Convention on Long-range Transboundary Air Pollution

Working Group on Effects

2024
ANNUAL REPORT
International Cooperative Programme
on Modelling & Mapping
of critical levels and loads
and air pollution effects, risks and trends
(ICP M&M)

Chair of the Programme Task Force : Alice James (INERIS, France)

Coordination Centre for Effects (CCE)
Hosted by the German Environment Agency (UBA, Dessau, Germany)
Headed by a team consisting of :
Markus Geupel, Thomas Scheuschner and Wiebke Galert

Centre for Dynamic Modelling (CDM)
Hosted by the IVL Swedish Environmental Research Institute
(IVL, Göteborg, Sweden)
Headed by a team consisting of :
Filip Moldan and Sara Jutterström

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Glossary

CCE	Coordination Centre for Effects
CDM	Centre for Dynamic Modelling
CfD	Call for Data
CIAM	Centre for Integrated Assessment Modelling
CL(s)	Critical Load(s)
CLempN	Empirical Critical Loads for Nitrogen
CLRTAP	Convention on Long-range Transboundary Air Pollution
EECCA	Eastern Europe Caucasus and Central Asia
EMEP	European Monitoring and Evaluation Programme
EUNIS	European Nature Information System
Gothenburg Protocol	Protocol to Abate Acidification, Eutrophication and Ground-level Ozone
ICP	International Cooperative Programme
IVL	Swedish Environmental Research Institute
M&M	Modelling and Mapping
MSC	Meteorological Synthesizing Centre
Ineris	French National Institute for Industrial Environment and Risks
NFC	National Focal Centre
SMB	Simple Mass Balance
SSWC	Steady-State Water Chemistry
TF	Task Force
TFIAM	Task Force on Integrated Assessment Modelling
UBA	German Environment Agency
WGE	Working Group on Effect
WGSR	Working Group on Strategies and Review

The ICP M&M

The International Cooperative Programme on Modelling and Mapping of Critical Levels and Loads and Air Pollution Effects, Risks and Trends (ICP Modelling & Mapping, ICP M&M) is a programme under the Convention on Long-range Transboundary Air Pollution (CLRTAP), now generally called Air Convention (https://unece.org/environmental-policy-1/air).

Interest in the critical loads (CL) and levels approach for pollution control has gathered momentum over the past decades. To provide strategies for emission reductions as inputs to the negotiations of protocols to the Convention, the ICP M&M was established in 1988.

The programme is planned and coordinated by a Task Force (TF) under the leadership of France, located at the French National Institute for Industrial Environment and Risks (Institut National de l'Environnement Industriel et des Risques, Ineris), in collaboration with the Coordination Centre for Effects (CCE) hosted at the German Environment Agency (UBA, Germany) and with the Centre for Dynamic Modelling (CDM) hosted at the Swedish Environmental Research Institute (IVL, Göteborg).

The mandate of the ICP M&M is to provide the Working Group on Effects (WGE) and the Executive Body and other subsidiary bodies with comprehensive information on (i) critical levels and loads and their exceedances for selected pollutants, (ii) the development and application of other methods for effects-based approaches, and (iii) modelling and mapping of the present status and trends in impacts of air pollution. With this aim in mind, the CCE together with the Programme TF determine receptor-specific CL for (indirect) effects of the (long-term) deposition of various air pollutants and critical levels for direct effects of gaseous air pollutants; map pollutant depositions and concentrations which exceed critical thresholds and establish appropriate methods as a basis for assessing potential damage, e.g. *via* dynamic modelling. Moreover, various European databases on soil, land, climatic and other variables are used to calculate CL for those countries that do not provide national data. The maps are used for integrated assessment modelling by the Task Force on Integrated Assessment Modelling (TFIAM). Since its creation in January 2020, the CDM is the second designated centre to the ICP M&M, hosted by IVL Swedish Environmental Research Institute. Its main tasks mandated by the Executive Body are the development and promotion of methods for dynamic modelling (including consideration of effects on biodiversity, interactions with climate change and land use, to complement CLs with additional measures of the effects such as, e.g., target loads) and the development and maintenance of the common Working Group on Effects (WGE) website (https://www.unece-wge.org/).

The ICP M&M 2024-2025 workplan

In line with the priorities set out in the long-term strategy for the Convention for 2020-2030 and beyond, the Executive Body of the CLRTAP has adopted, in December 2023, the biennial workplan 2024-2025 for the Convention Workplan items. The main items where ICP M&M together with its designated centres constitute the main lead bodies are listed below. ICP M&M workplan items are summarised in Table 1. An advanced version of the full workplan is available at the following address:

https://unece.org/sites/default/files/2024-05/Advance%20Report%20Add.1.pdf

Table 1: Biennial ICP M&M workplan for 2024-2025

Workplan item	Activity description/objective	Expected outcome/deliverable	Lead body(ies)	Resource requirements and/or funding source
1.1.1.20	Define Dynamic Modelling indicators for protection ofbiodiversity and Dynamic Modelling outputs	Instructions for 24/25 CfD	ICP M&M, CDM	In-kind contributions from Sweden, Recommended contributions
1.1.1.21	Launch 24/25 CfD to: (a) update SMB CL; and (b) include dynamic modelling of biodiversity recovery and restoration	CfD: results to be included in CCE status report	ICP M&M, CCE, CDM	In-kind contributions from Sweden and Germany and recommended contributions
1.1.1.22	Empirical Critical Loads: Illustrate and map exceedance data, including CfD 23/24 outcome and updated 2023 receptor map	Included in CCE status report and brochure	ICP M&M, CCE	In-kind contributions from Germany and recommended contributions
1.1.1.23	Update policy relevant CL data sets and find ways to use these to assess risks of biodiversity loss on large geographic scale based on outcomes of items 1.1.1.21–1.1.1.22	Dataset: results to be included in CCE status report	ICP M&M, CCE	In-kind contributions from Germany
1.1.1.24	Critical Levels of NH3: map exceedance data	Included in CCE status report	ICP M&M, CCE	In-kind contributions from Germany
1.1.1.25	Update background database for EECCA and Türkiye (with, e.g., updated 2022 receptor map)	Included in CCE status report	ICP M&M, CCE	In-kind contributions from Germany

News from 2023, objectives of 2024 annual meeting and content of the present report

The work achieved by CCE and CDM and the national contributions to ongoing activities held since the last annual TF meeting (March 2023) were presented during the 2024 Annual Meeting of the ICP M&M, in Oslo (Norway) from Tuesday 23 to Thursday 25 April 2024. This was the 40th TF and 31st CCE meeting. The presentations and discussions were mainly related to the previously defined main scientific challenges, grouped under the following items:

- Empirical Critical Loads,
- Steady state modelling, critical limits for simple mass balance models, critical levels for ammonia,
- Update of the harmonized Convention receptor map,
- Dynamic modelling.

The next section of this report summarises the main tasks achieved by CCE and CDM since last ICP M&M report (published July 2023). Chapter 1 states the publication of the report on "*Creation of a harmonized land cover map as an example for the entire region of the Geneva Air Pollution Convention*" achieved by CCE. Chapters 2 and 3 report on the state of play of the mapping on this new receptor map of the Empirical Critical Loads for Nitrogen (CLempN) and of the updated Critical Levels for ammonia, respectively. Chapter 4 informs on the several contributions of the CCE under the umbrella of the ICP M&M to the revision of the Gothenburg Protocol regarding several parameters which reflect risks for biodiversity through air pollution: Critical Loads for eutrophication, Critical Loads for acidification, as well as Critical Levels for ammonia. Chapter 5 is a special focus on the thematic session on surface waters led during the 2024 ICP M&M Task Force meeting where methods calculating Critical Loads for acidification of freshwater ecosystems on national and international levels were discussed in the perspective of further work to be led by CCE. Chapter 6 reports the status of the work on development of dynamic modelling carried out by CDM. Finally, the last section of this report lists the "Mapping Manual" updates subsequent to the above cited achievements.

The agenda and list of participants of the 2024 Annual Meeting of the ICP M&M are available as annexes, together with its proceedings (summaries of the presentations).

Main activities ongoing under ICP M&M since 2023 annual report

1. Update of the European receptor map

In 2023, the CCE of the ICP Modelling and Mapping successfully finalised the updated version of the European receptor map (see report "Creation of a harmonized land cover map as an example for the entire region of the Geneva Air Pollution Convention"). This database provides the distribution of more than 200 different ecosystem types on European Nature Information System (EUNIS) level 3 across the whole UNECE region including EECCA countries. The map can be provided to National Focal Centres (NFCs) for their national purposes upon request to CCE. Also, it may form a common basis for ecosystem related modelling of dispersion and deposition of air pollution and related risk assessment with indicators like critical loads and levels.

The final version of the report with technical descriptions is available at the following link:

https://www.umweltbundesamt.de/publikationen/creation-of-a-harmonized-land-cover-map-as-an

2. Interlinking CLempN for more than 50 different ecosystems with the updated receptor map

With a Call for data (CfD) in 2023, NFCs of the ICP Modelling & Mapping were asked to apply the updated CLempN (see report entitled "Review and revision of empirical Critical Loads of nitrogen for Europe" [1]) to their national territories and thus produce a national basis for future risk assessments. Following this call, CCE gathered updated national datasets from 13 countries (Austria, Belgium (Wallonia), Bulgaria, Czech Republic, Germany, Italy, Poland, Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom). Those maps reflect national knowledge on ecosystem distribution and national preferences for the protection level. The national deliveries will be included in the UNECE-wide policy relevant dataset of Critical Loads for Nitrogen.

Following this recent update, the CCE provided a homogenous UNECE-wide approach to attribute this data to UNECE ecosystems. The resulting map was elaborated by interlinking empirical Critical Loads for more than 50 different ecosystems with the updated receptor map (see report cited above). Figure 1 presents projection of CLmin data of CLempN on basis on the new Convention receptor map (updated 2023).

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[1] Roland Bobbink, Christin Loran and Hilde Tomassen, eds., Report No. 110/2022 (Dessau-Roßlau, German Environment Agency, 2022). Available at www.umweltbundesamt.de/publikationen/review-revision-of-empirical-critical-loads-of
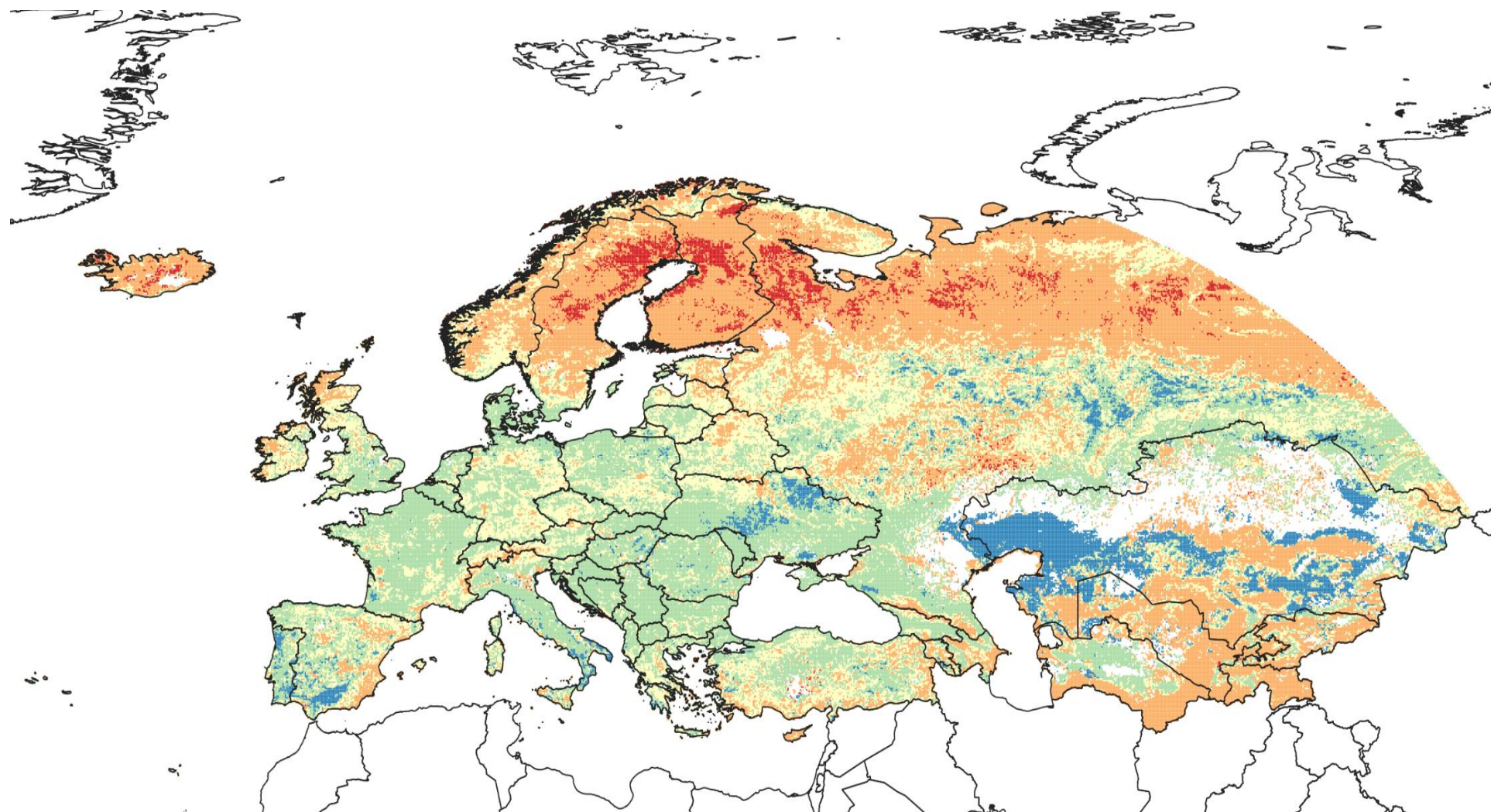
Figure 1 : CLempN on basis of new receptor map. Here the lower range of the empirical Critical Load (CLempN_min) data are presented.

3. Mapping revised Critical Levels of ammonia with the updated receptor map

In 2023, the CCE also finalised the review and revision of Critical Levels for Ammonia following a literature review and the organisation of a workshop. A report of this review was published by CCE (see report entitled "Review of internationally proposed critical levels for ammonia" [2]). In summary, the existing concentration levels to protect vegetation from harmful ammonia concentration were confirmed. As a follow-up to this activity the CCE presented an approach of linking the updated levels with the new receptor map, to provide a basis for future risk assessment. CCE proposed a brief follow-up online meeting with experts and interested parties in order to exchange ideas about potential improvements of the presented approach. The workshop was held on 5 July 2024. The feedback will be included in the documentation of the method.

4. Contributions to the revision of the Gothenburg Protocol

The revision of the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone, so-called "Gothenburg Protocol", as amended in 2012, is ongoing since the Executive Body Decision 2023 / 5[3] to revise it was published in December 2023.

Regarding Critical Loads for eutrophication

The current UNECE-wide dataset of empirical Critical Loads is expected to reflect risks for biodiversity through air pollution. This is because the exceedance of empirical Critical Loads in many cases is associated with observed shifts in species abundance and reduction or disappearance of indicator species. The updated and improved data including CCE data and NFCs data will be delivered to the Centre for Integrated Assessment Modelling (CIAM) for optimization calculations in 2025 and thus contribute to the effects-based approach of the Convention and the policy recommendations of the Gothenburg Protocol revision process. The main aim of this work is to address one of the negotiation items within the Gothenburg Protocol revision work consisting in identifying "overarching, collective risk-based target(s) to reduce harmful effects to health and to ecosystems, including biodiversity loss in ECE region".

During the meeting, the experts discussed the possibility to include these new scientific findings within a dataset to be delivered for CIAM the purpose of the Gothenburg Protocol revision.

ICP M&M Task Force concluded that the following steps and timeline should be followed :

- ICP M&M TF asked CCE to launch as soon as possible a CfD with 3 Options for NFCs (CfD in relation to Workplan item 1.1.1.21)
    - o Confirm the empirical CL as provided with 23/24 CfD for inclusion into the CLeutN policy relevant dataset;
    - o Provide modelled CLeutN to plan their inclusion in the CLeutN policy relevant dataset,
    - o Provide an active confirmation of earlier policy relevant data, if more relevant for the countries.
- Timeline : NFCs are to report to CCE end 2024 or early 2025 at the latest.
- In general, ICP M&M TF recommended to use CLempN based on the updated receptor map (see above) for gap filling.
- Timeline : CCE is to deliver new data to CIAM early 2025.

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[2] Franzaring F, Kösler J (2023) Review of internationally proposed critical levels for ammonia. Proceedings of an Expert Workshop held in Dessau and online on 28/29 March 2022. CCE, UBA, Dessau-Roßlau, Germany. Available at https://www.umweltbundesamt.de/en/publikationen/review-of-internationally-proposed-critical-levels

[3] https://unece.org/sites/default/files/2024-05/Decision%202023_5%20%28E%29.pdf

Regarding Critical Loads of acidification

The current UNECE-wide dataset of Critical Loads for acidification is expected to reflect risks for biodiversity through air pollution.

During the meeting, the experts discussed the possibility to include these new scientific findings within a dataset to be delivered for the purpose of the Gothenburg Protocol revision.

ICP M&M Task Force concluded that the following steps and timeline should be followed:

- ICP M&M TF asked CCE to launch as soon as possible a CfD with 2 Options for NFCs (CfD in relation to Workplan item 1.1.1.21)
    - Provide modelled CL and include in policy relevant dataset;
    - Provide an active confirmation of earlier policy relevant data, if more relevant for the countries.
- Timeline : NFCs are to report to CCE end 2024 or early 2025 at the latest
- In general, ICP M&M recommended to use the updated background database based on the updated receptor map, including extension of the domain to Turkey and EECCA countries for gap filling to reflect latest knowledge and the wish of the Convention to include EECCA region while revising Gothenburg Protocol
- Timeline : CCE is to deliver new data to CIAM early 2025

Regarding Critical Levels for ammonia

During the ICP M&M and CCE meeting, it was also deemed relevant to include the UNECE-wide database of revised Critical Levels for ammonia mapped with the new receptor map in the revision of the Gothenburg Protocol. With the help of interested NFCs, this activity will be finalised until early 2025 and the data will be delivered to the Centre for Integrated Assessment Modelling (CIAM) for optimization calculations.

During the meeting, the experts discussed the possibility to include these new scientific findings within a dataset to be delivered for the purpose of the Gothenburg Protocol revision.

ICP M&M Task Force concluded that the following steps and timeline should be followed:

- experts interested to contribute to the activity are to approach CCE before mid-May 2024
- CCE to organise an *ad hoc* video meeting in June 2024
- ICP M&M TF should consider and discuss the provision to CIAM by CCE of NH3 Critical Levels for the purpose of optimisation runs done by CIAM early 2025. Such scientific discussions in ICP M&M should be held during next ICP M&M TF meeting early 2025.

Consequences of these crucial contributions for the Gothenburg Protocol revision and its planned timeline on ICP M&M internal organisation

In consideration of that, it is foreseen to organise the ICP M&M TF meeting early 2025, most probably before end of March 2025 and, if possible, in February 2025.

5. Critical Loads for acidification of freshwater ecosystems on national and international level

During the 2024 ICP M&M Task Force meeting, Kari Austnes (Head of Waters Programme Centre and NFC for ICP M&M) and Heleen de Wit (ICP Waters Chairwoman) presented the methods of modelling Critical Loads for acidification of freshwater ecosystems extensively. This input was needed to clarify the boundaries of a potential application of this Critical Load approach and to describe the needed input data more precisely. Right now, modelling Critical Loads for freshwater ecosystems is only performed by NFC of ICP M&M on national and or regional level. This exchange shall start a process of identifying gaps in the input data and internal knowledge at the CCE which are in the way of including this method into the CCE background database.

Next steps will be the regional differentiation of the empirical CL in order to acknowledge the differences in the EUNIS Class C 1.1 more precisely. Identifying and filling data and knowledge gaps will be discussed at the upcoming ICP M&M meeting.

6. Current status of the work on development of dynamic modelling

Dynamic modelling can produce scenario analyses, which are in demand within the GP revision. CDM will have scenario analysis (often in CLRTAP context termed as "*ex-post analysis*") as an item at the CDM workshop in August 2024 and emphasize the role that models play in this effort. This applies not only to biodiversity modelling related to nitrogen, but equally to aquatic biodiversity that is linked primarily to acidification, such as the extensive work that has been carried out in Norway with MAGIC model on lakes. Another issue which continues to demand more effort is the choice of damage indicators and critical limits.

Manual updates

The "Manual on Methodologies and Criteria for Modelling and Mapping Critical Loads and Levels and Air Pollution Effects, Risks and Trends" was updated by CCE for 2 parts :

- Part of its chapter 3 on Critical Levels for NH3;
- Part of its Chapter 5 on the background database for Critical Load modelling and the UNECE receptor map.

The current version of the Mapping Manual is available at the following link :

https://www.umweltbundesamt.de/en/cce-manual

It is to be noted that the last update (2024) is pending for publication.

Annexes

Annex I - Agsnda of the meeting

Convention on Long-Range Transboundary Air Pollution
Working Group on Effects

**International Cooperative Programme on
Modelling and Mapping of Critical Levels & Loads
and Air Pollution Effects, Risks and Trends
(ICP M&M)**

40th ICP M&M Task Force meeting and 31th CCE workshop

Tuesday 23th, Wednesday 24th and Thursday 25th April 2024

Hosted in Oslo (Norway)

AGENDA (as of 9 April 2024) – all hours in CET

Tuesday 23 April

- **Registration from 8.30 to 9.00**

- **Opening session 9.00 am – 10.00 am**
  - Opening address by Chairs of TF and Centers (including housekeeping issues)
  - Opening by Torfinn Sørensen (Head of the Water Resources and Knowledge Department, Norwegian Environment Agency)
  - Keynote presentation by Thorjørn Larssen (Deputy Chief Executive Officer, NIVA) (20-30 min)

- **Feedback from ongoing activities and recent meetings under and outside CLRTAP (10.00 – 12.00 am)**
  - Recent development under the Convention by Anna Kaplina (Secretariat) (10 min)
  - Revision of the Gothenburg Protocol by Till Spranger (WGSR) (20 min)
  - Ongoing activities under Working Group on Effects (Jesper Bak) (20 min)

- **Coffee-Break (30 min)**

  - Overview on CCE ongoing and new activities (25 min)
  - Overview on CDM ongoing and new activities (15 min)

- **Lunch break (12.00 – 13.00)**

- **Contributions from other bodies of the convention to effect-oriented activities (13.00 – 14.30)**
  i.e. other ICPs and any ICP M&M related works within EMEP subsidiary bodies
  - Update on ICP Waters (Heleen de Wit)
  - Update on ICP IM (James Kurén Weldon)
  - Update on ICP Veg (Felicity Hayes / Katrina Sharps)
  - Update on ICP Forests by Kai Schwärzel (PCC)
  - Update on CIAM with focus on GAINS and how CL will be reflected (tbc)
  - Short update on TFRN by Markus Geupel (EPNB)
  - Update on EMEP MSC-West by Hilde Fagerli (MSC-West)

- **Coffee break (30 min)**

- **NFC's contributions to effect-oriented activities and Tour de table (15.00 – 17.30)**
  - Critical loads in Dutch policies (Arjen van Hinsberg)
  - Update on the new critical loads for the Netherlands (Wieger Wamelink)
  - Recent developments in Germany (Thomas Scheuschner)

Wednesday 24 April

- **Call for Data 2023/24 and CL$_{emp}$N (9.00 – 10.30)**
  - Receptor map and application of CL$_{emp}$N update (CCE)
  - Results of recent Call for Data (CCE)
  - Brochure CL$_{emp}$N (CCE)
  - Spanish receptor map for the use of empirical critical loads: methodology and exceedances (Tania Carrasco-Molina)

- **Coffee break (30 min)**

- **Upcoming Call for data 2024/25 regarding Steady State Critical Loads (11.00 am – 12.30)**
  - What is planned, what is the update potential
  - Review of SMB Critical Limits (Thomas Dirnböck)
  - Climate Sensitivity of German Level II Plot Critical Loads (Steady State) (CCE)
  - Part of the Call on Dynamic Modelling (CDM)

- **Lunch break (12.30 – 13.30)**

- **Scientific developments regarding Critical Loads & Critical Levels (13.30 – 15.00)**
  - How bedrock and dominant tree species influence the understorey vegetation's response to nitrogen deposition (Tomáš Chuman)
  - Follow up of the DOREN project - response curves for habitat types for nitrogen deposition (Wieger Wamelink)
  - Approaches to map NH3 Critical Levels on the European Scale (CCE)
  - Trends in UK atmospheric N pollution since 1960 and prospects for recovery (Ed Rowe)

- **Coffee Break (30 min)**

- **The Oslo fjord – environmental challenges and mitigation measures (Mats Walday, NIVA) (15.30 – 16.00)**

Social event

  - Guided tour of modern Oslo along the fjord (17:00-19:00)
    Urban development, city beaches and landmarks such as the Opera House, the Munch Museum and the new main library

  - Dinner at Stock Restaurant (19:00)

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Thursday 25 April

- **Surface waters critical loads and dynamic modelling (9.00 – 10.30)**
  - Overview, and recap on critical loads for acidification (Kari Austnes)
  - Empirical critical loads for water
    - ○ N effects in water and setting empirical critical loads (Heleen de Wit)
    - ○ Applying the empirical critical loads for water in Norway (Kari Austnes)
  - Dynamic modelling of surface water acidification – recent applications
    - ○ Applying MAGIC at Lake Langtjern and recent MAGIC developments (Heleen de Wit)
    - ○ Modelling 1000 Norwegian lakes with MAGIC

  - Discussion:
    - ○ How have the empirical critical loads for water been applied?
    - ○ Which countries consider surface water acidification to be an issue? Who will report critical loads for surface water acidification in the next call for data? Does anyone apply dynamic modelling? Which methods are used?
    - ○ How can effects of air pollution on surface waters be taken into account in the upcoming GP revision?

- **Coffee break (30 min)**

- **Summary and outlook session (11.00 – 12.30)**
  - Wrap-up session (all)
  - Workplan 2024-2025 (all)

- **Lunch (from 12.30)**

Presenters shall make sure to upload their presentation in advance of the meeting to the CCE-cloud: Dateien - ownCloud (uba.de) *using the password:* ICPMM2024+Oslo

For further details on the meeting:

Agenda issues :
Alice James - alice.james@ineris.fr
CCE – cce@uba.de

Practical issues, please contact :
Kari Austnes - kari.austnes@niva.no
Cathrine Brecke Gundersen - Cathrine.Brecke.Gundersen@niva.no

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Annex II – List of participants

Civility	Family name	First Name	NFC	CLRTAP Body	Participation type	Presentation
Mrs	Austnes	Kari	Norway	ICP W	In person	- Re-calibration of the MAGIC model with data from the National Lake Survey 2019. Results from phase 2. - Surface waters Critical Loads and dynamic modelling
Mr	Bak	Jesper Leth		WG E Chair	Online	Ongoing activities under the Working Group on Effects
Mr	Blanc	Pascal	Switzerland		In person	
Mr	Bleeker	Albert			In person	
Mrs	Brecke Gundersen	Cathrine		ICP W	In person	
Mrs	Carrasco-Molina	Tania	Spain		In person	Spanish receptor map for the use of empirical critical loads: methodology and exceedances
Mrs	Cathcart	Hazel			Online	
Mr	Chuman	Tomáš	Czech Republic		Online	How bedrock and dominant tree species influence the understorey vegetation´s response to nitrogen deposition.
Mr	Clark	Christopher			Online	
Mrs	de Wit	Heleen			In person	- ICP Waters update - ICP waters news and highlights
Mr	Duan	Lei	China		In person	
Mrs	Dury	Marie			Online	
Mrs	English	Yvonne			In person	
Mrs	Evstafeva	Elena			Online	
Mrs	Fagerli	Hilde		MSC-W	In person	Update on EMEP MSC-W activities
Mrs	Fornasier	Maria Francesca	Italy		In person	
Mrs	Galert	Wiebke		CCE	In person	- Overview on ongoing CCE activities - CLempN brochure
Mr	García-Gómez	Héctor			In person	
Mr	Georgiev	Georgi	Bulgaria		In person	
Mr	Geupel	Markus		CCE	In person	- Overview on ongoing CCE activities - Short update on TFRN activities - Proposal to map NH3 Critical Levels on a European scale

Civility	Family name	First Name	NFC	CLRTAP Body	Participation type	Presentation
Mr	Gromov	Sergey			Online	
Mrs	Hayes	Felicity		ICP V	Online	ICP Vegetation update
Mr	Hinsberg van	Arjen	The Netherlands		In person	Critical loads in Dutch policies
Mrs	James	Alice		ICP M&M TF Chair	In person	Wrap-up session of the meeting
Mrs	Jutterström	Sara		CDM	In person	
Mrs	Kaplina	Anna		Secretariat	Online	Recent development under the Convention
Mr	Kiesewetter	Gregor		IIASA	In person	GAINS model and Integrated Assessment Model
Mr	Knaebel	Karl	Austria		In person	Review of SMB Critical Limits
Mr	Kurén Weldon	James		ICP IM		Update on ICP Integrated Monitoring activities
Mr	Moldan	Filip	Sweden	CDM	In person	- Overview on ongoing CDM activities - Part of the Call on Dynamic Modelling
Mr	Pecka	Tomasz	Poland		In person	
Mrs	Rábago	Isaura		former WGE Chair	Online	
Mr	Rowe	Ed	United Kingdom		Online	Trends in UK atmospheric N pollution since 1960 and prospects for recovery
Mrs	Sawicka	Kasia	United Kingdom		In person	
Mr	Scheuschner	Thomas	Germany	CCE	In person	- Recent development in Germany regarding CL - Receptor map and application of CLempN - Climate Sensitivity of German Level II Plot Critical Loads (Steady State)
Mr	Schulz	Torsti			In person	
Mr	Schwärzel	Kai		ICP F	Online	
Mr	Skotte	Gunnar			In person	
Mr	Spranger	Till		WGSR	Online	Revision of the Gothenburg Protocol
Mr	Vowles	David			Online	
Mr	Wamelink	Wieger			In person	- Update on the new critical loads for the Netherlands - Follow up of the DOREN project - response curves for habitat types for nitrogen deposition

Annex III – Proceedings of the 40th ICP M&M Task Force meeting

The abstracts of the presentations made during the meeting outside of work properly achieved by CCE and CDM are available in the present document below.

The presentations themselves are available on the [CCE website](), providing consent for such dissemination has been given to CCE by their authors:

Ongoing and new activities

CCE (Markus Geupel, Wiebke Galert)

Markus Geupel (CCE) informed about recent activities of the CCE, starting with a recap of the data delivered within the context of the review process of the Gothenburg protocol. Including time series for CL exceedance calculations and the CAI approach to estimate critical input of atmospheric deposition in the Baltic sea. He then highlighted the recent workplan (2024/25) and gave a preview about the main topics which will be presented in following presentations by the CCE (e.g. Critical Level for ammonia, empirical Critical Load).

Wiebke Galert (CCE) informed about the main objectives of the CCE. Which are to develop and update methods for the assessment of critical loads; to compile national data on critical loads in a European database, the creation of maps of European critical loads and their exceedances. Most of CCE products are available on the CCE homepage. CCE strives to meet the needs and make our products relevant. In order to further promote cooperation, CCE wants to ask participants and NFC to reflect on CCE services. Therefore, CCE has conducted an online survey (via Mentimeter) during the meeting and closed the survey 14days after the meeting.

CDM (Filip Moldan)

CDM activities are related to preparing the dynamic modelling part of the coming CfD, according to workplan items 1.1.1.20 and 1.1.1.21. Participants from ICP M&M NFCs and from other ICPs were invited to the CDM workshop on this theme which will be held in Copenhagen in August 26 – 28, 2024. The key objective of the workshop is to discuss Dynamic Modelling of Biodiversity change in the next CfD so that it could be proposed in September at the EMEP SB / WGE meeting. The other area where dynamic modelling is useful is in scenario analysis such as "*ex-post analysis*" to demonstrate damage to biodiversity and benefits of air pollution abatement. Dialogue with Integrated Assessment Modelling is important to ensure the relevance of model outcomes.

Feedback on ongoing activities and recent meetings under and outside CLRTAP

Recent development under the Convention (Anna Kaplina, Air Secretariat)

Anna Kaplina from the UNECE Secretariat, presented an overview of the activities ongoing under the CLRTAP, including a summary of the main points discussed at the 9th Joint session of EMEP Steering Body and Working Group on Effects in Geneva in September 2023, a summary of the main points discussed at the 43rd session of the Executive Body in Geneva in December 2023, recalled financial elements such as the 2023 cash contributions towards financing the core activities under the Convention. Anna Kaplina also drawn the main lines of work for the upcoming 10th Joint session of EMEP Steering Body and Working Group on Effects to be held in Geneva in September 2024 and the associated deadlines for inputs from ICPs into, e.g. the Joint progress report on policy-relevant scientific findings, the technical report of the ICP M&M; Finally, she introduced the two e-learning course initiated by the Convention in 2023 on "The Convention and its protocols" [4] as well as on "The Convention emission inventories" [5].

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[4] https://unccelearn.org/course/view.php?id=150&page=overview

[5] https://unccelearn.org/course/view.php?id=166&page=overview

Revision of the Gothenburg Protocol (Till Spranger, WGSR)

Till Spranger, Chair of the Working Group on Strategies and Review (WGSR) presented the status of the current revision process of the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (Gothenburg Protocol, thereafter abbreviated "GP") launched since 2023 by EB Decision 2023/5[6]. This Decision specifies that the Gothenburg Protocol shall be revised, especially for a number of 8 main negotiating items which are:

(a)   New emission reduction commitments (current GP pollutants)

(b)   Technical Annexes (scope and level of ambition)

(c)   further BC emission reductions

(d)   Whether and how to address methane emissions

(e)   additional ammonia emission reductions

(f)   New flexibilities etc to facilitate ratification & implementation by non-Parties

(g)   Overarching, collective risk-based target(s) (health and ecosystems/biodiversity)

(h)   integrated approaches among climate, energy and air policies

Apart from these main items, a special focus shall be made on enhancement of capacity-building awareness-raising and cooperation within and beyond the ECE region, especially in the countries of Eastern Europe, the Caucasus and Central Asia (EECCA), the countries of the Western Balkans and Türkiye.

The WGSR was tasked by EB with leading and concluding the revision process of the Gothenburg Protocol, as amended in 2012, by the forty-sixth session of the Executive Body, unless decided otherwise. Till Spranger presented the Gothenburg Protocol revision plan for 2024 and 2025 as proposed by WGSR Bureau to achieve this aim.

Ongoing activities under Working Group on Effects (Jesper Bak, WGE Chair)

Jesper Bak, the new chair of the Working Group on Effects (WGE), presented what he identified as the main strategic discussions to be held under the WGE:

(a) the question of which scale (regional and/or local and global) should be tackled for the analysis of risks and the subsequent optimized solutions to maintain a sufficient focus on supporting the policy development in the convention;

(b) the important question of identifying optimized solution to protect non only health but also nature, environment, materials, and vegetation;

(c) the request for an event better consideration of biodiversity as an important target to protect in applying the current CLRTAP scientific strategy and defining the future one;

(d) the importance of addressing increasing importance to climate change and mitigation issues and their influence and interaction with air pollution effects and policies;

(e) the need to start thinking about how shifting from nature protection to nature restauration can be reflected in effects assessment and air pollution policies.

Jesper Bak also recalled all the inputs planned to be delivered by all the WGE ICPs under the biennial workplan 2024-2025, and that the new UNECE WGE portal was built to communicate on these.

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[6] https://unece.org/sites/default/files/2024-05/Decision%202023_5%20%28E%29.pdf

Session on "Contributions from other bodies of the Convention to effect-oriented activities"

ICP Waters (Heleen de Witt)

The latest reports from ICP Waters are the annual reports on biological and chemical intercalibration, as well as Task Force proceedings. All reports and relevant papers are available at www.icp-waters.no. The latest report is focused on "Trends and patterns in surface water chemistry in Europe and North America between 1990 and 2020". Some of the main results of this data analysis are that:

- SO_4 in surface waters declines in response to reductions in S deposition.
- The base cations are expected to follow the decline in SO_4 because of electroneutrality.
- Studies from Norway shows less decline in Ca than expected, resulting in larger-than-expected increase in ANC.

Another important topic is the long-term weathering from CO_2 and the release of carbonates and base cations from soils into surface waters (which leads to natural acidification of the soil). A preliminary conclusion is that the increases in Ca can be related to bicarbonates from weathering. This is policy-relevant because:

- Higher weathering rates may lead to quicker recovery
- But highly acid-sensitive sites have low weathering rates, unclear whether these will accelerate
- Calcium in water is important for organisms with exoskeletons (snails, fish)

The next 2025 ICP Waters Task Force meeting will be held in Dessau, Germany, 23 – 25 April.

ICP Integrated Monitoring (James Kurén Weldon)

1) Early results from study showing deposition linked to reduced vegetation community stability.
2) Mercury project led by Canada to test passive mercury samplers – we will publish an evaluation once more data are available.
3) Report on dynamic modelling of Swedish sites + biodiversity, available from IM website. Models often underestimate probability of mosses and lichens due to a central/western Europe bias in training data.
4) Open data - We are moving forward with this now and work on the data paper will be begun shortly.
5) Manual revision – beginning a rolling revision process with working group formation at this TF meeting.
6) Climate change – Time series of IM data is now long enough that we can see effects of climate change, e.g. the vegetation period at SE04 (Gårdsjön) has increased by around a month since 1995.

ICP Vegetation (Felicity Hayes)

ICP Vegetation provided a summary of activities for 2023-4 and outlined the ongoing workplan for 2024-25. The ICP Vegetation Taskforce Meeting was held in Lithuania this year, with 62 participants. Recent development of a nitrogen module within the DO3SE model will allow an assessment of ozone impacts on crop quality for wheat. Investigations into the impact of ozone on floral signalling suggest changes in the 'signature' of BVOCs emitted by plants with increased ozone. Work on the Gothenburg Protocol Review is ongoing, with plans for further work on ozone impacts on grassland biodiversity and investigations into methane as a pre-cursor. Initial data from the MADAME project has shown that airborne microplastics are found throughout the UNECE region, even in rural areas such as Scandinavia and western Ireland. Upcoming work for ICP Vegetation this year will include producing the report for the 2020– 2021/22 moss survey on heavy metals, nitrogen and POPs.

ICP Forests (Kai Schwärzel)

In representation of the Programme Co-ordinating Centre of ICP Forests, Lena Wohlgemuth gave an overview of new research results and ongoing activities. Recent ICP Forests publications of interest for ICP Modelling & Mapping include the following papers:

- Guerrieri et al. 2024: Microbial canopy nitrification was identified as a key process in nitrogen cycling at 10 ICP Forests monitoring sites with potential implications for nitrogen fluxes and critical loads assessments.
- Verstraeten et al. 2023: Pollen appears to play a complex role in forest nutrient cycling and contributes to annual throughfall fluxes of e.g. K^+, DOC and NH_4^+.
- Ferretti et al. 2024: Ozone concentration data from ICP Forests sites was analyzed along with visible ozone foliar symptoms from 2005 to 2018. There is risk of ozone damage particularly in parts of Alpine and Continental Europe.

Along with research activities, there are multiple meetings and conferences by the ICP Forests community in 2024. The FORECOMON scientific conference took place in Prague at 11th/12th of June with a high number of presentations and posters. The 40th Task Force Meeting of ICP Forests took place directly after FORECOMON on 13th/14th of June. ICP Forests organizes a session at the 26th World Congress of IUFRO in Stockholm in June 2024 with the title "Nitrogen deposition in forests in a changing climate: Trends and implications on forest ecosystem services". Due to ongoing data work within the ICP Forests community with regard to the Ecological Studies Book, there are new gapfilled and aggregated data sets available on annual wet deposition fluxes of inorganic N, SO_4^{2-}, Ca, Mg, Cl, K, Na and of O_3, NO_2 and SO_2 air concentrations.

Centre for Integrated Assessment and Modelling (Gregor Kiesewetter)

Gregor Kiesewetter, representing the Centre for Integrated Assessment Modelling (CIAM), summarised the latest developments in the context of the Convention. This included CIAM's contribution to the revision of the Gothenburg Protocol (to be finalised end 2026), some updates of the GAINS-Europe integrated assessment model (e.g., new SRMs from EMEP/MSC-W), and the development of future scenarios for the assessment with the Convention using the GAINS model (now covering all EECCA countries). In this regard, the ongoing work on the integration of the empirical CL was presented, using the data provided by the CCE.

Short update on TFRN by Markus Geupel (EPNB)

According to the workplan 2024/2025 it is foreseen to: Provide technical support on options for possible future updating of annex IX to Gothenburg Protocol; the revision of the Guidance document for preventing and abating ammonia emissions; to continue cooperation with INMS on the International Nitrogen Assessment; to analyse implications of NH_3 as energy carrier as part of decarbonization strategies; the examination of benefits and barriers to dietary change to reduce N air pollution; the assessment of technical and non-technical options for meeting Global Biodiversity Framework target 7; the assessment of opportunities for mobilizing N recovery and reuse and the revision and publication of Guidance document on national nitrogen budgets (incl. template and CfD)

→ Next meeting 18-19 June, in Aarhus

Update on EMEP MSC-West by Hilde Fagerli (MSC-West)

Hilde Fagerli, representing EMEP MSC-West, informed about recent updates of the EMEP deposition model and its application in the context of the Gothenburg Protocol review and revision processes. Especially, she informed that the use of different emission scenarios provided by the CIAM / IIASA group was identified as important input data.

Session on "NFCs' contributions to effects-oriented activities, Tour de table"

Critical loads in Dutch policies (Arjen van Hinsberg)

Arjen van Hinsberg (Dutch NFC of ICP M&M) informed about the history and the content of the Dutch law on "Nitrogen Reduction and Nature Improvement". He also informed about the recent effect-oriented work in the Netherlands focusing on the monitoring action and assessing the potential effects of future emission reductions plans. The reflection on knowledge gaps included the identification of:

- missing information on dynamics: How fast must deposition be reduced ?
- missing link with monitoring work on status & trends;
- missing information on experiences in neighbouring countries.

Update on the new critical loads for the Netherlands (Wieger Wamelink)

Wieger Wamelink (Wageningen University) presented the recent work on the "Revision of critical loads for nitrogen deposition for Natura-2000 Habitat types occurring in The Netherlands". He described the general workflow of accessing critical loads in the Netherlands and the potential impact of the "DOREN" project on the modelled critical loads.

Recent developments in Germany (Thomas Scheuschner)

Thomas Scheuschner (German NFC of ICP M&M) informed about recent progress in Germany which is related to improving the CL methodology. Main focus of the presentation was to inform about:

- Developments of a regional CL-project within the context of Natura 2000 protection and licensing process
- Modelling Deposition in Germany (extension of the PINETI project series)
- Publication of the BERN Model
- Results of Critical Load Project including reflections of the impact of climate factors on CL

Call for data 2023/2024 and CLempN

Receptor map and application of CLempN update (Thomas Scheuschner)

The workflow of the CCE for linking the receptor map and the empirical Critical Loads was presented. The first result for the upper and the lower value of the CLempN range were presented. These datasets were already delivered to the CIAM (IIASA) for a preliminary analysis of the impact of different emission reduction scenarios on CL exceedances and to assess risks for biodiversity.

Results of recent call for data (Thomas Scheuschner)

The recent CfD contains the request to submit information about empirical critical load in the respective country of the NFC. Following this call, CCE gathered updated national datasets from 13 countries (Austria, Belgium (Wallonia), Bulgaria, Czech Republic, Germany, Italy, Poland, Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom). Integration of this data to the dataset which will be used in the Integrated Assessment Approach (by CIAM/IIASA) is still under discussion. Especially the decision which end of the range of the CLempN should be used will need further revision.

Brochure CLempN (Wiebke Galert)

The aims of the CLempN brochure are to visualize the habitats (according to the EUNIS classification system), to show the protected ecosystem visually with its diversity and to provide access to this field of research for interested people from NGOs, the public and politics. The target groups are interested scientists/researchers, but also the interested public and political decision-makers. The origin of the data is the report "Review and revision of empirical critical loads of nitrogen for Europe" by Bobbink et al. 2022 with main revisions on:

- 9 new ecosystems on list of sensitive receptors
- New CLempN for EUNIS classes (51 different receptors)
- Adaptions CLempN for harmful N inputs into natural and semi-natural ecosystems for 40% of habitats (more sensitive to reactive N)
- New studies, analysis of new scientific data or using advanced models (adapted input parameter)

The brochure will be available soon (expected summer 2024).

Spanish receptor map for the use of empirical critical loads; methodologies and exceedances (Tania Carasco-Molina)

Tania Carrasco-Molina (CIEMAT, Spain) presented "*Spanish receptor map for the use of empirical critical loads: methodology*". The Spanish receptor map is based on the National Forest Map and the National Biodiversity Inventory cartography. The floristic composition (dominant and diagnostic species) has been used to classify the habitats from national maps to level 3 of the EUNIS classification. The current national receptor map has nearly 20 M grid cells with EUNIS codification, covering 70 % of the territory. The next step is to use this receptor map for the empirical critical loads 2024-2025 call for data. In the medium term, it will also be used to calculate CL exceedances for two national climate change scenarios and emission reductions.

Upcoming Call for data 2024/2025 regarding Steady State Critical Loads

What is planned, what is the update potential (Markus Geupel)

Current database 2021, used in the Gothenburg Protocol review is a composed NFC/CCE-DB. Spatial extent without Turkey and EECCA region.

Next steps for CCE under workplan 24/25 is to update CCE background database (integration of new receptor map, soil and forest growth data for Turkey and EECCA and adapt R- and ArcGIS procedures). Also to consider update potential (methological) and enable the NFCs to update their modelled CL.

For the Gothenburg Protocol revision an update is needed rather earlier than later

Review of SMB Critical Limits (Karl Knaebel)

In preparation of the upcoming CfD on national SMB and Steady State Critical Load the findings of the project to review current critical limits in the framework of modelling CL might be considered. The results of the project was presented in the meeting.

The draft version of the final report can be downloaded here: https://www.umweltbundesamt.de/publikationen/critical-limits-for-acidification-nutrient-nitrogen

Climate Sensitivity of German Level II Plot Critical Loads (Steady State) (Thomas Scheuschner)

Results of a recent project at the UBA indicates update potential of the equations of the Steady-State/Simple-Mass-Balance CL for terrestrial ecosystems. The translation and the integration of these results is planned within the recent workplan activities.

Part of the Call on Dynamic Modelling (CDM – Filip Moldan)

Part of the CfD based on using dynamic modelling will be further discussed and developed in the CDM workshop in Copenhagen, in August 26 – 28, 2024. The work will link to six previous CfDs issued between 2006 and 2015, which all contained elements of dynamic modelling of biodiversity change to set critical loads. Two other important aspects are inclusion of scenario analysis and analysis of the potential of the dynamic modelling outputs in light of their ability to generate messages useful in the political context. The complexity and demand on data for using dynamic modelling needs to be motivated by the quality and relevance of the dynamic modelling outputs.

Session on "Scientific developments regarding Critical Loads & Critical Levels"

How bedrock and dominant tree species influence the understorey vegetation´s response to nitrogen deposition (Thomás Chuman)

The analysis of repeated forest plots revealed that the response of forest understorey vegetation to nitrogen deposition is context-dependent. It depends on the site trophism (bedrock geochemical reactivity classified as eutrophic, mesotrophic and oligotrophic site) and varies according to dominant tree layer species. N deposition led to species homogenization across the trophic gradient.

Follow up of the DOREN project – response curves for habitat types for nitrogen deposition (Wieger Warmerlink)

Approaches to map NH3 Critical Levels on the European Scale (Markus Geupel)

CCE provided information regarding the workflow of accessing Critical Levels for Ammonia on basis of the recent CCE receptor map. Most relevant is the integration of information from the European Environment Agency (EEA) website which describes plant species occurrence in relation to EUNIS classes (https://eunis.eea.europa.eu/).

The work on this topic is still progressing, experts and interested parties are welcome to join a brief online meeting on 5th of July 2024 organized by CCE.

Trends in UK atmospheric N pollution since 1960 and prospects for recovery (Ed Rowe)

Ammonia concentrations in air were calculated for the UK at approximately 3 km x 3 km resolution using the EMEP MSC-W rv5.0 model, for the period 1960 – 2020. Although UK ammonia emissions have decreased somewhat since 1980, ammonia concentrations have increased over this period, due to the much greater proportional decline in emissions of acid gases. The Air Pollution Recovery Indicators (APRI) project assessed how evidence for ecosystem recovery might be obtained. Few areas show major decreases in modelled N pollution pressure, but areas close to point sources that stop emitting are an exception. If such sources can be identified in advance of their closure, baseline monitoring can be implemented. Controlled experiments provide more reliable evidence of pollutant effects and recovery than surveys. Imposing continued pollution pressure on experimental plots at locations where pollution is declining could provide an important control treatment for recovery studies.

Surface waters critical loads and dynamic modelling

Overview, and recap on critical loads for acidification (Kari Austnes)
  - Empirical critical loads for water

N effects in water and setting empirical critical loads (Heleen de Wit)

Applying the empirical critical loads for water in Norway (Kari Austnes)
  - Dynamic modelling of surface water acidification – recent applications

The presentation "Surface waters critical loads and dynamic modelling" gave an overview of air pollution effects and modelling of surface waters. Surface waters show strong chemical recovery from acidification, but there is a lag after non-exceedance of critical loads has been reached due to depletion of base cations from the soil. Recovery in biota is also seen, but more knowledge is needed regarding thresholds and lag times in biological recovery. The methods for steady-state modelling of critical loads for surface waters acidification was explained. A key point is that the critical loads apply to the catchment area, not only the water surface. Calculation of critical loads for surface water acidification for potentially acid-sensitive regions was encouraged. The background for the revised empirical critical loads for nutrient nitrogen for surface waters was presented. Nitrogen is shown to increase algal biomass per unit

phosphorus in nutrient-poor waters. The revised critical loads are differentiated depending on catchment properties. Recent studies applying the dynamic acidification model MAGIC were presented. The new modelling platform Mobius is more flexible and has several new features, including a module for organic matter solubility. Both a single-catchment and a Norway-wide modelling exercise showed the importance of weathering rates in chemical recovery. For the Gothenburg protocol revision, it is important that critical loads of acidification of surface waters are included. Both critical loads for acidification and eutrophication address effects on biodiversity. The empirical critical loads of nitrogen may not sufficiently protect aquatic biodiversity as they are only applied to the surface water area.

Applying MAGIC at Lake Langtjern and recent MAGIC developments (Heleen de Wit)
- o Modelling 1000 Norwegian lakes with MAGIC

- Discussion:
    - o How have the empirical critical loads for water been applied?
    - o Which countries consider surface water acidification to be an issue? Who will report critical loads for surface water acidification in the next CfD? Does anyone apply dynamic modelling? Which methods are used?
    - o How can the effects of air pollution on surface waters be taken into account in the upcoming Gothenburg Protocol revision?