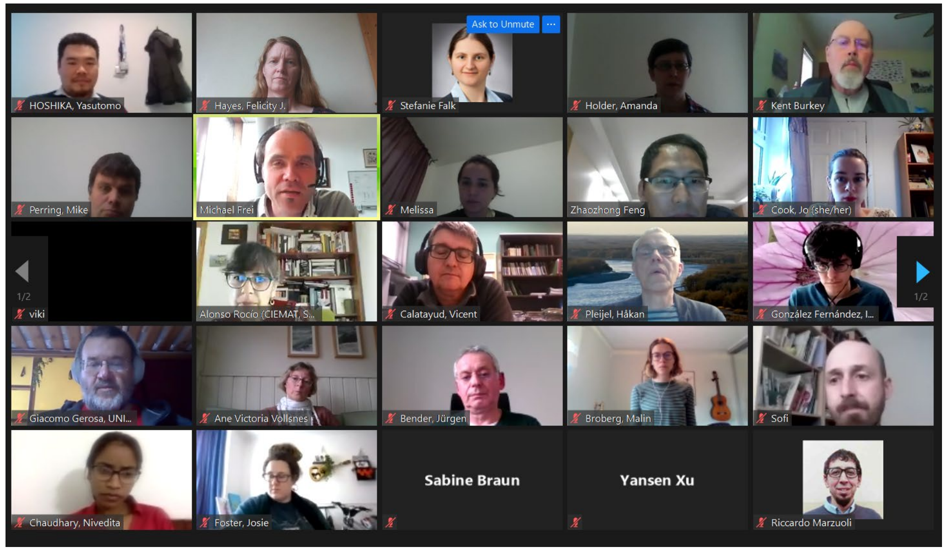
Task Force Meeting 2021



22-24 February 2021
125 participants from 35 countries, by Zoom

Condensed programme, including separate moss and ozone specific sessions, plenary session, and breakout discussion/poster/informal sessions

(2022 meeting planned to be in Kaunus, Lithuania)

Mapping Manual – Annexes Added

SBD-B (Scientific Background Document)
Gap-filling (for flux-effect modelling) - added

Interactions between ozone exposure and N application in crops – added

Workplan item 1.1.1.9

Preparing for the Review of the Gothenburg Protocol – parameterisations for (semi-)natural vegetation, and for upscaling to the whole canopy for large-scale modelling – *with EMEP*

Workplan item 1.4.1

New DO_3SE model parameterisations

Tropical Crops

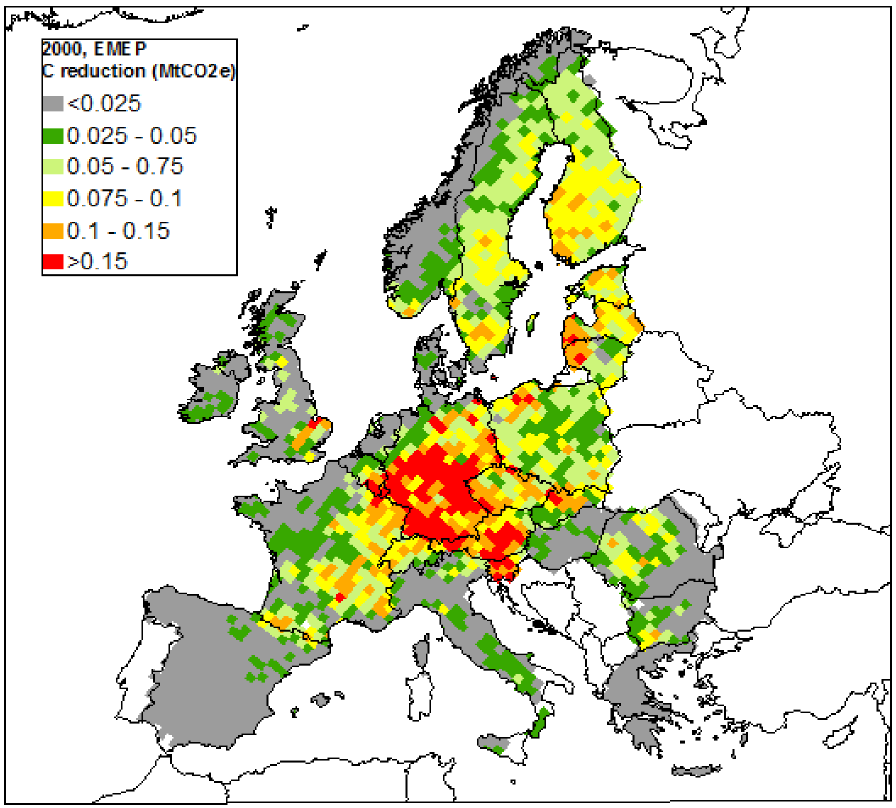
Parameterisations developed for bean, sweet potato and finger millet

Allowing improved risk assessment in tropical areas – particularly relevant as temperate crops e.g. wheat are not commonly grown in all regions

Sweet potato and bean are ozone-sensitive, showing yield reductions

Effect of ozone on living biomass (carbon sequestration) of sensitive trees

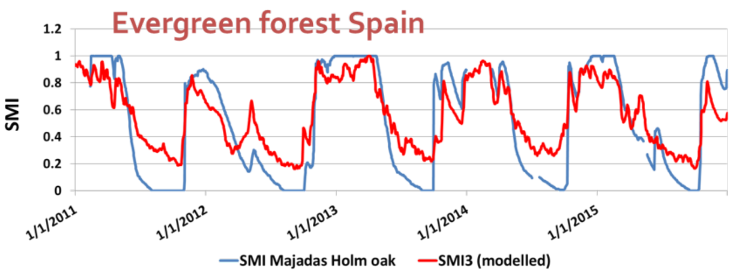
Lisa Emberson, Sabine Braun et al.



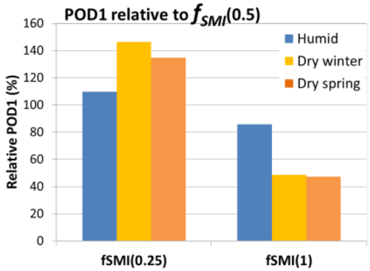
- Based on gross annual increment
- Using dose-response relationships for 12 species / species groups
- Weighted by the presence of each species/species group in each gridcell
- Ozone fluxes in 2000 reduced the increase in C storage by 12.6% (EMEP model) to 17.7% (Rossby Centre Regional Climate (RCA3) model)
- Also affected by soil moisture – particularly in the Mediterranean region

Ozone risk assessment in soil moisture limited areas

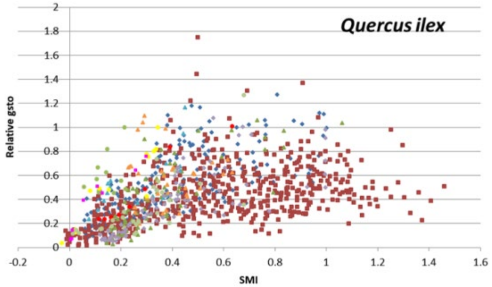
- Objective: improving POD-based O_3 risk assessment in soil moisture limited areas (and under future climatic conditions)
- Participants: ICP-Vegetation (Spain and Italy + Switzerland + Sweden + UK) in collaboration with EMEP MSC-W



Test Soil Moisture Index at monitoring sites: tend to over-estimate soil moisture



Sensitivity analysis: depth and species-specific parameters important for POD estimation



New species-specific parameters into EMEP model

- Next steps (2022-2023): further development of soil moisture parameters and assessment of effects of drought on POD estimation across Europe

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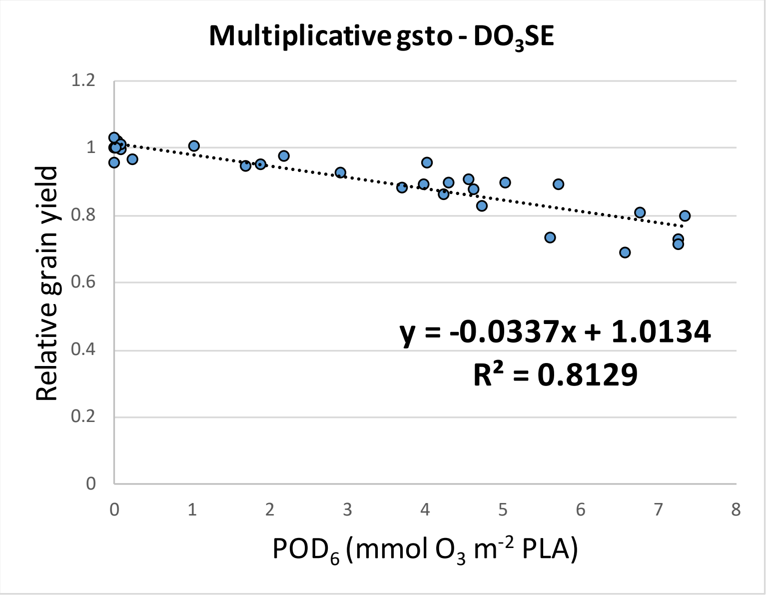
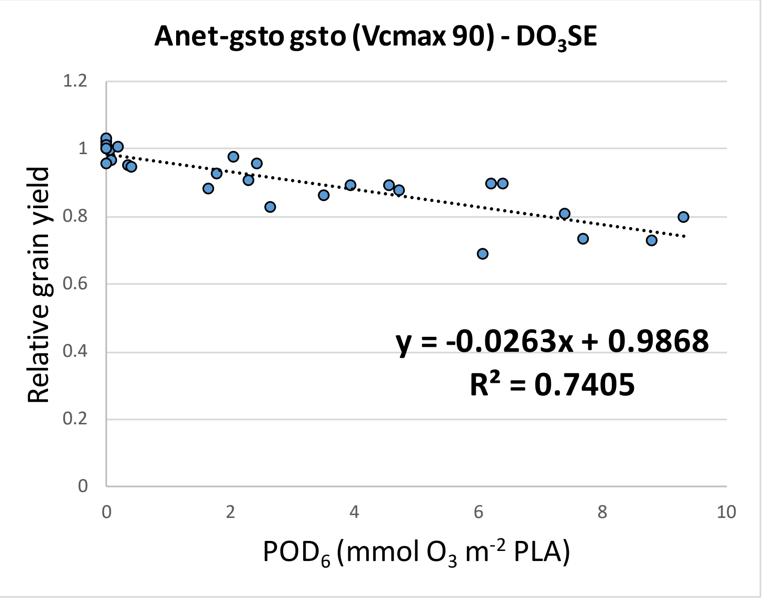
emep

Development of coupled gsto-An model

i. Multiplicative stomatal conductance (gsto) model



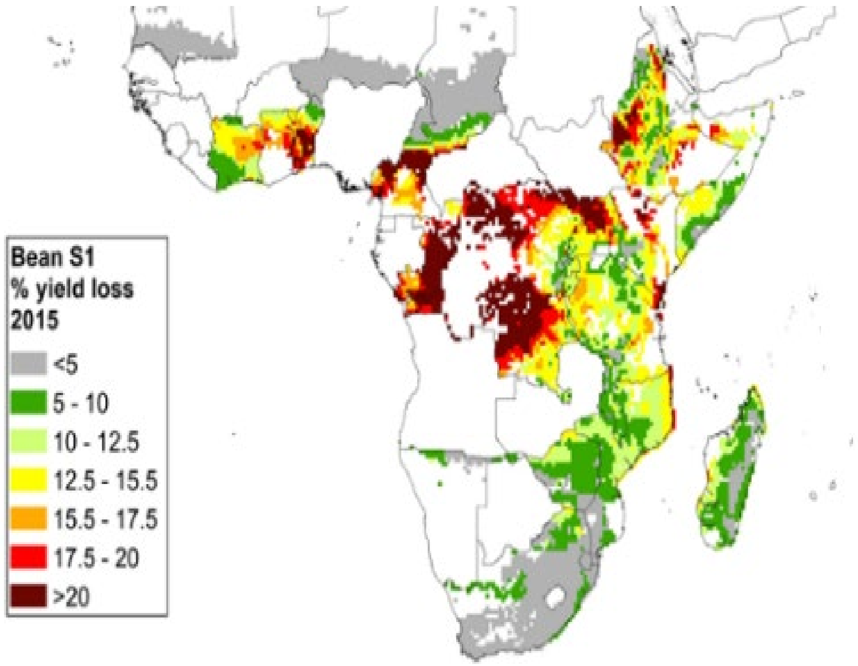
ii. 'New' coupled photosynthesis-stomatal conductance (Anet-gsto) model



Next steps:

- Add new datasets to flux-response relationships (Europe & India)
- Explore parameterisation according to Vcmax term (by cultivar), and sensitivity of senescence to ozone

Outreach - maps of predicted impacts on yield



Sharps et al., (2021)

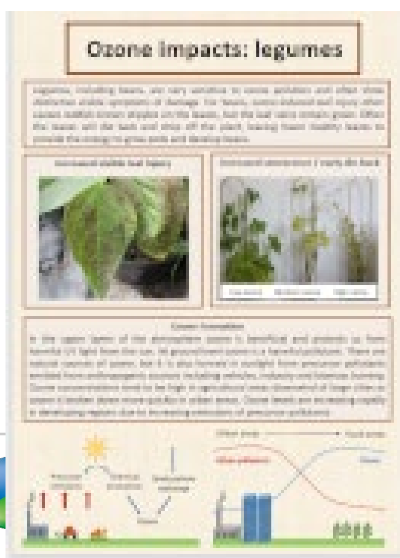
- % yield loss for common beans
- Modelled ozone flux data (for 2015) from EMEP MSC-W.
- >20% estimated yield loss for some areas.
- Ozone diffusion tubes deployed in: DRC, Ethiopia, India, Kenya, Sri Lanka, Malaysia, Rwanda, Uganda, United Republic of Tanzania, Zambia
- Variable ozone concentrations, up to monthly average concentrations of 36 ppb in some parts of Uganda

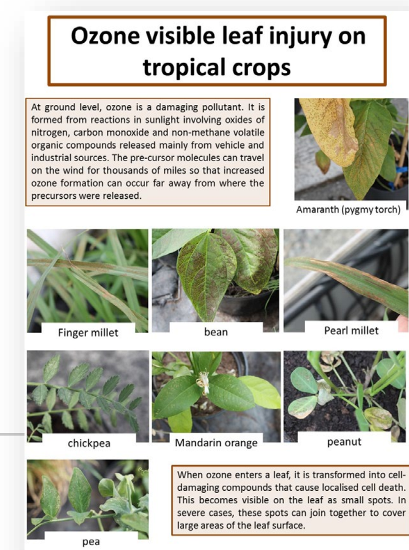
Outreach – Information sharing

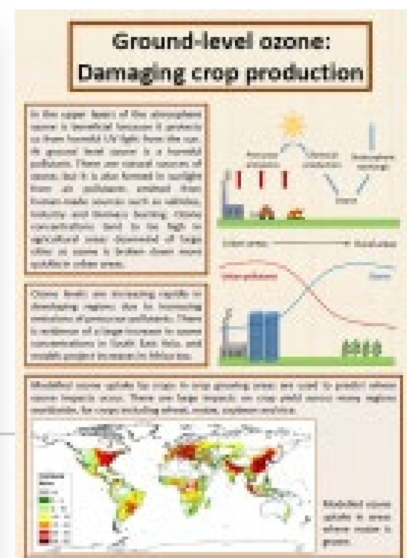
- ❑ Webinar – to Tanzania (virtual)
- ❑ Youtube video – ozone impacts on agriculture

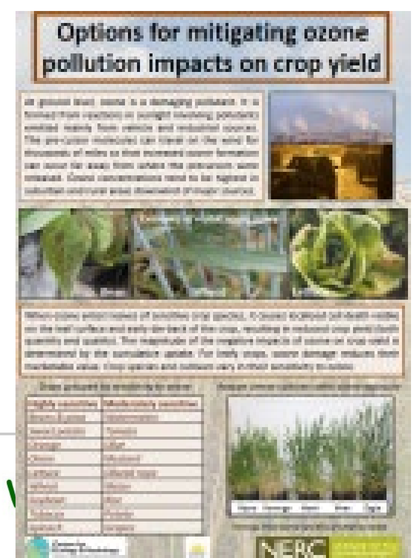
https://youtu.be/OBEJB-60jQU

- ❑ Ad-hoc advice – including to India
- ❑ Information leaflets – including to Plantwise Knowledgebank



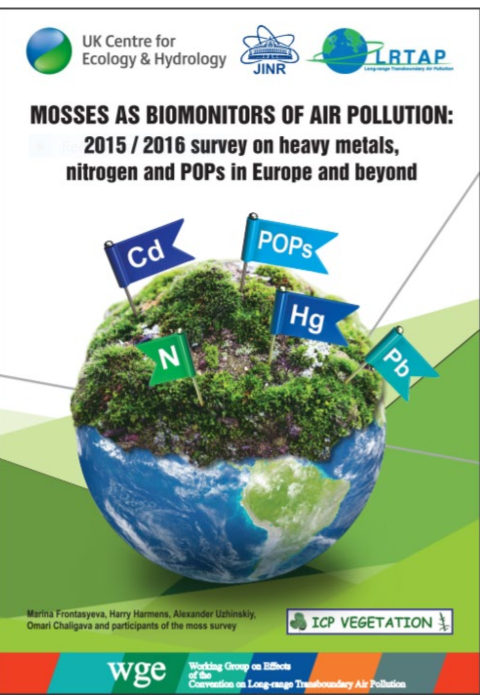




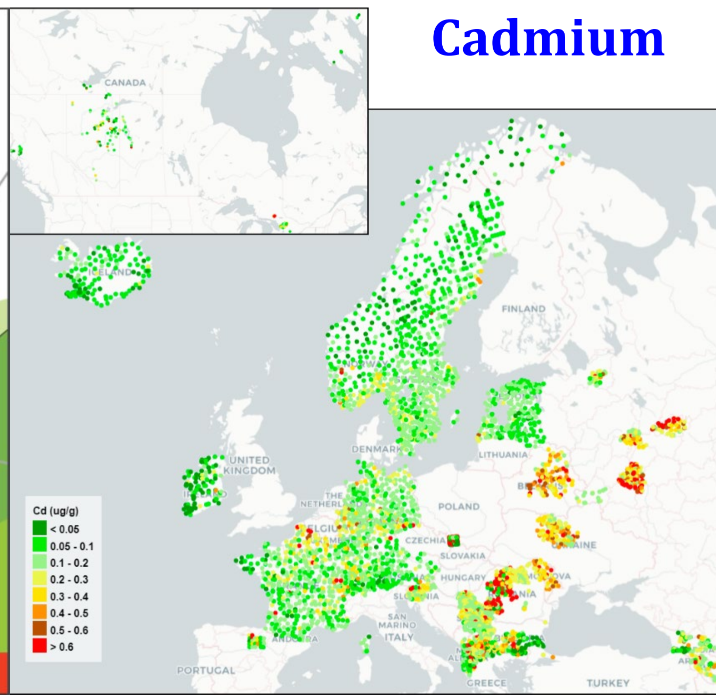


Moss survey 2015/16

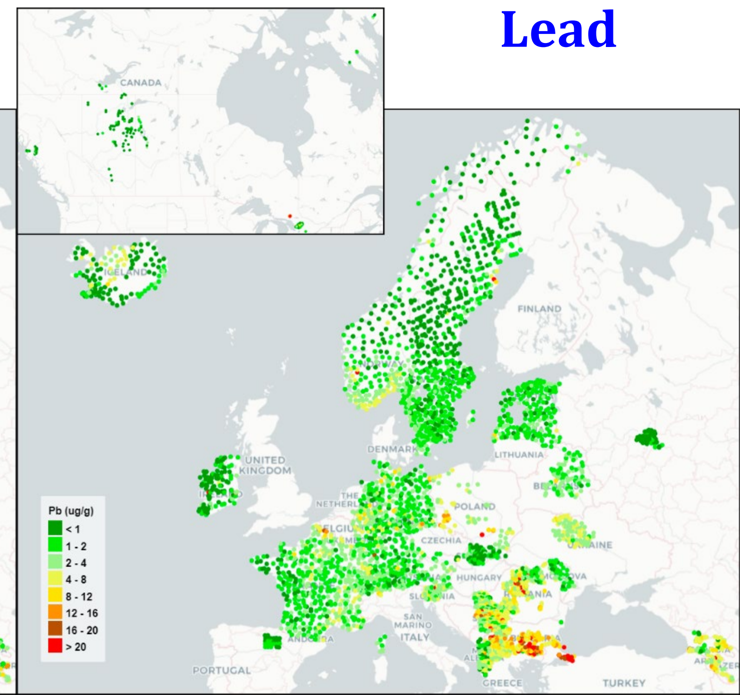
- North-West to South-East gradient in Europe
- High concentrations in (south-)east due to anthropogenic sources and high wind-resuspension?
- Final report for 2015/2016 now available



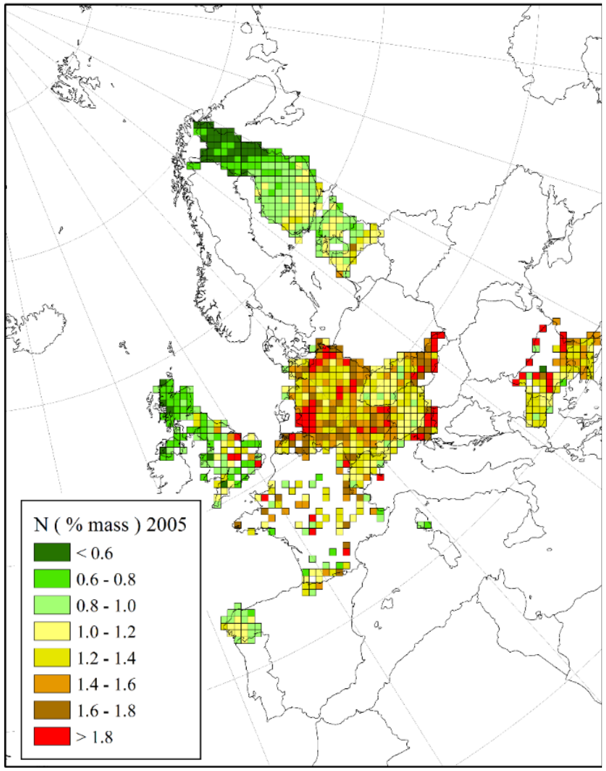
Cadmium

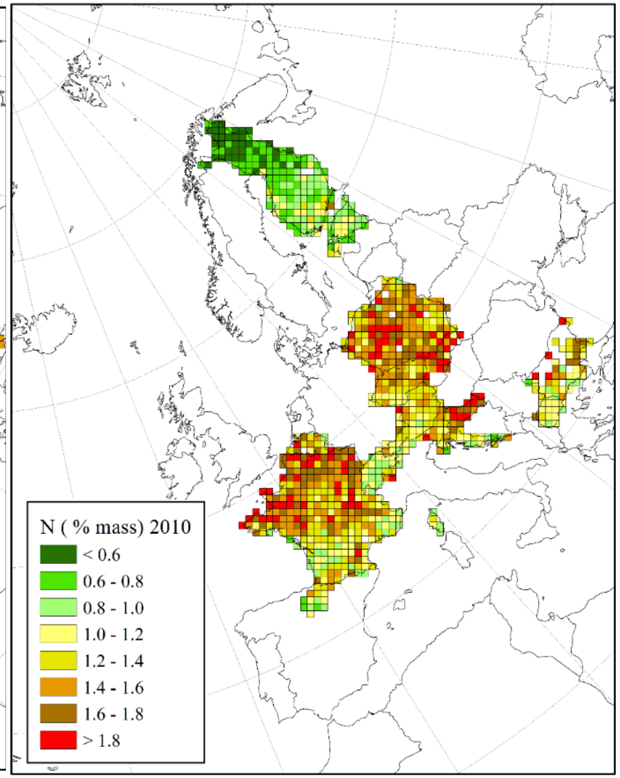


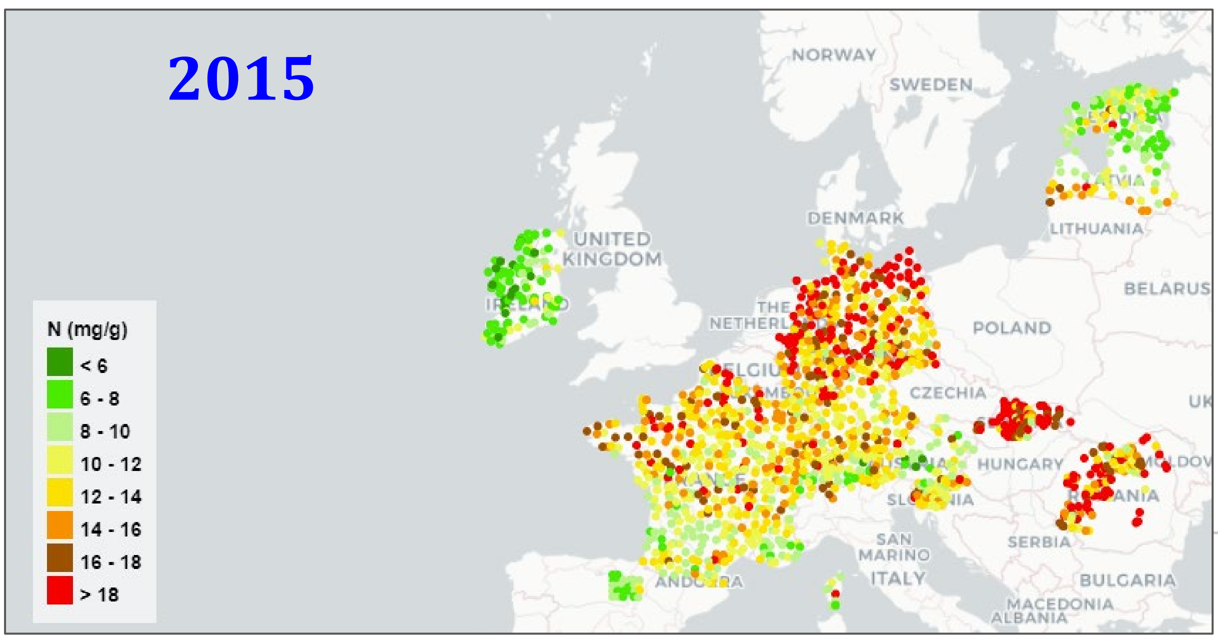
Lead



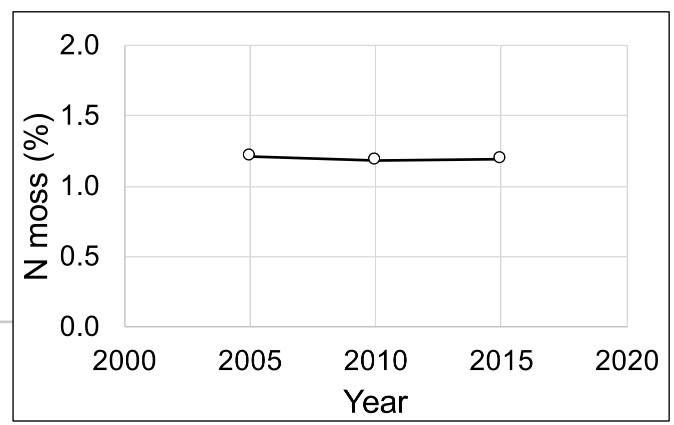
N in moss







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



Moss survey 2020-2022

- **Next survey 2020-2022:**
  Call for data issued (HM, N, POPs) (approximately 1500 sites sampled already)

- 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	Switzerland
Georgia	Italy	North Macedonia	Sweden	UK
Netherlands				

Current ICP Vegetation Workplan

2021 delivery:
Call for data for moss survey 2020-22 (collection extended due to Coronavirus)

Ozone flux-based risk maps for soil moisture limited areas (with EMEP/MSC-West)

Ozone flux-based risk assessment for vegetation at various air pollution scenarios (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 N (with CCE, ICP Modelling and Mapping)

ICP Vegetation - Draft Future Workplan

2022 delivery:
Call for data for moss survey 2020-22 (collection extended due to Coronavirus). Final report 2024.

2022/2023.
Ozone flux-based risk assessment for vegetation at various air pollution scenarios. Maps and reports 2023
- (GP, also methane precursors) (with EMEP/MSC-West, HTAP)
- Further development and applications of ozone modified photosynthesis-based flux-response models (with EMEP/MSC-West)
- *the effects of drought under present and future climatic conditions (with EMEP/MSC-West, and in-kind contributions from participating countries).*

2022/2023
Review of air pollution and climate change impacts on vegetation – focus on implications for calculation and application of flux-based Critical Levels and risk assessment.

2022/2023
State of knowledge report: Genetics of crop resilience to ozone and potential for improved crop breeding.

ICP Vegetation Workplan – other items

Ongoing Annual Activities

Review and update Scientific Background Document B for Chapter 3 of Modelling and Mapping Manual

Outreach and networking activities in developing regions (e.g. ICP Vegetation-Asia); linking with other networks

Additional (unofficial) items

???? delivery:
Comparison of spatial patterns and temporal trends of heavy metals in mosses and EMEP-modelled deposition (with EMEP/MSC-East)

2021 delivery: *Joint workshop with other working groups (e.g. ICP Waters) on latest developments in analysis of environmental microplastics*

2022 delivery: *Review metals and pollutants of focus, including emerging pollutants*

2022 delivery*: Pilot studies on use of mosses as bioindicators of airborne microplastics*

Thank you

Notes for minutes:

ICP Vegetation have continued to prepare 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.
Progress presented with improving ozone risk assessment in soil moisture limited areas – this work will continue
Progress with flux-effect models for some tropical crops – to improve global risk assessments.
Assessment of the effect of ozone on living biomass of sensitive trees showed that ozone decreased carbon sequestration in many parts of Europe.
Development of a coupled photosynthesis-based flux model is ongoing.

Heavy metals in mosses report from 2015/16 survey is published. 2020/21 survey is underway (extended to 2022). Approximately 1500 samples collected .already. The survey will include a pilot study on microplastics content of mosses.
Outreach activities continue, to raise awareness and to share skills and expertise.