



Achievements of the ICP Vegetation in 2019 and future work plan

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Changes ICP Vegetation per 1 April 2020



Felicity Hayes
Chair Task Force



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Head Programme Centre



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Research Associate

Vacancy
*Research Associate
(currently being
advertised)*

Task Force meeting 2020 - Latvia



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

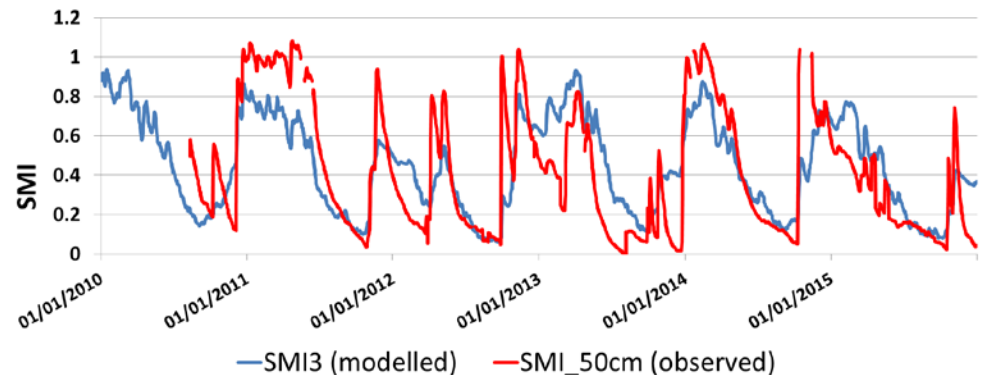
Overview of the achievements in 2019 and discussion of workplan for 2020-2022.

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



ICP Forests – ICP Vegetation expert workshop

Assessing and estimating ozone impacts on forest vegetation – opportunities for improved co-operation

- ❑ **12 April 2019** - Swiss Federal Research Institute WSL, supported by Swiss Federal Office for the Environment (FOEN)
- ❑ **Objectives:** Identify critical points, data needs and availability, joint initiatives to advance understanding/assessment/monitoring of ozone effects on forests:
 - Make more use of existing, quality assured data
 - Endpoints: growth/biomass (not O₃-specific) and foliar injury (O₃-specific)
 - Need for realistic O₃-exposure experiment (free air exposure systems)
 - Joint projects/publications/meetings



Interactive impacts O₃ and N

- ❑ **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 (weak relationships)
- ❑ **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)

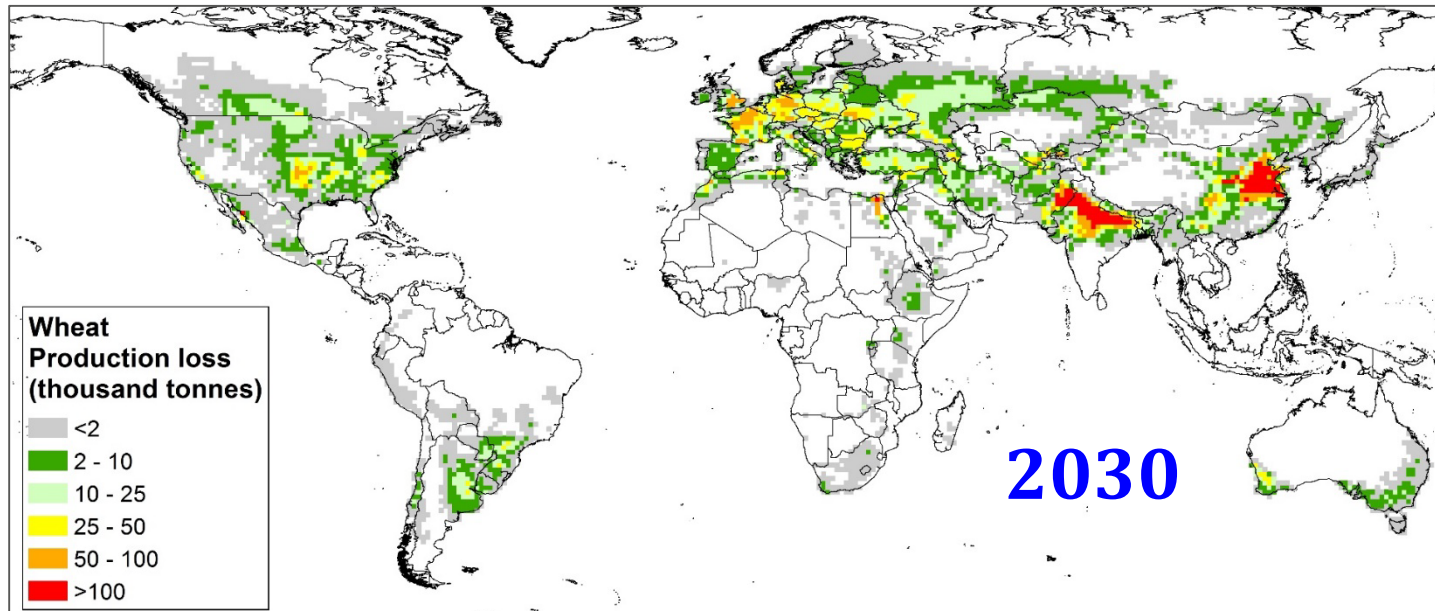
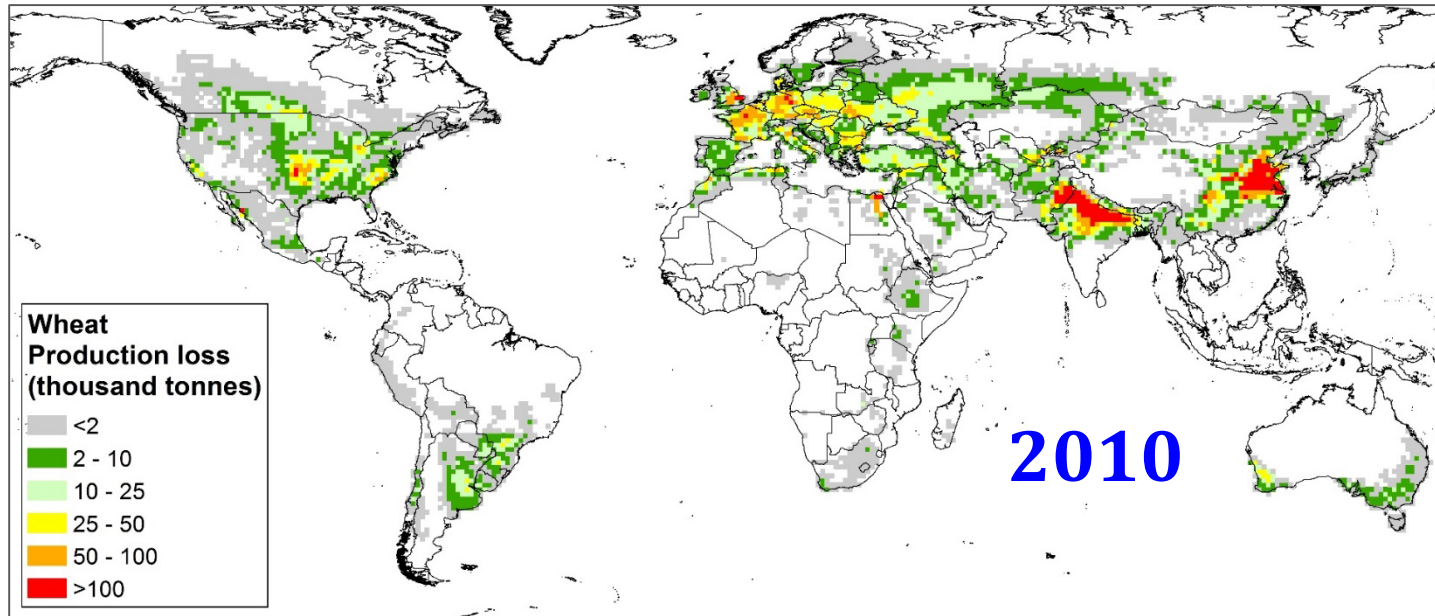
Risk ozone impacts on wheat

- ❑ Current legislation scenario (ECLIPSE v5a emissions for 2010 and 2030)
<http://www.iiasa.ac.at/web/home/research/researchPrograms/air/ECLIPSEv5.html>
- ❑ EMEP model v4.16, POD₃IAM for wheat (1° x 1°), 2010-2012 meteorology.
Assumption: no change in climate and wheat production 2010 - 2030
- ❑ Global annual wheat production losses similar for 2010 & 2030 due to rising emissions of methane and stable emission of nitrogen oxides

| Region | 2010 | 2030 | Production loss (million tonnes) |
|------------------|-------------|-------------|----------------------------------|
| Europe | 12.8 | 10.8 | |
| EECCA | 8.2 | 7.5 | |
| North America | 6.6 | 5.4 | |
| C & S America | 1.8 | 1.7 | |
| S & E Asia | 28.9 | 28.3 | |
| Rest of Asia | 1.5 | 1.5 | |
| Pac., Austr., NZ | 0.8 | 0.7 | |
| Africa | 1.7 | 1.6 | |
| Total | 62.3 | 57.7 | |

Global yield loss:
 2010: 7.1%
 2030: 6.5%

Risk ozone impacts on wheat production



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

- Development new chapters for Scientific Background Document B

Scientific Background Document B

| TOPIC | LEAD | OTHERS |
|--|--------------------|---------------------------------|
| Guidelines for gap filling in ozone flux modelling data | <i>UK</i> | <i>Italy</i> |
| Guidelines for assessing ozone-induced foliar damage and yield loss of horticultural crops | <i>Spain</i> | <i>Italy</i> |
| Impacts of ozone on pasture quality | <i>UK, Spain</i> | |
| Ozone flux-effect relationships and methodology for net annual increment (NAI) of trees | <i>UK</i> | <i>Switzerland, Sweden</i> |
| Ozone removal by vegetation in urban areas | <i>Italy</i> | <i>France, Spain</i> |
| Validation of soil moisture index used in EMEP model | <i>Spain</i> | <i>Switzerland, Italy, EMEP</i> |
| Ozone-induced injury guidance for educational and awareness raising purposes | <i>Poland</i> | <i>UK, China (HK), Spain</i> |
| Critical levels for ozone-sensitive clones of poplar | <i>Italy</i> | <i>Spain, France</i> |
| Interactive impacts of ozone and nitrogen on vegetation | <i>Sweden</i> | <i>UK</i> |
| Ozone impacts on insects | <i>Lithuania</i> | <i>UK</i> |
| Improved phenology for ozone flux modelling in trees | <i>Switzerland</i> | <i>Sweden</i> |

Outreach activities

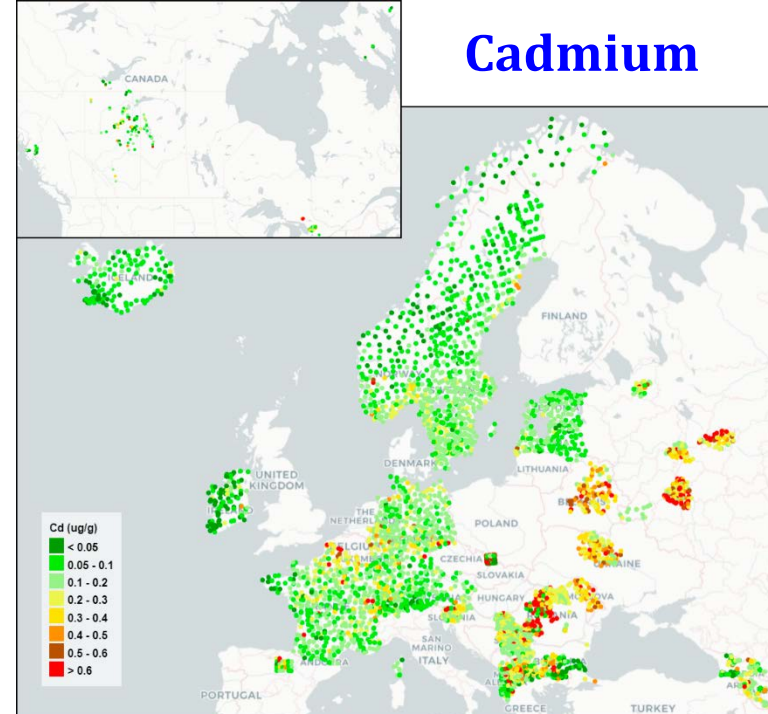
- ❑ Bean biomonitoring ongoing in India, Pakistan, Hong Kong, Vietnam, Malaysia
- ❑ 24 – 26 Sept 2019: Ozone training workshop for African crop scientist, Bangor, UK
- ❑ Ozone injury factsheets to be included in plant health clinics run by ‘plant doctors’ in Plantwise programme (‘Lose less, feed more’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



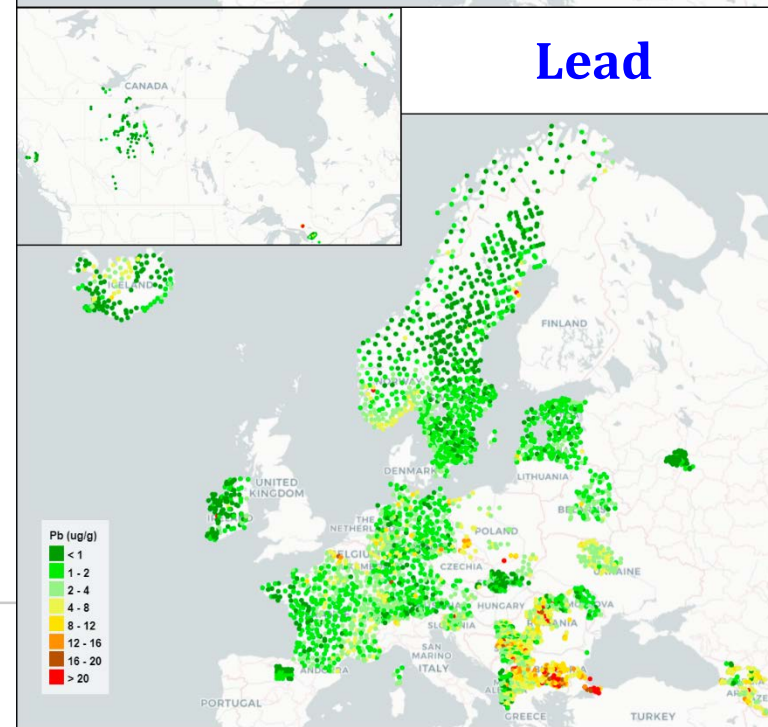
Moss survey 2015/16

- ❑ North-West to South-East gradient in Europe (Publication report: May 2020)
- ❑ High concentrations in (south-)east due to anthropogenic sources and high wind-resuspension (mineral soils)
- ❑ **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>

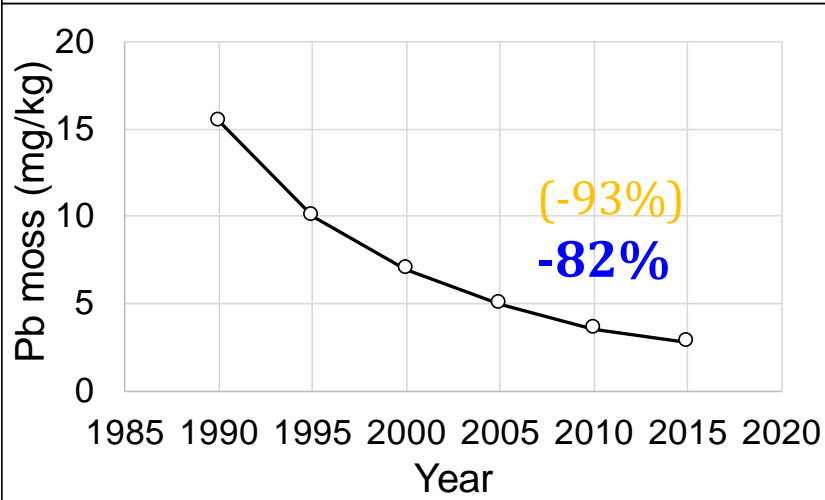
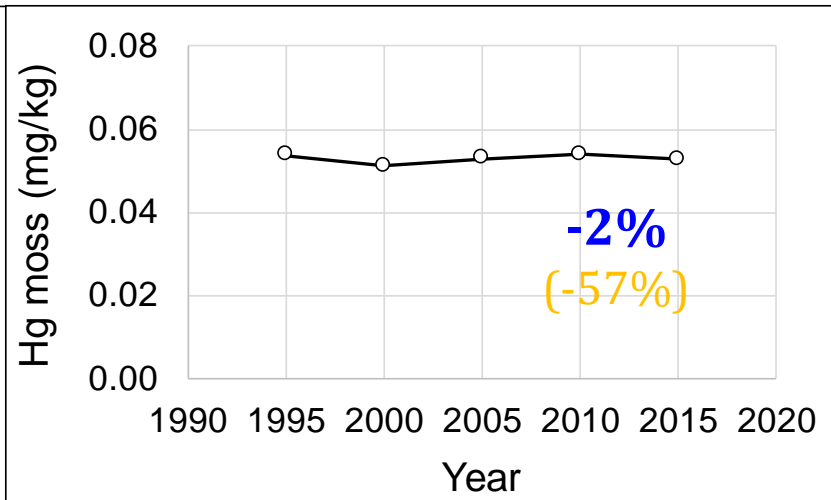
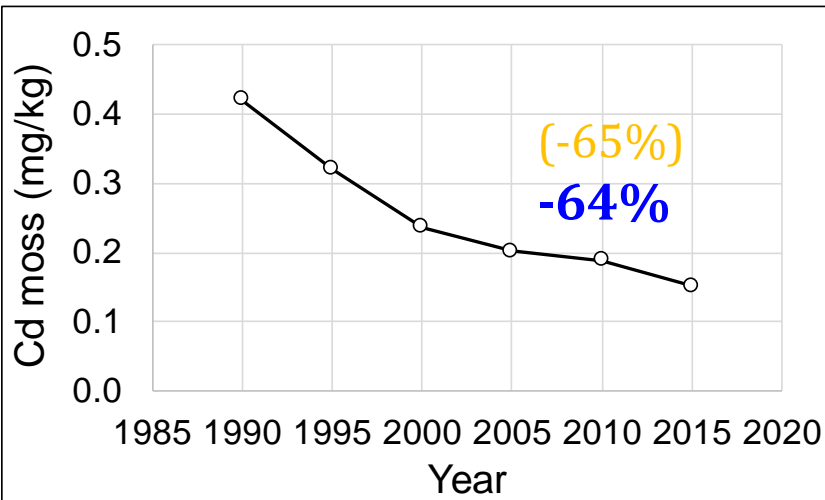
Cadmium



Lead



Heavy metals in mosses trends

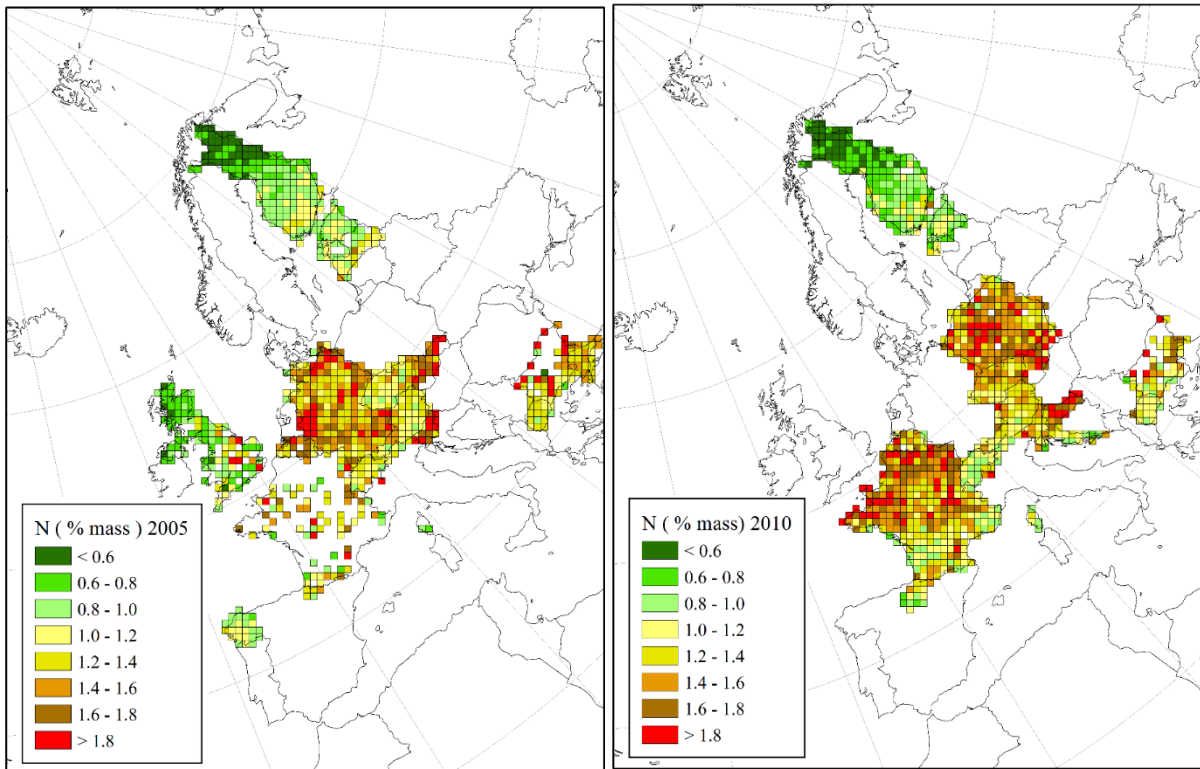


| Metal | Decline 1990(/5*) - 2015 (%) |
|----------|---------------------------------|
| Vanadium | 56 |
| Copper | 30 (+7%) |
| Zinc | 26 (39) |
| Nickel | 25 (73) |
| Iron | 18 |
| Arsenic* | 13 (33) |
| Chromium | 19 (71) |

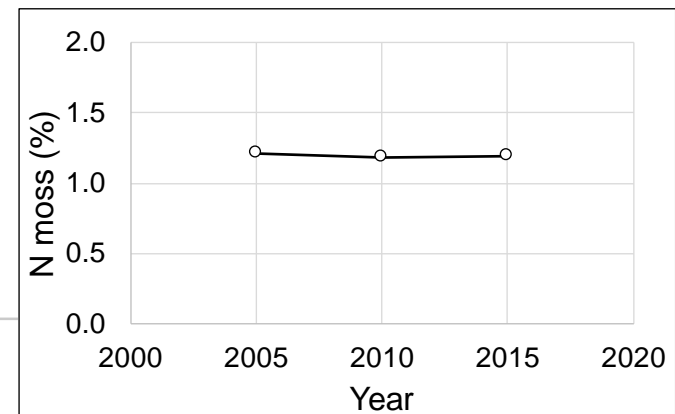
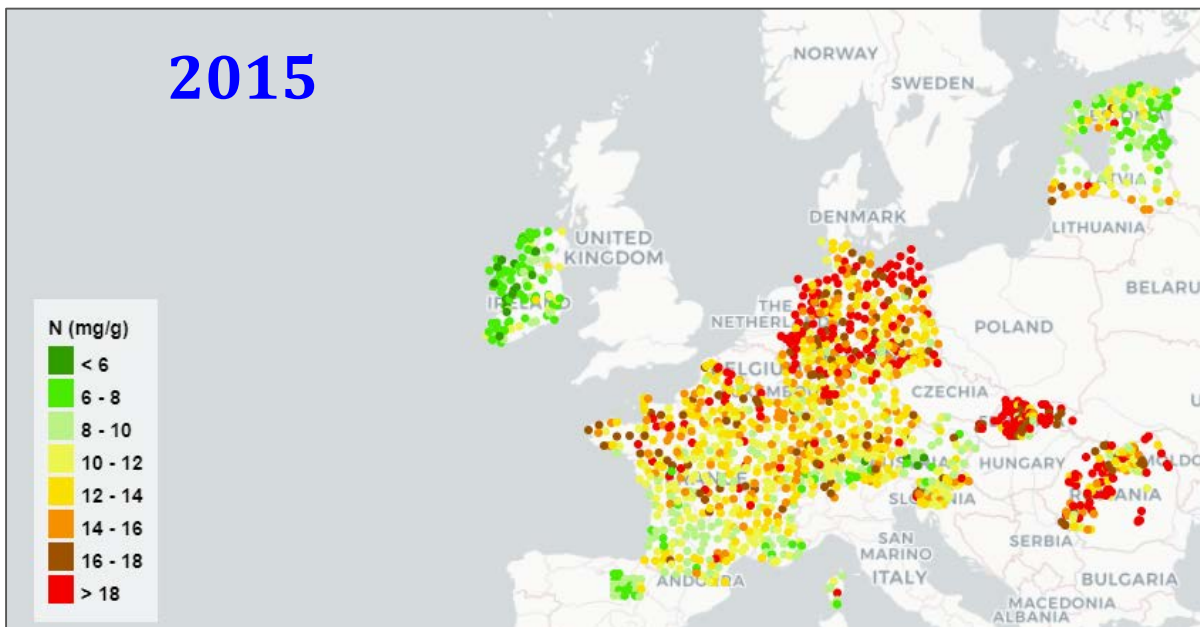
Blue: moss; Orange: EU28 emissions

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



Work plan 2020-21

- ❑ Ozone flux-based risk maps soil moisture limited areas (EMEP/MSC-W) (20)
- ❑ Review interactive impacts O₃ and N on vegetation (Crops: 20; Semi-nat: 21)
- ❑ Contribution to improve estimation environmental benefits of decreasing ozone through mitigation of methane emissions (various Convention bodies; HTAP workshop: 22-24 April 2020) (20)
- ❑ Ozone flux-based risk assessment for vegetation at various air pollution scenarios (EMEP/MSC-West, TFIAM, CIAM; input to GP review) (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)

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, 7-11 September 2020:

- 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://www.ozoneandplants2020.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

Blog



A man with glasses, wearing a light blue long-sleeved shirt, is leaning over and working with scientific equipment in a greenhouse. The greenhouse has a complex metal frame and is filled with green plants. The background shows another similar structure and some trees outside.

Thank you

Any questions?

