Convention on Long-range Transboundary Air Pollution

Working Group on Effects

2021

Annual report of the

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 Casas (INERIS, France)

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Introduction of the ICP, 2020 news, and 2021 meeting objectives

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).

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 hosted at IVL 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 (EB) 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. To this aim, the CCE together with the Programme TF determine receptor-specific critical loads 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 critical loads 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).

The year 2020 was an important year for the CLRTAP community, with the launching of the Gothenburg protocol review.

The year 2020 was also an important year within the ICP M&M community itself, as the "Centre for Dynamic Modelling (CDM)" was created on 1 January 2020 as the second designated centre under ICP M&M. CDM is hosted by IVL Swedish Environmental Research Institute. Main tasks for which CDM is mandated by the EB is the development and promotion of methods for dynamic modelling (including consideration of 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 work achieved by CCE and CDM and the national contributions to ongoing activities held since the last annual TF meeting (April 2020) were presented during the 2021 Annual Meeting of the ICP M&M (web-conference) from Tuesday 20 to Thursday 22 April 2020. This was the 37th TF, 28th CCE and 2nd CDM meeting. The presentations and discussions were mainly related to the previously defined main scientific challenges, grouped under the following items:

- Steady state modelling
- Empirical Critical Loads
- Dynamic modelling

A special focus was also put on the review process of the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (Gothenburg Protocol), addressing to the meeting's participants questions put forward by the Gothenburg Review Group to the European Monitoring and Evaluation Programme (EMEP) and the Working Group on Effects (WGE), including TF Modelling & Mapping, CCE and CDM.

Proposals made by CCE, CDM and the Chair of the Task Force for the next ICP M&M workplan (2022-2023) were also presented and discussed.

The current ICP M&M workplan for 2020-2021 is presented in Chapter 1.

The main discussions and conclusions regarding the scientific and science-to-policy challenges cited above, on which it was chosen to focus during the meeting, are presented thereafter: Chapter 2 presents the update of Critical Loads. Chapter 3 informs on the link between ICP M&M's activities and the current review of the Gothenburg Protocol, and Chapter 4 informs on the link between ICP M&M's activities and the current review of the joint EMEP and WGE Science Strategy with respect to the Long-Term Strategy (LTS) for the Convention, adopted in 2018.

Chapter 5 presents the ICP M&M workplan proposals for 2022-2023, as presented to the meeting's participants and adopted by the Task Force during the meeting.

Summaries of presentations (proceedings) and the discussions (notes) directly associated to those are given in Chapter 6.

Chapter 1 – ICP M&M 2020-2021 workplan

In line with the priorities set out in the long-term strategy for the Convention for 2020–2030 and beyond, the EB of the CLRTAP had endorsed the biennial workplan for the Convention in a document including items where ICP M&M together with its designated centres constitute the main lead bodies. The document is available at the following address:

https://www.unece.org/fileadmin/DAM/env/documents/2019/AIR/EB/ECE_EB.AIR_144_Add.2__Advance_version_.pdf

The biennial current ICP M&M workplan is summarised in Table 1.

Table 1: Biennial ICP M&M workplan for 2019-2021.

Workplan item	Activity description/objective	Expected outcome/deliverable	Lead body(ies)	Resource requirements and/or funding source
1.1.1.13	Call for data and contributions Steady-state Critical Loads: (a) update of National Critical Loads by National Focal Centres (b) establishment of European Background Database by CCE	Database (2020/2021) for Critical Loads for acidification and eutrophication; Report	ICP Modelling and Mapping /CCE	National Focal Centres and Germany
1.1.1.14	Empirical Critical Loads: Review and revision of the empirical Critical Loads on nitrogen published in 2011	Report on empirical Critical Loads in Europe (2021)	ICP Modelling and Mapping /CCE	National Focal Centres and recommended contributions
1.1.1.22	Review of the dynamic modelling work under the Convention; identification of areas of common interest and potential gaps	Final report 2020	ICP Modelling and Mapping /CDM(1)	Recommended contributions
1.1.1.23	Development of metrics for quantifying damage to biodiversity due to air pollution and of biodiversity damage indicators suitable as a criterion for calculating critical loads for nitrogen as a nutrient	Report on indicators of damage to biodiversity (2021)	ICP Modelling and Mapping /CDM(1)	Recommended contributions

(1) CDM's role is not stated as such in EB.AIR 144 Add.2 Advance version document but this role is valid since EB endorsed the creation of this centre during its 39th session (cf. EB.AIR Decision 2019-22 amending Decision 2002-1 on the financing of core activities.

Chapter 2 – Current status of the work on Critical Loads (CL) and CL exceedance calculations, main 2021 TF meeting discussions and conclusions for next steps

Current status of the Background Database (BGDB)

The UBA is hosting the CCE since 2018 and is continuing its efforts towards information and data retrieval from the previous contributors. To this aim, CCE has contracted in 2019 Wageningen Environmental Research (WUR) and members of the former CCE to build, update and document the Background Database (BGDB). Up to date, data compilation and assessment has been achieved, including compilation of data, derivation of CL parameters for eutrophication and acidification as well as consolidation of data in a geodatabase. The current focus of the project is on calculating steady-state CL for eutrophication and acidification for terrestrial ecosystems, i.e data import and preparation, development of calculation framework and calculation of Simple Mass Balance (SMB) Critical Loads. The status of this work and the future tasks were presented during the annual 2021 TF meeting (see presentation(s) in Chapter 5 – Workplan 2022-2023, Session 3).

- **Resulting CL for eutrophication and acidification, computed and mapped with newly developed R procedures, will be evaluated. This evaluation step will consist in comparisons of (i) new CLeut and CLacid with previous CL computed by the former CCE, (ii) modelled CLeut with Empirical CL and (iii) modelled CL from volunteering countries using either a different CL model than SMB, or different criteria.**

Current status of the work on steady-state CL

The **Call for Data (CfD) on steady-state CL** was launched by the CCE and the chair of the TF in November 2019 and a clear roadmap was communicated. The deadline for the deliverables for the steady-state CL topic are spring 2020 for the status report and spring 2021 for the most recent data delivery. Following the CfD, 6 countries submitted status reports.

During the annual 2021 TF meeting, 2 National Focal Centres (NFCs) presented preliminary contribution to the Call for Data on Steady State Critical Loads with different priorities and experiences.

In the light of the ongoing workplan and the upcoming Gothenburg Protocol (GP) review, NFC were encouraged to continue their work on SMB and steady-state CL and to request support from CCE to implement steady-state CL if needed.

- **Based on the national contributions and on the gap filling of CCE with the future BGDB, in 2021 ICP Modelling & Mapping will propose CL data to be used in Integrated Assessment Modelling (IAM) work to support the review of the GP.**

Current status of the work on empirical CL

The Call for Data (CfD) and contribution on empirical CL was launched by the CCE and the chair of TF in November 2019, together with the one for steady-state CL. NFCs were asked to contribute with two deliverables for the empirical CL topic in spring 2020 and in spring 2021.

Following the CfD, 6 countries submitted empirical CL related information in their written reports to the CCE.

CCE presented the current status of the work on the empirical CL (see Chapter 6 – Session 7)

- **A virtual kick-off meeting in June 2020 was attended by 58 participants.**
- **Since then, 45 authors have been working on updating the different chapters of Bobbink et al. 2011. The schedule anticipates that the first (internal) revision will be completed in June 2021.**

- **In July, the CCE will prepare and send the progress report to WGE for the 7th joint session. A second review by external experts is planned between July and September 2021.**
- **The UNECE CCE expert workshop on empirical Critical Loads for nitrogen is currently planned for 26th to 28th October 2021 in Bern, Switzerland**

Within session 7, the different chapters of the empirical Critical Load document were presented by the lead authors. Beside technical discussions, the chapter on "Area and aspects of application" was discussed.

Current status of the work on development of CL for biodiversity and dynamic modelling

In 2019, it was stated that methods to compile CL for biodiversity were not robust enough to be used in IAM, and that further development was needed in this area under ICP M&M. This task falls under the mandate of the Centre for Dynamic Modelling (CDM), the new centre under ICP M&M, which is operational since 1 January 2020.

Besides that, biodiversity indicators may be developed regardless of the aim of CL calculation. In this sense, the "positive indicator species per habitat" is identified as a promising concept. HSI is also an operational tool even if there are remaining challenges and if other parameters (light, P, acidification) might need to be added to it. In the meantime, other tools such as e.g. PROPS model are under development at several places. Links may also be done between CL for biodiversity and empirical CL for eutrophication with tools such as TITAN.

Any other items of interest for CL calculation – ongoing discussions

During the annual 2021 TF meeting, **publication of BDB** as open-source code was encouraged. CCE will be considering the possibility to give the best possible access to data results and the corresponding documentation.

Any information regarding the ICP M&M BDB, the CfD and associated data and models can be reached at the following address: *https://www.umweltbundesamt.de/en/cce-data-models*.

Chapter 3 – Review of the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (Gothenburg Protocol): Food for thoughts on activities specific to M&M

Decision 2019/4 specifies that the amended Gothenburg protocol (GP) shall be reviewed for its effectiveness and adequacy as of its article 10. The Working Group on Strategies and Review (WGSR) Chair decided, in consultation with the Executive Body (EB) Bureau, to create the GP Review Group (GPG) to assist in developing the scope, content and work schedule for the review.

At the time at which the annual Meeting of the ICP M&M was held (20 – 22 April 2021), the "Draft annotated outline of the report on the review of the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (2021/4)" was the key document containing the questions addressed to the subsidiary bodies to address GP's effectiveness and efficacy.

In the case of ICP M&M, questions 2.2 and 2.8 have been especially addressed during the discussion of the 2021 Annual Meeting of the ICP M&M.

Item 2.2 relates to changes in exceedance of Critical Loads for acidification and eutrophication since last decades and projected changes and referred to in section "D. Measured and modelled atmospheric concentrations and deposition levels" of the core text of the Draft Annotated Outline. As this regard, there will be input from CCE. An arranged collaboration with the Centre on Emission Inventories and Projections (CEIP) and the Meteorological Synthesizing Centre – West (MSC-W) will allow assessment of risks of exceedances based on ICP M&M data on Critical Loads on the one hand, and on deposition data provided by MSC-W on the other hand. MSC-W in a first step will provide deposition data for the years 2000 – 2019 based on the latest emission data provided by CEIP. Based on that, CCE will calculate Critical Load Exceedance for those countries which have submitted new data (CfD 2020-2021), confirmed data already delivered for the previous Cfd (2015-2017) or which are in the domain of the newly updated and documented background database. That means, that the risk assessment will not cover Eastern European, Caucasian and Central Asian (EECCA) countries unless corresponding national Critical Loads data have been made available and reported. The arrangement with CEIP and MSC-W foresees a timely delivery of risk assessment data for the years 2000 – 2019 until the joint WGE-EMEP Meeting in September 2021. As soon as projected deposition data for future years is available the scenario calculation of Critical Loads exceedances will be complemented.

Item 2.8 relates to expected impacts of new scientific findings on environmental and health effects assessments, e.g. on Critical Loads, critical levels of ozone, PM, NO2 and NH3, dynamic modelling of ecosystem recovery, interactions between air pollution, climate change, nitrogen fluxes and other stress factors for biodiversity and referred to in section "E. Measured and modelled effects on natural ecosystems, materials and crops and assessment of human health effects" of the core text of the Draft Annotated Outline. During the 2021 Annual Meeting of the ICP M&M, the group highlighted the interaction between atmospheric pollution and climate change, effects, adaptation and strategies for mitigation e.g. storage of C in soil to be the most important issues. Another issue raised was that even though N-deposition had been going down since the 1990's there is still very little known about ecosystem recovery and the question of effects on biodiversity due to different pollutants as well as their interactions.

Chapter 4 – Review of the Science Strategy: Food for thoughts on activities specific to M&M

During the 2021 Annual Meeting of the ICP M&M discussions, support was communicated to the Science Strategy as an important document supporting effects-oriented activities. It was suggested that communication on the success of the Science Strategy could be enhanced by communicating on scenarios of what would have been the atmospheric environment status without the work achieved under the Convention and the implementation of the corresponding mitigation measures over the past 20 years. In this regard, it was indicated that this message may be as forceful as the statement of the progress achieved *with* these mitigation measures into place (cf. “cost of inaction”).

As a further input to the review of the Science Strategy, it was also suggested that a clearer communication on scales was needed, also to support work linked to biodiversity, as scales used are very different between different topics of interest and different pollutants (NH3 to be treated on local scale, health effects need to be treated on a city scale, etc.).

Chapter 5 – Workplan 2022-2023

In line with the priorities set out in the long-term strategy for the Convention for 2020–2030 and beyond and according to the proposals adopted by the ICP M&M, CCE and CDM 2021 meeting (see Session 10 – Workplan 2022-2023

– Chair: Alice James Casas, Markus Geupel (CCE) and Filip Moldan (CDM), page 28), ICP M&M will propose to the 7th Joint EMEP/WGE Session in September 2021 for their next workplan the items reported below in Table 2.

Table 2: Biennial ICP M&M workplan for 2022-2023 to be proposed at 7th Joint EMEP/WGE Session.

Workplan item	**Activity description/objective**	**Expected outcome/deliverable**	**Lead body(ies)**	**Resource requirements and/or funding source**
#1	Empirical Critical Loads: Review and revision of the CLempN published in 2011 (*continued*)	Report on empirical Critical Loads in Europe (2022)	ICP M&M / CCE	National Focal Centres and recommended contributions
#2	Update of the harmonized CLRTAP receptor map	Harmonized receptor map for Europe (2023)	ICP M&M / CCE	CCE and Germany
#3	Critical Levels of ammonia: literature review and empirical data provision supporting a workshop	Organization of an International Workshop and Workshop report	ICP M&M / CCE	CCE and Germany
#4	Modelling interaction between air pollution and climate change: N and C	Expert workshop (2022)	ICP M&M / CDM	CDM and National Focal Centres experts
#5	Modelling impact of air pollution on biodiversity in 2030 and beyond	Report on methodology development (2023)	ICP M&M / CDM	CDM and National Focal Centres experts

Chapter 6 – Meeting proceedings & notes

Session 1 – Welcome and opening session

– Chair: Alice James Casas

Within this session, 2 presentations were given:

- *"Gothenburg Protocol (GP) review process" – by Dominique Pritula (Vice Chair of the WGSR)*
- *"Update on WGE and Convention issues" – by Isaura Rabago Juan-Aracil (Chair of the WGE)*

The abstracts of these are available in the present document below and the presentations themselves are available on the CCE website (https://www.umweltbundesamt.de/en/Coordination_Centre_for_Effects), providing consent for such dissemination has been given to CCE by their authors.

Welcome to the ICP M&M Web Conference

Alice James Casas welcomed the participants and introduced the meeting with a few words on the agenda, announcing in particular the special focuses on the Gothenburg Protocol review. These were foreseen in the opening session with the setting of the wider context by Dominique Pritula (Working Group on Strategies and Review Vice Chair) and the setting of the review within the WGE context by Isaura Rabago (WGE Chair) before two other sessions would be dedicated to the questions relating to direct inputs from ICP M&M, CCE and CDM work.

Gothenburg Protocol (GP) review process

Dominique Pritula, Vice Chair of the WGSR presented an overview of the process of the review of the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (Gothenburg Protocol, thereafter abbreviated "GP") launched since 2019 by EB Decision 2019/4. This Decision specifies that the GP shall be reviewed for its effectiveness and adequacy as of its article 10. The WGSR being tasked by EB with leading the review process and developing the scope, content and work schedule for the review, the WGSR Chair decided, in consultation with the EB Bureau, to create the GP Review Group (GPG) to assist in undertaking the work. Dominique Pritula introduced the main up-to-date information on the process : key priorities for review including (i) legally required elements under article 10 (e.g. black carbon and ammonia issues) and broadly existing elements like the sufficiency and effectiveness of current obligations and success in achieving the GP's objectives but also (ii) elements meant to address the gaps and additional inputs to achieve dedicated objectives. She introduced the GPG "preparatory document" providing a list of questions to the subsidiary bodies, amongst which ICP M&M and how this document submitted to the EB in December 2020 had given birth to a further document called the "Draft annotated outline of the report on the review of the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (2021/4)". This latter document, prepared as an official document for the 59th Session of the WGSR which was expected to be held in May 2021, is the key document containing the questions addressed to the subsidiary bodies. Answers to these questions will be key inputs to elaborate on the GP review and specially to address its effectiveness and efficacy (see questions 2.2 and 2.8 further addressed during the ICP M&M meeting).

Dominique Pritula presented the process for submitting inputs and the corresponding timeline for completion of these in details (see screenshot below). The next key step was announced to be the Draft 1 of the Review report, which will be incremented with further inputs until January 2022, before these further inputs are included in the Draft 2 of the Review Report which will be discussed for WGSR 60th meeting in April 2022. Draft 3 elaborated after this meeting will be submitted officially to UNECE for September 2022 in order to be adopted by EB at its 42nd meeting in December 2022.

Timeframe

Meeting	Title of report tabled for consideration	Deadline
WGSR 58 / EB 40	***Preparations for the review (final)*** ***ECE/EB.AIR/WG.5/2020/3*** *Consideration for ammonia relevant to future review of the Gothenburg Protocol* *Informal document on prioritizing reductions of PM to also achieve reduction of BC*	*25 September 2020 for official documents* *Evaluation per Article 10.3 & 10.4 (WGSR informal documents)*
WGSR 59 (18-20 May 2021)	**First draft annotated outline** on the Review	February 2021
TF/centre/ICP meetings	**First draft** of the report for the review **Informal Document**	**Initial Input April 2021**
EMEP SB/WGE meeting (13-17 Sept 2021)	**First Draft** of report of the review ECE/EB.AIR/WG.#/##	September 2021
WGSR 60 (11-14 April 2022)	**Second Draft** of report of the review ECE/EB.AIR/WG.#/##	January 17 2022
EB 42 (Dec 2022)	**Final** report of review adopted/Conclude the Review	September 2022

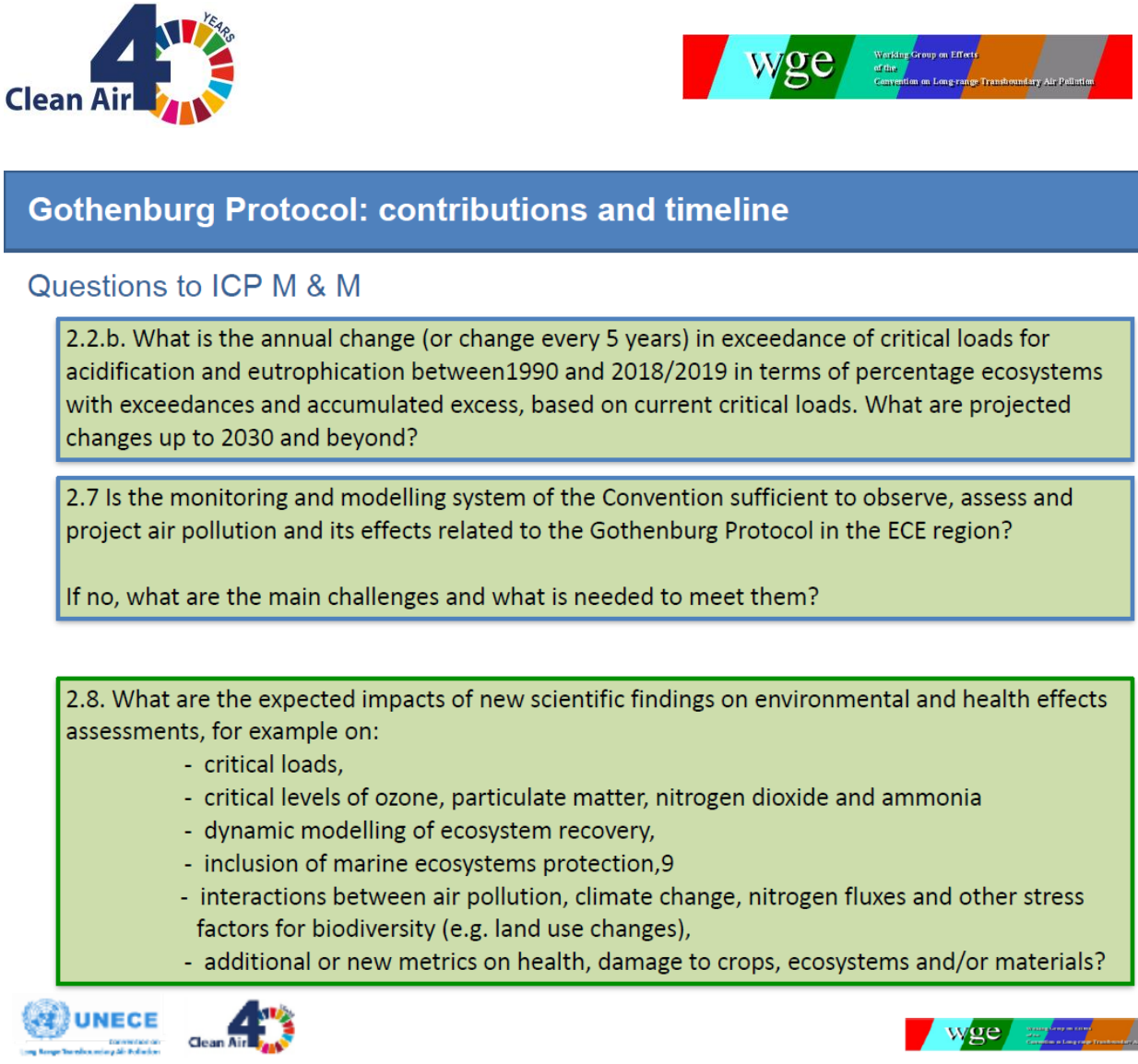
Further discussions were held later during the meeting in two dedicated sessions (see Session 4 – Special focus on Gothenburg Protocol review (1/2)

– *Chair: Markus Geupel (CCE)*, page 17 ; Session 8 – Special focus on Gothenburg Protocol review (2/2)

– *Chair: Filip Moldan (CDM)*, page 23).

Update on WGE and Convention issues

Isaura Rabago Juan-Aracil, chair of the Working Group on Effects (WGE), presented the latest news from the Convention and WGE: meetings held since last ICP M&M meeting (6th Joint EMEP/WGE meeting in September 2020, 40th EB meeting in December 2020, Joint EMEP/WGE Extended Bureaux meeting in March 2021), and topics addressed herein, including the GP review, the Science Strategy review, some financial issues, as well as the follow-up of the activities foreseen for the WGE workplan 2022-2023. She focused on three questions especially addressing ICP M&M areas of work within the GP review outline document which are listed in the screenshot here below:



Isaura Rabago Juan-Aracil also explained the further plan and schedule for the update of the Science Strategy for EMEP and effects-related activities, coordinated by the chairs of EMEP and WGE with the participation of the Bureaux and TFs/ICPs. The schedule is reported in the table here below and a specific agenda item was dedicated to this issue in a next session of the annual meeting.

Tentative timeline for the update of the Science Strategy for 2020 – 2030 and beyond		
First half of May 2021	Circulate First draft of the Strategy	Chairs Bureaux
Second half of May 2021	Comments from TF/ICPs	Chairs Extended Bureaux
First half of June 2021	Final draft to be submitted to the Secretariat for translation	Chairs Extended Bureaux
September 2021	Final draft to be discussed at the 7th Joint EMEP/WGE Session	

Session 2 – Current Status of the Call for Data

– Chair: Thomas Scheuschner (CCE)

Within this session, 4 presentations were given:

- *"Current status of the Call for Data" – by CCE (Christin Loran, Thomas Scheuschner and Markus Geupel)*
- *"Modelling and monitoring impacts of air pollution in Ireland" – by David Kelleghan*
- *"Update on Steady state Critical Loads in the Czech Republic" – by Tomáš Chuman, together with Filip Oulehle, Jakub Hruška*
- *"Recent advances in Critical Loads research from the US-EPA's Office of Research and Development" – by Christopher Clark, Kevin Horn, Todd McDonnell, Sam Simkin, Charley Driscoll, Nathan Pavlovic, Linda Pardo, Kayla Wilkins, Julian Aherne, Michael Bell, et al.*

The abstracts of these are available in the present document below and the presentations themselves are available on the CCE website (https://www.umweltbundesamt.de/en/Coordination_Centre_for_Effects), providing consent for such dissemination has been given to CCE by their authors.

Presentations and directly associated discussions

Thomas Scheuschner presented the **state of play of ICP M&M work as regards steady-state modelling and the corresponding Call for Data**. He recalled the timeline and objectives of the Call for Data launched in November 2019 and for which a first status report was expected from NFCs in April 2020. This first report objective is to prepare the modelling task, inter alia by identifying the aspects of the model which require improvement. To this aim, it should contain a critical assessment of the tentative methods and challenges of the national modelling of the steady-state CLs. Up to date, a total of 10 answers on this part of the CfD were received by the CCE including 6 reports. Belgium (Flanders), Canada, Ireland, Norway, Switzerland and the United Kingdom did provide a steady-state report. The second report objective of this part of the CfD was aiming on the empirical Critical Loads. The NFCs were asked to answer questions about the application of empirical CL in their countries and also give information about specialists concerning the topic empirical CL. This part of the CfD was aiming to support the process of reviewing the empirical CL (see Session 7). Seven countries (AT, BE (Flanders), CA, CH, IE, NO and UK) provided written input for this part of the CfD.

In the second phase (2020/2021) of the CfD the NFCs were asked to provide an updated of the national steady-state CL which have a medium-term validity (ca. 5 years) and with that are deemed policy relevant in the light of the GP review. Optionally, the NFCs could also confirm the data sent in the previous CfD (2015/2017). Up to date 3 countries updated their national CL (CZ, BE (Flanders), NL), 7 countries (AT, BE (Wallonia), CH, DE, FI, NO, SE) confirmed the previous CL data, 5 countries (PL, CA, IE, HU, UK) announced a delayed data delivery and one country declared no data delivery (ES).

Two presentations were then given by NFCs representing Ireland (David Kelleghan), and the Czech Republic (Tomáš Chuman) to inform on the status of steady-state CL in their countries and a third presentation gave insights about the current developments of CL in the United States of America (by Christopher Clark)

David Kelleghan's presentation, "Modelling and monitoring impacts of air pollution in Ireland," presented the current status on ecosystem modelling and monitoring in Ireland.

Tomáš Chuman presented recent developments in his presentation: "Update on Critical Loads in the Czech Republic". He highlighted the updated input dataset and some updated methods and showed some of the result of the modelling exercise.

Christopher Clark presented "Recent advances in Critical Loads research from the US EPA's Office of Research and Development". In his presentation he showed various examples of the application of the Critical Load approach and highlighted the differences of the TITAN and PROPS models.

General discussions about further work on steady-state CL

During the general discussion the efforts of the Irish and Czech NFC were highly appreciated.

- ***The idea was proposed to use the previously sent CL data of the NFC (CfD 2015/17) even if they were not specifically confirmed and no arguments against it were presented.***

Session 3 – Progress on development of the European background database for Critical Loads

– Chair: Christin Loran (CCE)

Within this session, 2 presentations were given:

- *"Progress achieved on developing the new European background database" – by CCE (Christin Loran, Thomas Scheuschner and Markus Geupel)*
- *"Critical loads for eutrophication and acidification for European terrestrial ecosystems; A project that supplied the UBA CCE with a flexible and well documented background data base for Critical Loads" – by Gert Jan Reinds, Max Posch and Jaap Slootweg*

The abstracts of these are available in the present document below and the presentations themselves are available on the CCE website (https://www.umweltbundesamt.de/en/Coordination_Centre_for_Effects), providing consent for such dissemination has been given to CCE by their authors.

Presentations and directly associated discussions

Christin Loran presented an **introduction to the background database (BGDB) project**. The project called "Critical loads (CLs) for eutrophication and acidification for European terrestrial ecosystems" was funded by the German Environment Agency and ran over 15 months from November 2019 till February 2021. The BGDB is used by the CCE if an NFC does not provide own national Critical Loads data. The main objective of the project was to receive a more detailed description of the existing BGDB and to update the input data where possible, so that the new CCE, which was relocated from the RIVM in The Netherlands to the UBA in Germany in 2018, is able to work reliably with the database. The main contractor was Gert Jan Reinds (Wageningen Environmental Research), who carried out the project together with Jaap Slootweg (RIVM) and Max Posch (IIASA). The CCE plans to publish the final report of the project as an official UBA document as soon as possible (foreseen for summer 2021). The national results of the database can be made available to NFCs on request.

Gert Jan Reinds (Wageningen Environmental Research, contracted by CCE) presented the achievements made for the update of the European BGDB in a presentation entitled "**CLs for eutrophication and acidification for European terrestrial ecosystems; A project that supplied the UBA CCE with a flexible and well documented background data base for CLs**". Gert Jan firstly presented the aims of the project which are (i) to construct a database and software in R to compute CLs for eutrophication (by nitrogen) and acidification (by nitrogen and sulphur) for terrestrial ecosystems in Europe, (ii) to precisely and extensively report the background data used (maps, tables), the computational rules implemented to derive some of the data (e.g. transfer functions between soil type and soil characteristics) and of the procedures that compute the CLs and (iii) to validate this database and its results. In the new system, the following CLs for N and S were computed with the Simple Mass Balance (SMB) method: the maximum CL for sulphur (CLmaxS), the minimum CL for nitrogen (CLminN), the maximum CL for nitrogen (CLmaxN) and the CL for nutrient nitrogen (CLnutN). CLmaxS can be based on critical values for various chemical criteria such as molar [Al]:[Bc] ratio in soil solution, pH or base saturation. The results compare very well with the BGDB CLs of 2017 from the former CCE (RIVM). However, the comparison of results to national data is hampered by the fact that NFC's use different criteria, different underlying maps and different methods that cannot be reproduced (e.g. Germany uses > 20 different critical pH values depending on soil types on the German soil map). The map overlays were made using ArcGIS and all other computations were made in R. Even the MetHyd model was migrated from FORTRAN to R. The overall computational speed is very good given the fact that MetHyd needs to be run only once (unless meteorological data are updated).

During the discussion, many participants expressed their appreciation for the revision of the BGDB. The question was raised whether the packages will be publicly available. CCE plans to publish the report and make results from the database available upon request. CCE will explore options for publishing the R packages or libraries. The release of the report will be communicated to ICP M&M members. The calculation of exceedance calculations was not part of the project as the scripts are already part of the CCE routines. It is important to note that the BGDB only covers terrestrial ecosystems, therefore in countries with many sensitive freshwater lakes the results may differ significantly (e.g. Norway).

Furthermore, it was discussed to what extent a comparison between the results of the BGDB with national data is useful. A direct comparison between national and European results is difficult, because not only the input data differ, but also the criteria and models. A comparison is only meaningful if the same criteria and models are used. Nevertheless, the results will differ due to the different input data. This is perfectly okay, because the goal is not to have the same results from the European BGDB and the national modelling. Rather, the goal is to make it clear to the countries what causes the differences and how much the results differ. Ultimately, countries are free to model and provide their own CLs to the CCE, as national modelling will always be more detailed and accurate than modelling at the European level. The new BGDB is just a backup for countries that do not provide their own CLs and it is also a good way to look at the national results from a different perspective. One option could be for the NFCs to provide their national criteria to UBA, who will calculate the CLs in the BGDB for that country using those criteria and provide the results (similar to the comparison of the BGDB with the Irish and German CLs in this project).

Session 4 – Special focus on Gothenburg Protocol review (1/2)

– Chair: Markus Geupel (CCE)

Within this session, one presentation was given:

- *"GPG Document Item 2.2 : Data input from CCE (CCE risk calculations, cooperation with EMEP)" – by CCE (Christin Loran, Thomas Scheuschner and Markus Geupel)*

Presentations and directly associated discussions

Markus Geupel and Thomas Scheuschner jointly presented the workflow at CCE, the anticipated next steps and the arranged collaboration with the Centre on Emission Inventories and Projections (CEIP) and the Meteorological Synthesizing Centre – West (MSC-W). Risk assessments done by CCE are based on ICP M&M data on Critical Loads on the one hand, and on deposition data provided by MSC-W on the other hand. MSC-W in a first step will provide deposition data for the years 2000 – 2019 based on the latest emission data provided by CEIP. Based on that, CCE will calculate Critical Load exceedances for those countries which have submitted new data (CfD 2020-2021), confirmed data already delivered for the previous Cfd (2015-2017) or which are in the domain of the newly updated and documented background database. That means, that the risk assessment will not cover Eastern European, Caucasian and Central Asian (EECCA) countries unless corresponding national Critical Loads data have been made available and reported. The arrangement with CEIP and MSC-W foresees a timely delivery of risk assessment data for the years 2000 – 2019 until the joint WGE-EMEP Meeting in September 2021. As soon as projected deposition data for future years is available the scenario calculation of Critical Loads exceedances will be complemented.

Session 5 – NFCs' contributions to effect-oriented activities

– Chair: Filip Moldan (CDM)

Within this session, 4 presentations were given:

- *"Evaluating the Critical Lads using data from the national lake survey 2019" – by Kari Austnes*
- *"Critical Loads of hundreds of headwater streams in China using SSWC model" – by Lei Duan*
- *"Nitrogen Futures: ambitions for reducing N pollution in a rapidly changing UK context" – by Ed Rowe*

- *"Investigating the links between climate, phenology and soils in a Mediterranean forest with the ForSAFE model" – by Hector Garcia-Gomez, Salim Belyazid, Giuliana Zanchi, R. Alonso, I. González-Fernández, H. Pérez-Jordán, I. Rábago, R. Ruiz-Checa, A.I. Cardona, M.A. Clavero, J.L. Garrido, M.G. Vivanco*

Presentations and directly associated discussions

Kari Austnes presented **"Evaluating the Critical Loads using data from the national lake survey 2019".** Data from the 2019 re-survey of 1000 lakes (sampled previously in 1995) were used to evaluate the Critical Loads methodology at the national scale in Norway. The work is reported in *Critical Loads and the MAGIC model. Evaluating the country-scale applications in Norway using data from the 2019 national lake survey* (https://niva.brage.unit.no/niva-xmlui/handle/11250/2725461). The MAGIC model performance was evaluated by comparing modelled projections for 2019 with measured concentrations from the 2019 survey. The results showed that MAGIC generally performed well, suggested future work was a re-calibration MAGIC to the 1000 lakes using the new Mobius platform. In the evaluation of the CL methodology various alternative values for inputs and parameters in the Critical Loads and exceedance calculations were tested and a comparison of the acidification status of the 1000 lakes with the Critical Load exceedance showed that most lakes in the areas with Critical Load exceedance were not acidified. The recommendations suggested two different approaches for updating the Critical Loads and other updates needed. As there is not yet a decision if and how CL for Norway should be updated, there is no new data in response to the Call for data, however there might be an update on the progress in the national chapter of the 2022 CCE Status report.

Lei Duan presented **"Critical Loads of hundreds of headwater streams in China using SSWC model"** Small headwater streams are generally more susceptible to acidification than large rivers, but often underrepresented in monitoring programmes. Exceedance of Critical Loads has rapidly decreased following emission controls implemented since 2000, but the monitoring programme did not conclude an increase in pH in surface waters. Explanation could in part be in that the surface waters pH is in general very high (>7) in large rivers which dominate the monitoring programme. Monitoring of 346 small headwater streams was evaluated with SSWC model. The CL exceedance has by 2018 decreased by 41%. The remaining area at risk for acidification is concentrated to the southeastern part of the country.

Ed Rowe presented **"Nitrogen Futures: ambitions for reducing N pollution in a rapidly changing UK context"** showing work carried out in the Nitrogen Futures Project (https://jncc.gov.uk/our-work/nitrogen-futures). In the project several scenarios were developed containing future emission reduction policies and potential emission mitigation options and evaluated to see whether they would lead to meeting targets such the Clean Air Strategy and the 25 Year Environment Plan. The results showed that all the future scenarios were predicted to result in meeting the Clean Air Strategy target, while none met the target for the 25-year Environment Plan. The project included several site studies which showed which emission sources contributed to the deposition on a specific site. This could be useful for policymakers and implementations of local-scale mitigation measures. He stressed that ammonia is the largest problem with livestock farming the major contributor to the ammonia emissions of the whole agriculture sector. In a wider context, high latitude countries need to be able to maintain food production but to meet greenhouse gas targets there might be needed changes in land use.

Hector Garcia-Gomez presented **"Investigating the links between climate, phenology and soils in a Mediterranean forest with the ForSAFE model"**, showing results from modelling a water limited forest in the Mediterranean in the framework of the MODICO-project. In the Mediterranean region, the hot and dry periods are expected to increase in the future, and to predict the consequences it is important to be able to model these areas. For the work, the ForSAFE 3.0 is used with several new components including daily time resolution, P-cycle, new phenology and improved hydrological processes in soil. The preliminary results show that the depletion of water during dry periods is well captured by the model, however periods of sustained high soil water content are not maintained in the simulation. Seasonal plant activity is well simulated. With regards to soil water chemistry abrupt changes are not captured by the model. As N-deposition is distributed in the rain by the model, it does not take into account dry deposition. The next challenge is to try do model the N-pulses and the effects of these on CL and CL exceedance calculations and the effect of changing climate.

Session 6 – Cooperation with other groups

– Chair: Alice James Casas

Within this session, 7 presentations were given:

- *"Update in the GAINS model, progress report from EMEP-CIAM" – by Wolfgang Schöpp*
- *"Task Force on Reactive Nitrogen – Good practices to strengthen the implementation of air pollution-related policies, strategies and measures" – by Tommy Dalgaard, Cláudia Marques dos Santos Cordovil, Mark Sutton*
- *"Achievements of the ICP Vegetation in 2019 and future work plan" – by Felicity Hayes, Katrina Sharps, Amanda Holder, Mike Perring and Josie Foster*
- *"Current activities at ICP Integrated Monitoring" – by Ulf Grandin, Salar Valinia, Martin Forsius, presented by Maria Holmberg*
- *"Status report ICP Waters" – by Kari Austnes*
- *"Update on ICP Forests activities" – by Kai Schwärzel, Anne-Katrin Prescher*
- *"Using Critical Loads in risk assessment" – by Jesper Leth Bak, Susan Zappala and Alexandra Cunha*

The abstracts of these are available in the present document below and the presentations themselves are available on the CCE website (https://www.umweltbundesamt.de/en/Coordination_Centre_for_Effects), providing consent for such dissemination has been given to CCE by their authors.

Presentations and directly associated discussions

Wolfgang Schöpp detailed the **Centre for Integrated Assessment Modelling's (CIAM) most recent activities**. He listed and explained the most recent developments of the GAINS model including its domain update, allowing coverage of EECCA countries. He presented the work achieved under the Second Clean Air Outlook (https://ec.europa.eu/environment/air/clean_air/outlook.htm) published in January 2021. He presented one of the key results under this remit, with differences shown between emission reduction commitments (ERCs) and emission projections for 2030 which are compliant for all pollutants (SO_2, NO_x, PM2.5 and VOC) except NH_3. Finally, he presented CIAM's work supporting the GP review with improved representation modelling of the EECCA and Western Balkan countries in the GAINS model.

Cláudia Marques dos Santos Cordovil, co-chair of the **Task Force on Reactive Nitrogen (TFRN)**, presented this subsidiary body under the WGSR and its four experts panels : the Expert Panel on Mitigating Agricultural Nitrogen (EPMAN), the Expert Panel on Nitrogen Budgets (EPNB), the Expert Panel on Nitrogen and Food (EPNF) and the Expert Panel on Nitrogen in EECCA countries (EPN-EECCA). She recalled the TFRN mandate to mainly enhance good practices to strengthen the implementation of air pollution-related policies, strategies and measures by, i.e. developing *"technical and scientific information, and options which can be used for strategy development across the UNECE to encourage coordination of air pollution policies on nitrogen in the context of the nitrogen cycle and which may be used by other bodies outside the Convention in consideration of other control measures"*. As an example, Cláudia Marques dos Santos Cordovil presented the UNECE Guidance Document on Integrated Sustainable Nitrogen Management which is an advisory document providing options to support Parties in "*managing the many impacts of wasted nitrogen for multiple societal benefit*". This Guidance complements the existing Ammonia Guidance and illustrates "*how action on air pollution has co-benefits for climate, water, biodiversity, health and economy*". Cláudia Marques dos Santos Cordovil also presented tasks and project under the four expert panels. In particular, she presented the EPNB (see http://www.clrtap-tfrn.org/epnb) co-chaired by Wilfried Winiwarter (IIASA-AT) and Markus Geupel (UBA-DE, also part of the CCE team) which elaborated the "Guidance Document on National Nitrogen Budgets" including detailed provisions of creating N budgets for seven out of eight pools (and a general overview on definitions and principles). She indicated that this guidance had been successfully applied to Germany (and other countries like Denmark). Finally, she indicated the revised mandate for permanent activities, stressing *inter alia* the importance of the development and publication of guidance documents on preventing and abating ammonia emissions from agricultural sources (ECE/EB.AIR/120, National Ammonia Codes (NAC)).

Felicity Hayes presented "**Achievements of the ICP Vegetation in 2020 and future work plan**", firstly announcing that the ICP Vegetation had been held early 2021 (22 – 24 February, web-conference) following a condensed programme, including separate moss and ozone specific sessions, a plenary session and some breakout discussion/poster/informal sessions. Presentation of main achievements comprised addition of mapping manual annexes (see Scientific Background Document B), development of coupled gsto-An model, relation between ozone flux and volume increment of *Fagus sylvatica* and *Picea abies*, ozone impacts on yield (loss for common beans) in India, Sri Lanka, Malaysia, Ethiopia, Tanzania, Kenya, Rwanda, Uganda, and DRC. Felicity Hayes also indicated the current work of ICP Vegetation in collaboration with other groups, including the contribution of many ICP Vegetation experts to the ongoing review and revision of empirical Critical Loads led by CCE, in particular for the chapters of the report dedicated to forests and grasslands. She also presented the main results of the moss survey led on 2015-2016 and announced the next survey to be held 2020-2022 for heavy metals, nitrogen and persistent organic pollutants (POPs). Finally, current workplan 2020-2021 was recalled and draft future workplan presented. **Next cooperation opportunities with ICP Vegetation** announced is 35th ICP Vegetation Task Force Meeting (Kaunas district, Lithuania) on 21 – 24 February 2022.

Maria Holmberg presented "**Current activities at ICP Integrated Monitoring**". The current ICP IM network involves 15 active countries, with 48 active sites. New interest from Canada has been noted. Three scientific papers are on the way of publication in priority topics as of workplan 2020-2021 items : (i) on the impacts of internal catchment -related nitrogen parameters to TIN leaching (by Jussi Vuorenmaa, to be submitted 2021), (ii) on heavy metals trends in concentrations and fluxes across ICP IM sites in Europe (by Karin Eklöf et al., draft manuscript submission); (iii) the effects of N enrichment on forest bryophyte vegetation, in cooperation with ICP Forests (by James Weldon et al., already submitted 2021). Maria Holmberg also indicated other Integrated Monitoring related scientific papers already published (doi:10.1017/S0024282921000037, doi.org/10.1016/j.scitotenv.2020.141791). Finally, she briefly presented the launching of "IM Light", which materialises the extension of ICP IM monitoring strategy which consists *inter alia* in a simplified reporting protocol and a wider openness for other ecosystem types than forests and for a higher number of sites. ICP Integrated Monitoring held its 29th Task Force Meeting (web-conference) on 13 – 14 May 2021.

Kari Austnes presented the "**Status report ICP Waters**". Besides information on regular meetings and website, she presented the progress and work foreseen and achieved, with the new reports published or ongoing. One noticeable ongoing work is the report on nitrogen 2020 – 2021 addressing trends and spatial patterns as well as biological responses to nitrogen. Kari Austnes presented the preliminary main findings of this report. Regarding the trends, it was shown that nitrogen deposition declined significantly in most sites, but that nitrogen trends in lakes and rivers do not show a simple response to deposition as almost half of the sites show nitrate concentration decrease and half of the sites show no significant trend in nitrate. Analysis are ongoing to better understand these observations, investigating the combined effects of deposition, climate and land cover. There was no clear indication of enrichment of soil N pools from TOC/TON. Regarding spatial variations issues, it was shown that there was a tendency towards higher NO_3 in sites with high nitrogen deposition and potentially low nitrogen retention and that TOC/TON ratio was related to land cover but may also reflect nitrogen enrichment. Further analyses are planned for a more in-depth analysis (e.g., different statistical approaches and time periods, inclusion of most recent water chemistry data). Potential nitrogen limitation during growing season, as indicated by low DIN:TP ratio, was shown for Norwegian river data. A Nordic lake dataset is also being analysed for similar effects. Kari Austnes indicated how the nitrogen report findings (e.g., phosphorous being the main control of lake productivity, better understanding of relationships between N deposition, water chemistry and biological responses, seasonal limitation of nitrogen) will contribute to revision of empirical Critical Loads for natural freshwaters. **Next cooperation opportunity with ICP Waters** is 37th ICP Waters Task Force Meeting (online) on 28 – 29 April 2021.

Anne-Katrin Prescher from ICP Forests presented an "**Update on ICP Forests activities**". Besides information on regular meetings and website, she presented the progress achieved in the 2020-2021 workplan with information from a study on heavy metals in forest floors and topsoils of ICP Forests Level I plots. She indicated how this work allowed concluding that heavy metals spatial variation patterns in forest floors and topsoils are found within countries, biogeographical regions and Europe, specifying that regional hotspots are visible on maps and can be linked interestingly with local pollution sources and well-known contaminated areas. On another scale, large-scale differences in heavy metal concentrations could be partly explained by soil group and humus form. Finally, it had also been noted that heavy metals accumulated significantly more in the humus

layer. ICP Forests held its Joint Expert Panel Meeting from 8 – 12 March 2021 (online). **Next cooperation opportunities with ICP Forests** are (i) 37th ICP Forests Task Force Meeting (Birmensdorf, Switzerland and online) on 10 – 11 June 2020 and (ii) the 9th Scientific Conference "FORECOMON 2021" (Birmensdorf, Switzerland and online), 7 – 9 June 2021.

Susan Zappala announced the wish of Aarhus University and the Joint Nature Conservation Committee (JNCC) to organise a workshop on the use of Critical Loads in Risk Assessment. She first recalled briefly the background for risk assessment and that impacts of air pollution on the natural environment may be using Critical Loads to conclude on. Susan Zappala indicated that the relevance of assessing how we use Critical Loads varies and could benefit from expert consideration could be discussed during a workshop JNCC and Aarhus University would organise. A call was made for advice on the organisation of such a workshop, including question on the scope and agenda with items such as (i) country overview, including heterogeneity of Critical Loads use in risk assessment and (ii) identification of challenges regarding e.g., caselaw, monitoring data availability, habitat degradation, clustering of emission sources. A list of issues to which attendees could answer was provided: What are the identified areas of alignment? Where approaches differ, explain why? Agreement on a set of principles to develop guidance on, Agreement upon the scope of what guidance should cover and who does what. ICP M&M members, CCE and CDM were identified as first community of experts to be invited and advice was asked for other possible invitation. The idea of the workshop was in general very much welcomed. Markus Geupel commented that Germany was interested in this initiative because Germany already applied Critical Loads for risk assessment purpose. He stressed that such a workshop would help fostering exchanges with nature conservation community and how they can make use of these data.

Session 7 – Progress on empirical Critical Load revision process

– Chair: Christin Loran (CCE)

Within this session, 2 presentations were given:

- *a joint presentation was given by CCE as the coordinator of this task and several experts as leaders of the chapters review "Review & Revision of Empirical Critical Loads for Nitrogen" – by Christin Loran, Roland Bobbink, Laurence Jones, Chris Field, Carly Stevens, Leon van den Berg, Sabine Braun and Markus Geupel et al.*
- *"Status and application of CLempN in the United States" – by Michael Bell*

The abstracts of these are available in the present document below and the presentations themselves are available on the CCE website (https://www.umweltbundesamt.de/en/Coordination_Centre_for_Effects), providing consent for such dissemination has been given to CCE by their authors.

Presentations and directly associated discussions

The presentation on the current status of the revision of empirical Critical Loads for Nitrogen (CLempN) was a joined presentation by Christin Loran, Laurence Jones, Chris Field, Carly Stevens, Sabine Braun and Markus Geupel. The first presenter was Christin from the CCE, who is the main person responsible for the coordination of the process in close collaboration with Roland Bobbink, who has been assigned by the CCE with the scientific lead (unfortunately Roland could not attend this meeting). The process is funded by the CCE and its NFCs.

Schedule: The virtual kick-off meeting in June 2020 was attended by 58 participants. Since then, 45 authors have been working on updating the different chapters of Bobbink et al. (2011). The schedule anticipates that the first (internal) revision will be completed in June 2021. In July, the CCE will prepare and send the progress report to WGE for the 7th joint session. A second review by external experts is planned between July and September 2021. Experts who are interested in participating the external review round are welcome to contact CCE@uba.de (latest by mid May 2021). The UNECE CCE expert workshop on empirical Critical Loads for Nitrogen is currently planned for 26th to 28th October 2021 in Bern, Switzerland (if the corona pandemic allows it, otherwise it will need to be changed to an online meeting). Following the expert workshop, the background document will be finalized after addition and incorporation of the comments of the workshop participants. In addition, a draft executive summary will be produced for formal use in the UNECE till April 2022.

Current status of work: This was presented by the main authors. Christin Loran, on behalf of Roland Bobbink, presented an overview of the changes to Chapter 2, which describes the procedure for updating CLempN. An important paragraph on gradient studies was added to provide guidance to the authors on the use of gradient studies. The current status of work and preliminary results for the various EUNIS classes were presented by experts: marine habitats; inland surface waters; heath, scrub, and tundra by Christin Loran on behalf of Leon van den Berg, coastal habitats by Laurence Jones, bogs and fens by Chris Field, grasslands and areas dominated by grasses, mosses, or lichens by Carly Stevens, forest, woodland, and other forested areas by Sabine Braun. Finally, Markus Geupel introduced the new chapter “aspects of application”. Overall, the literature review for most chapters has been completed and most authors are now in the process of revising CLempN. For some CLempN in different habitats, the authors presented their preliminary results from the literature review and proposed a modification of the currently proposed CLempN. It is to be noted that scientific evidence currently available lead to a decrease of the CLempN in most cases.

Discussion: Following the presentation, there was an extensive discussion on the use of gradient studies. These studies are an extremely important source of information and should be included in the process, as they provide very useful findings in addition to experimental studies. Nevertheless, it is important to critically consider the methodology used in each gradient study and thereby assess their reliability to consider the corresponding results with caution. In addition, the question was raised about appropriate change points and how far a change point may be defined as the point at which adverse effects can be measured. The discussion on the inclusion of gradient studies will be further continued during the process.

As stated already, the preliminary results on the empirical Critical Loads of the respective EUNIS classes show that based on new scientific evidence, a decrease of some Critical Loads is proposed. During the discussion it was pointed out that a further decrease of these should be well elaborated. Because for conservationists and biodiversity specialists working with sensitive ecosystems, these changes are of great importance. If achieving the Critical Loads becomes (almost) impossible, it may result in politicians resigning. On the other hand, it is important that the current state of science is openly communicated and that results are not withhold. A good balance is therefore needed in this matter.

The proposal for the new chapter "Aspects of Application of CLempN" was controversially discussed. Concerns were expressed that the remaining time period is too short to produce a qualitative chapter. In addition, some participants think that the report should be kept purely scientific and that science and policy should not be mixed. As an answer to this, CCE expressed its view that the linking of science and policy was deemed one of its main tasks, given that the task of the CCE in the convention is to collect and process data and make them available to policy makers. The CL is a concept developed for policy making to inform about risks. Therefore, it will be useful to provide guidance on how data can be used for policymaking. The aim of this chapter is to provide a summary how CLs are applied in different countries and thus provide guidance on how CLs can be used in general. The goal of this chapter is not to give an instruction on how to use CL, but a guidance to the possible uses to help NFCs and policymakers in their work. Reference was also made to a similar chapter in the Mapping Manual that should be considered as well.

Michael Bell presented under the title “**Status and application of CLempN in the United States**“ that the amount of data used to develop and implement Critical Loads of nitrogen and Critical Loads of sulfur within the United States has increased greatly in recent years. US federal agencies are using this data to help assess National Ambient Air Quality Standards, inform management decisions, and assess the risk of new and modified sources of air pollution. Given that each Critical Load uses a unique dataset and methods summarizing this information can be challenging. Scientists and land managers have developed a hierarchical approach to summarizing data that provides an initial metric for each ecosystem type then allows the user to expand data based on their interests. The outputs for land management boundaries provide species lists, point-based assessments, and distribution maps that report Critical Loads and Critical Load exceedances based on current deposition levels.

Session 8 – Special focus on Gothenburg Protocol review (2/2)

– Chair: Filip Moldan (CDM)

Within this session, 4 presentations were given:

- *"Modelling and Mapping community new scientific findings contributing to GP review" – by Filip Moldan*
- *"Specific issues relating to Dynamic Modelling activities" – by Filip Moldan*
- *"Mobius: A Model building system" – by Magnus Dahler Norling, Leah Jackson-Blake, Jose-Luis Guerrero, James Sample, Øyvind Kaste, Heleen de Wit, Thorjørn Larssen, Luca Nizzetto, Raoul-Marie Couture, Francois Clayer, Zofia Rudjord, Johannes Grødem*
- *"Soil Organic Matter Dynamics and Nutrient Cycling: Updates to the MAGIC Model" – by Jack Cosby*

The abstracts of these are available in the present document below and the presentations themselves are available on the CCE website (https://www.umweltbundesamt.de/en/Coordination_Centre_for_Effects), providing consent for such dissemination has been given to CCE by their authors.

Presentations and directly associated discussions

Filip Moldan presented an "**Overview of JEG DM achievements until Dec. 2019 & Work Plan for CDM**" starting with a look back on the formation of JEG DM in 1999 as an *ad hoc* group directed towards the future development of dynamic modelling and its inclusion under the WGE in 2001. The presentation then focused on the work with developing target loads in the early days of JEG DM and the question why they were never used to form the policy and what lessons could be learned for future work. Speculatively, this could be attributed to factors such as resistance to new concepts or too complicated calculations, but more likely there was not enough of follow up to explain and demonstrate the benefits of the concept outside the scientific community. Filip Moldan then discussed different useful aspects of dynamic modelling: to calculate and visualize possible future development under different scenarios, integrate, interpret and package theoretical knowledge with results from experiments and monitoring. JEG DM was an important forum for scientists to interact and to co-ordinate efforts and many issues were discussed and reported to the WGE. However, it had no mandate and no resources, in contrast the newly formed CDM have both. The key elements of the mandate are to develop and promote dynamic modelling, develop common web access point to all groups within WGE and to connect with DM groups both within and outside the Convention. The presentation ended with some thoughts on how to utilize dynamic modelling in the work of LRTAP.

Maximilian Posch gave an overview of the work done until the end of 2017 by the ICP M&M on biodiversity modelling, especially on CL, in a presentation entitled "**Critical Loads for Biodiversity CCE work ≤ 2017 & view on future**". This work had ended with a European biodiversity CL (CLbio) database. However, the NFCs who submitted CLbio (7 Parties) did not feel enough confidence in the calculations to be used for policy purposes. Therefore, WGE had decided that those CLs were not (yet) to be used in IAM. Finally, points for potential further work on biodiversity indicators were summarised, including a continuation linking biodiversity indicators to CLs, but also, e.g. dose-response modelling.

Ed Rowe presented "**Progress with metrics and biodiversity-based Critical Loads**". Simple metrics and targets are often preferred, e.g. the target in the 2019 Clean Air Strategy for England is expressed in terms of N deposition, not Critical Load exceedance. However, dynamic modelling of species responses can account for damage and recovery delays, and produce metrics more closely related to biodiversity targets. Models and metrics developed in recent years have great potential for summarising and communicating the science of pollution impacts.

Todd McDonnell gave an overview of the "**Biodiversity Modeling and Critical Loads Assessment in the USA**". Vegetation response functions (expressed as version 2 of the Probability of Occurrence of Plant Species model for the United States [US-PROPS v2]) were developed based on observations of forest understory and grassland plant species presence/absence and associated abiotic characteristics derived from spatial datasets. Improvements to the US-PROPS model, relative to version 1, were mostly focused on inclusion of additional input data, development of custom species-level input datasets, and implementation of methods to address uncertainty. The application of US-PROPS v2 were investigated to evaluate the potential impacts of atmospheric nitrogen (N) and sulphur (S) deposition, and climate change on forest ecosystems at three

forested sites located in New Hampshire, Virginia, and Tennessee in the eastern United States. Species-level N and S Critical Loads (CLs) were determined under ambient deposition at all three modeled sites. CL exceedance was found at all three model sites. The New Hampshire site included the largest percentage of species in exceedance. Simulated warming air temperature typically resulted in lower maximum occurrence probability, which contributed to lower CLs of N and S deposition. According to the authors of this work, the US-PROPS v2 model, together with the PROPS-CLF model to derive CL functions, can be used to develop site-specific CLs for plants within broad regions of the United States.

Thomas Dirnböck presented "**Biological effects of currently legislated decreases in nitrogen deposition in Europe**" Presented results are based on the work of ICP IM, ICP Forests and the H2020 project eLTER. Based on CLE and B10 emissions scenario modelled with the EMEP model and climate scenarios RCP4.5 and RCP8.5, the used model chain (including VSD+ and PROPS) predicted further decrease in oligotrophic species attributable to still high N deposition between now and the year 2030. The presentation acknowledged the leading role of the PROPS database. The importance of factors other than air pollution (such as changes in light conditions for the forest understory vegetation due to management practices) was highlighted. Further work on development of biodiversity change indicators was recommended. Using positive indicators such as low-N species was identified as a very promising approach.

Kayla Wilkins informed on a tremendous piece of work on "**Response of more than 1000 herbaceous species across 20 vegetation alliances to atmospheric deposition of nitrogen in the United States**". She introduced the topic stating that as atmospheric N deposition is recognized as a key driver of biodiversity loss leading to shifts in species composition, often to undesirable species, through eutrophication, acidification, and reduced pest resistance, adding that while N deposition has decreased in the United States (U.S.) since the enactment of air quality policies in the 1990s, reduced forms of N have increased in many regions, and atmospheric N deposition still remains elevated at levels that may negatively impact sensitive plant species. The authors applied Threshold Indicator Taxon Analysis (TITAN) to plant species abundance data for more than 1000 species occurring within 20 vegetation alliances across the U.S. to identify N deposition thresholds at which those species significantly changed in abundance. Further, TITAN was used to assess synchrony in the individual species change points to determine a community level N deposition change point for each vegetation alliance. The community level change points ranged from 1.8 kg N ha^{-1} yr^{-1} (*Artemisia tridentata* shrubland alliance) to 14.3 kg N ha^{-1} yr^{-1} (*Fagus grandifolia* - *Quercus rubra* - *Quercus alba* forest alliance), based on species that demonstrated a decrease in abundance across the N deposition gradient. At the species level, a wide range of change points for species was found decreasing in abundance, from 1.3 kg N ha^{-1} yr^{-1} (*Sisymbrium altissimum*) to 16.8 kg N ha^{-1} yr^{-1} (*Euonymus americanus*). In general, for species that occurred in multiple vegetation alliances there was little variation in their change points across the alliances (mean = 1.92 kg N ha^{-1} yr^{-1}, median = 1.3 kg N ha^{-1} yr^{-1}). Kayla Wilkins concluded stating that this approach offers a powerful way to examine a large number of species across different habitats, thus expanding our understanding of the impacts of N deposition in the U.S., and could contribute to air quality policies in the U.S.

Discussion about further work on DM

Filip Moldan presented the **GPG Document Item 2.8: Modelling and Mapping community new scientific findings contributing to GP review,** asked the group what the most important questions would be and opened the floor for discussion. The responses included the interaction between atmospheric pollution and climate change: effects, adaptation and strategies for mitigation e.g. storage of C in soil. Another issue raised was that even though N-deposition has been going down since the 1990's there is still very little known about ecosystem recovery and the question of effects on biodiversity due to different pollutants as well as their interactions.

Filip Moldan gave a **brief presentation of CDM** and continued on to **updates on dynamic modelling activities**. In view of the review of the GP DM is an important complement to CL calculations that can be used to make predictions/projections of the state of ecosystems in the future. There is a clear wish from LRTAP to have biodiversity modelling as a basis for CL calculations and more work is needed in this matter. Several examples on DM have been mentioned from ICPs IM, Waters, Forests and from other groups/projects.

Magnus Norling presented "**MOBIUS – A Model building system**". MOBIUS is an open source model building system available at GitHub - NIVANorge/Mobius: C++ Model Building System. Optimized for speed of execution. MOBIUS is aimed at model users and model developers with an easy to read model code and user-friendly graphical user-interface and file formats. Modules can be linked together to produce different models and has a flexible structure. Furthermore, it is easy to plug models into larger systems e.g. to run climate scenarios, batch runs or uncertainty/sensitivity analysis. Primarily MOBIUS was developed to model catchments (routing of precipitation through soil and groundwater into rivers and streams and assorted transport and reactions of chemical compounds and sediments) but can also be used to build e.g. biological population models. Several existing catchment models are already implemented in Mobius including MAGIC, INCA models + PERSiST (C, N, P, Microplastics, Tox) and Simply models.

Jack Cosby presented **"Soil Organic Matter Dynamics and Nutrient Cycling: Updates to the MAGIC Model"** This latest development of the MAGIC model reflects new way of understanding of soil organic matter dynamics. Rather than viewing the SOM dynamics being determined by the molecular structure of the material entering the soil, the SOM persistence is controlled by the physical and chemical environment (soil humidity, air, soil pH) and by the microbial community and its access the SOM. This has led to new conceptual development in DM, introduction of new definitions of SOM pools and introduction of new links between SOM dynamics and nutrient cycles. He also discussed the increased focus on understanding and modelling soils, the concept of soil health and the importance of C storage in soils. To correctly model the soils requires to consider both air pollution and climate driven effects.

Session 9 – Special focus on Science Strategy review

– Chair: Alice James Casas

Within this session, one presentation was given:

- *"Progress made towards the update of the Science Strategy with respect to the Long-Term Strategy (LTS) for the Convention" – by Alice James Casas, Markus Geupel and Filip Moldan*

Presentations and directly associated discussions

Alice James Casas introduced the Science Strategy of the effects-oriented activities[1] update with respect to the Long-Term Strategy (LTS) for the Convention and ICP M&M linked topics.

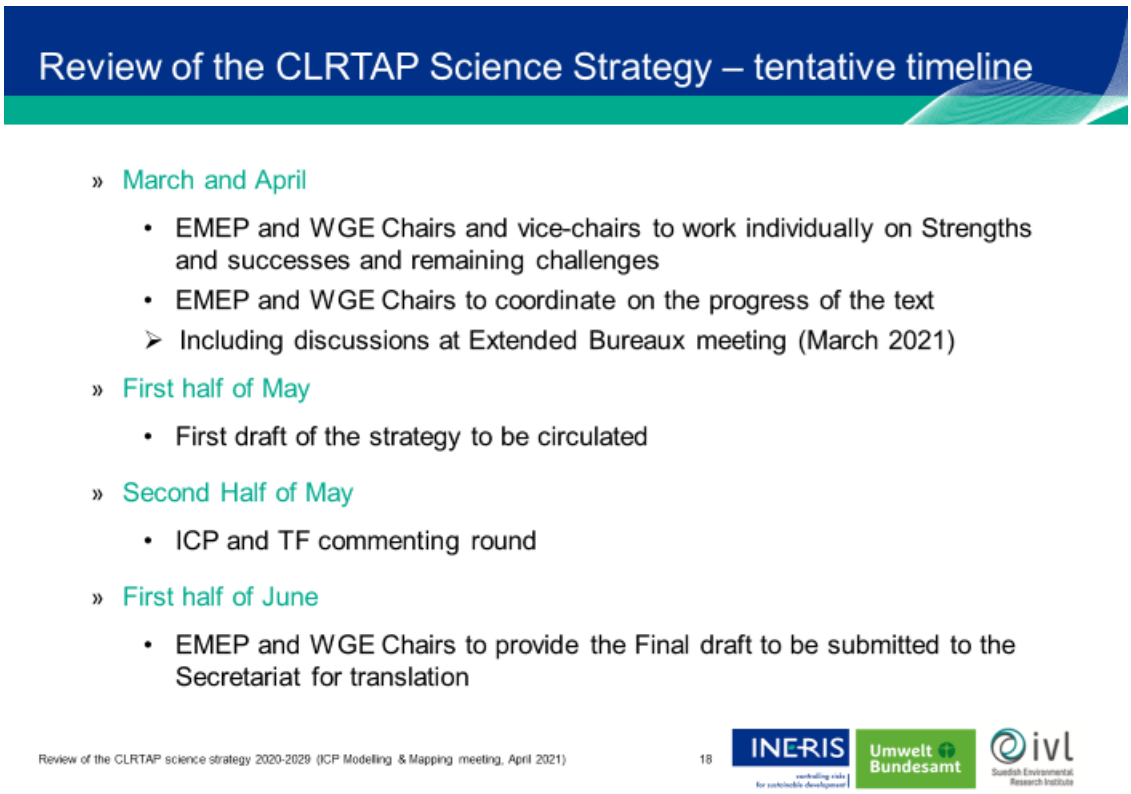
In 2019, the EMEP Steering Body and the WGE were asked to review jointly their 2010 – 2020 long-term Science Strategy and to align with the 2018 version of the LTS for the LRTAP Convention[2]. This update was launched in 2020 by requesting subsidiary bodies for their input but the Covid-19 pandemic has delayed the process. This is the reason why the update is still ongoing. Alice James Casas presented progress made on the draft document since last year and recalled the inputs sent by ICP M&M to WGE as outputs of the discussions held on the topic during the ICP M&M 2020 annual meeting:

- Main scientific tasks for ICP M&M in the next 10 years and beyond:
  - Improve the modelling and calculation of Critical Loads for eutrophication
  - Improve assessment of ammonia effects via (i) the review and update of critical levels of NH3, (ii) the better linking of air quality and biodiversity monitoring.
  - Enhance the role of non-forest ecosystems in future monitoring and modelling activities
  - Consider Heavy Metals (HM) in future assessments of ecosystem health, update Critical Loads on HM
- Remaining challenges and needed improvements of methods and tools:
  - link biogeochemical change to species changes, possibly with tools such as Target Loads;
  - include all habitat types for biodiversity, with a better harmonization between countries; or/and on the European scale
- Ways of and improvement of communication:
  - communication leaned towards ICP M&M experts, via training sessions
  - communication leaned towards policy

Finally, Alice James Casas present the imminent next steps with the foreseen timeline communicated during the Joint EMEP/WGE Extended Bureaux meeting in March 2021 (see the screenshot below) and welcomed any new input to be communicated to the WGE Chair.

[1] https://www.unece.org/fileadmin/DAM/env/documents/2013/air/wge/Informal_document_no_18_Revised_Long-term_Strategy_of_the_effects-oriented_activities_clean_text.pdf

[2] http://www.unece.org/fileadmin/DAM/env/documents/2018/Air/EB/correct_numbering_Decision_2018_5.pdf



Further inputs to the Science Strategy update

During the discussion, Ed Rowe welcomed the opportunity to comment. He first communicated his full support to the Science Strategy, stressing the importance of this document. He also suggested that communication on the success of the Science Strategy in question could be enhanced by communicating scenarios of what would have been the atmospheric environment status without the work achieved under the Convention and the implementation of the corresponding mitigation measures over the past 20 years, indicated that this message may be as forceful as the statement of the progress achieved *with* these mitigation measures into place. Reto Meier indicated that a report on "cost of inaction" is currently under preparation by the Task Force of Integrated Assessment Modelling. This remark was supported by Jesper Bak.

Later in the discussion, Jesper Bak also commented that a clearer communication on scales was needed, also to support work linked to biodiversity. Indeed, scales used are very different between different topics of interest and different pollutants (NH3 to be treated on local scale, health effects need to be treated on a city scale, etc.).

Session 10 – Workplan 2022-2023

– Chair: Alice James Casas, Markus Geupel (CCE) and Filip Moldan (CDM)

Within this session, one presentation was given:

- *"ICP M&M workplan 2022-2023 – Preliminary proposals to be discussed – by Alice James Casas, Markus Geupel and Filip Moldan*

Presentations and directly associated discussions

Markus Geupel (CCE) and Filip Moldan (CDM) presented the new items proposed for the upcoming workplan of the ICP M&M. These are reported in the Table 2 (repeated below).

(repeated) Table 2: Biennial proposed ICP M&M workplan for 2022-2023.

Workplan item	Activity description/objective	Expected outcome/deliverable	Lead body(ies)	Resource requirements and/or funding source
#1	Empirical Critical Loads: Review and revision of the CLempN published in 2011 (*continued*)	Report on empirical Critical Loads in Europe (2022)	ICP M&M / CCE	National Focal Centres and recommended contributions
#2	Update of the harmonized CLRTAP receptor map	Harmonized receptor map for Europe (2023)	ICP M&M / CCE	CCE and Germany
#3	Critical Levels of ammonia: literature review and empirical data provision supporting a workshop	Organization of an International Workshop and Workshop report	ICP M&M / CCE	CCE and Germany
#4	Modelling interaction between air pollution and climate change: N and C	Expert workshop (2022)	ICP M&M / CDM	CDM and National Focal Centres experts
#5	Modelling impact of air pollution on biodiversity in 2030 and beyond	Report on methodology development (2023)	ICP M&M / CDM	CDM and National Focal Centres experts

Regarding the update of the harmonized CLRTAP receptor map, Christin Loran explained that this project will be carried out in the coming months and funded by CCE. The call for tenders is currently being prepared at UBA and is expected to be communicated externally at the end of summer 2021 with a view to receiving a response in the fall and launching before the end of this year. The project, which will run a little over a year, consists in updating the European landcover map currently used in the European BGDB and also adding data from EECCA countries and even the entire Convention region. This update is of interest for CCE tasks, e.g. Critical Loads modelling, but also for other subsidiary bodies of the Convention, e.g., MSC-W for calculating of deposition data.

Regarding the critical levels of ammonia Markus Geupel, representing the CCE and Germany, proposed to hold an international expert workshop including the preparation of a workshop report as workplan items for 2022-2023. Ammonia is a main driver of nitrogen deposition. Besides that, it causes direct effects on vegetation. Critical levels of ammonia have lastly been updated scientifically last in 2009. Following previous discussions within meetings, e.g., ICP M&M 2020 and WGE-EMEP Extended Bureau Meeting 2021, there was a consensus interest on a future review of the critical levels of ammonia. UBA Germany has launched a project to update knowledge on critical levels of ammonia already in 2019. This project aims at reviewing the most recent literature with respect to effects of ammonia on ecosystems and at the implementation of experimental setups to assess ammonia sensitivity for different sensitive plant species in Germany. In the framework of this project an international workshop will be prepared to discuss and communicate the results of the mentioned tasks to the international scientific community. It is proposed that this workshop and its report are part of the ICP M&M workplan 2022-2023.

Filip Moldan then introduced CDM's plan to hold an expert workshop on modelling interaction between air pollution and climate change. Modelling N and C cycling in ecosystems provides a logical link between air pollution and climate change. CDM proposed that more interaction is needed between our community modelling the N cycling and the national climate reporting which is dealing with C cycling as such. This link to stimulate exchanges between the two communities is the aim of this workplan item. Filip Moldan asked for advice on contacts to climate experts who might be interested to participate in the work jointly with CDM and WGE experts.

Finally, Filip Moldan recalled the reason for CDM's future work for modelling impact of air pollution on biodiversity in 2030 and beyond. A report on methodology development is proposed for 2023 to progress on how Critical Loads for biodiversity may be calculated. He, *inter alia*, recalled that indicators of biodiversity change need to be agreed upon (e.g. Habitat Suitability Index, HSI).

Discussion about further work under workplan 2022-2023

Regarding the update of the receptor map, it was raised during discussions that an extension to the whole Convention region would be very welcome. It was also added that while developing this task's call for tender, it may be relevant to specify the possible cross work with designated areas concerned in regard to the Habitat Directive (cf. Annex I). Ed Rowe indicated that UK was about to revise its soil and land use maps in 2021 and was welcoming to collaborate on the receptor map's update.

Regarding the work plan items on further development for Critical Loads for biodiversity, it was agreed that work should progress and that differences in timing between empirical Critical Loads for N and the mass balance Critical Loads should be highlighted.

More widely, while working on development of Critical Loads for biodiversity, it was indicated that one should be aware of what biodiversity is in terms of concept. A concept which should not simply relate to ecosystems services but more closely to tools preventing us from species extinction.

- **On the whole, proposals made by the chair of the Programme Task Force, CCE and CDM were welcomed and adopted during the meeting. These will be presented to the next Joint EMEP/WGE Session in September 2021.**

Annexes

Annex I – Final Agenda

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)

37th Task Force Meeting, 28th CCE Workshop, and 2nd CDM Meeting

Web-conference, on Microsoft TEAMS

on afternoons of Tuesday 20, Wednesday 21 and Thursday 22 April 2021

Times listed in UTC +2

FINAL AGENDA

Tuesday 20 April afternoon				
Welcome and Opening session Chair: Alice James Casas				
13:30	–	14:00	Connection to the meeting / welcome	Alice James C.
14:00	–	14:15	"Tour de table", introduction & meeting good practices	Alice James C.
14:15	–	14:30	Gothenburg Protocol (GP) review process	Dominique Pritula
14:30	–	14:45	Update on WGE and Convention issues	Isaura Rabago
14:45	–	15:00	Agenda of the meeting	Alice James C.
Current status of the Call for data Chair: CCE				
15:00	–	15:15	Current status of the Call for Data	Thomas Scheuschner
15:15	–	15:30	Discussion on the process	All
15:30	–	15:50	Modelling and monitoring impacts of air pollution in Ireland	David Kelleghan
15:50	–	16:10	Update on Critical Loads in the Czech Republic	Tomáš Chuman
16:10	–	16:30	Updates from the US : an overview of several projects related to Critical Loads and ecosystem vulnerability to N and S deposition in the US	Christopher Clark
16:30	–	17:00	Comfort Break	
Progress on development of the European background database for Critical Loads Chair: CCE				
17:00	–	17:10	Progress achieved on developing the new European background database	Christin Loran
17:10	–	17:30	New European background database: Updates and changes	Gert Jan Reinds
17:30	–	18:00	Discussion on the process	All

Wednesday 21 April afternoon				
13:30	–	14:00	Connection to the meeting / welcome / side discussions	Alice James C.

Special focus on Gothenburg Protocol review (1/2) – Focus on inputs foreseen from ICP M&M Chair: CCE				
14:00	–	14:15	GPG Document Item 2.2 : Data input from CCE (CCE risk calculations, cooperation with EMEP)	CCE
14:15	–	14:30	Discussions on the process	All

NFCs' contributions to effect-oriented activities Chair: CDM				
14:30	–	14:45	Evaluating the Critical loads using data from the national lake survey 2019	Kari Austnes
14:45	–	15:00	Critical Loads of hundreds of headwater streams in China using SSWC model	Lei Duan
15:00	–	15:15	Nitrogen Futures: ambitions for reducing N pollution in a rapidly changing UK context	Ed Rowe
15:15	–	15:30	Investigating the links between climate, phenology and soils in a Mediterranean forest with the ForSAFE model	Hector Garcia-Gomez
15:30	–	15:45	Discussion	All
15:45	–	16:15	Comfort Break	

Cooperation with other groups Chair: Alice James Casas				
16:15	–	16:30	Update in the GAINS model, progress report from EMEP-CIAM	Wolfgang Schoepp
16:30	–	16:45	On behalf of the Task Force on reactive nitrogen	Claudia Cordovil
16:45	–	17:00	Recent and relevant activities of the ICP vegetation	Felicity Hayes
17:00	–	17:15	Brief update on ICP IM activities	Maria Holmberg
17:15	–	17:30	ICP Waters status and progress	Kari Austnes
17:30	–	17:45	Update on recent activities from the ICP F	Ann-Katrin Prescher
17:45	–	18:00	Using Critical Loads in risk assessment: examples and a request for advice	Susan Zappala

Our very special focus this year is on the on-going Gothenburg Protocol review process, with two dedicated sessions dealing with the review of progress made towards achieving the environmental and health objectives of the Protocol.

For further details, see item 2 of the table of the Annex in the Draft annotated outline of the report on the review of the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone) and more particularly :

** **question n° 2.2** relating to changes in exceedance of Critical Loads for acidification and eutrophication since last decades and projected changes and referred to in **section "D. Measured and modelled atmospheric concentrations and deposition levels"** of the core text.*

** **question n° 2.8** relating to expected impacts of new scientific findings on environmental and health effects assessments, e.g. on Critical Loads, critical levels of ozone, PM, NO2 and NH3, dynamic modelling of ecosystem recovery, interactions between air pollution, climate change, nitrogen fluxes and other stress factors for biodiversity and referred to in **section "E. Measured and modelled effects on natural ecosystems, materials and crops and assessment of human health effects"** of the core text.*

Thursday 22 April afternoon				
13:30	–	14:00	Connection to the meeting / welcome / side discussions	Alice James C.

Progress on empirical Critical Load revision process Chair: CCE				
14:00	–	15:00	Current status of the revision of empirical Critical Loads for Nitrogen (CLempN)	
			General overview of the process	Christin Loran
			Chapter - Updating and reviewing procedure for CLempN	Roland Bobbink
			Chapter - Marine habitats (EUNIS class A)	Roland Bobbink
			Chapter - Coastal habitats (EUNIS class B)	Laurence Jones
			Chapter - Inland surface waters (EUNIS class C)	Christin Loran
			Chapter - Mires, bogs and fens (EUNIS class D)	Chris Field
			Chapter - Grasslands and lands dominated by forbs, mosses or lichens (EUNIS class E)	Carly Stevens
			Chapter - Heathland, scrub and tundra (EUNIS class S)	Leon v.d.Berg / Christin Loran
			Chapter - Woodland, forest and other wooded land (EUNIS class T)	Sabine Braun
			Chapter - Area and aspects of application	Markus Geupel
15:00	–	15:15	Discussion on the process	All
15:15	–	15:30	Status and application of CLempN in the United States	Michael Bell

Special focus on Gothenburg Protocol review (2/2) – Focus on inputs foreseen from ICP M&M Chair: CDM				
15:30	–	15:45	GPG Document Item 2.8 : Modelling and Mapping community new scientific findings contributing to GP review	Filip Moldan
15:45	–	16:00	Discussion on the process	All
16:00	–	16:30	Specific issues relating to Dynamic Modelling activities	CDM / Magnus Norling
16:30	–	16:45	Adding Phosphorous to the C and N cycling in MAGIC	Jack Cosby
16:45	–	17:00	Brief Break	

Special focus on Long Term Strategy review Chair: Alice James Casas & CCE & CDM				
17:00	–	17:15	Presentation of the process and state of play	Alice James C.
17:15	–	17:30	Discussions on the process	All

WorkPlan 2022-2023 Chair: Alice James Casas & CCE & CDM				
17:30	–	17:45	Preliminary proposals to be discussed	CCE & CDM
17:45	–	18:00	Discussion	All

Please return any inputs or comments to all the following contact points:

Alice James Casas – alice.james@ineris.fr
CCE – cce@uba.de
CDM – cdm@ivl.se

Annex II – List of participants

Name	First Name	CLRTAP Role	Oral presentation
Aherne	Julian	NFC	
Akujärvi	Anu		
Augustin	Sabine		
Austnes	Kari	NFC	1) evaluating the critical loads using data from the national lake survey 2019 2) ICP Waters status and progress
Bak	Jesper	NFC	
Bealey	Bill		
Bell	Michael	NFC	Status and application of CLempN in the United States
Branquinho	Cristina		
Braun	Sabine		Review of critical loads of nitrogen : Progress report from the forest group
Bugalho	Lourdes		
Chuman	Tomáš	NFC	Update on Critical Loads in the Czech Republic
Clark	Christopher		Updates from the US: an overview of several projects related to critical loads and ecosystem vulnerability to N and S deposition in the US
Cordovil	Claudia		On behalf of the Task Force on reactive nitrogen
Cosby	Bernard		Adding phosphorous to the C and N cycling in MAGIC
De Marco	Alessandra		
Dirnböck	Thomas	NFC	
Dombos	Miklos	NFC	
Duan	Lei		Critical loads of hundreds of headwater streams in China using SSWC model
Evstafava	Elena	NFC	
Felker-Quinn	Emmi		
Field	Chris		Revision of empirical CL for Nitrogen
Forbes	Emily		
Fornasier	Francesca	NFC	
Futter	Martyn		
Garcia-Gomez	Hector		Investigating the links between climate, phenology and soils in a Mediterranean forest with the ForSAFE model
Geiser	Linda		
Georgiev	Georgi	NFC	
Geupel	Markus	CCE Team	Part of the CCE's contribution
Gromov	Sergey	NFC	
Hayes	Felicity	ICP Vegetation	Recent and relevant activites of the ICP vegetation
Hinsberg van	Arjen	NFC	
Holmberg	Maria	NFC / ICP IM	Brief update on ICP IM activities
James	Alice	ICP MM Chair	Update on Science Strategy review process
Jones	Laurence		Revision of empirical CL for Nitrogen

Name	First Name	CLRTAP Role	Oral presentation
Junttila	Virpi		
Jutterström	Sara	CDM Team	Part of the CDM's contribution
Kaltenegger	Katrin		
Karimov	Bekzod		
Kelleghan	David		Modelling and monitoring impacts of air pollution in Ireland
Kohli	Lukas		
Kurén Weldon	James		
Loran	Christin	CCE Team	Part of the CCE's contribution
Manninen	Sirkku		
Marmane	Ian		
Meier	Reto	NFC	
Moldan	Filip	CDM Team	Part of the CDM's contribution
Neirynck	Johan	NFC	
Norling	Magnus		As part of CDM activities update, The Mobius modeling framework
Olendrzynski	Krzysztof		
Oliveira	Maria Alexandra		
Pardo	Linda		
Pecka	Tomasz	NFC	
Phelan	Jennifer		
Posch	Maximilian		
Prescher	Ann-Katrin	PCC (ICP Forest)	Update on recent activities from the ICP F
Pritula	Dominique	WGSR Vice Chair	Gothenburg Protocol (GP) review process
Rabago	Isaura	WGE Chair	Recent developments under the Air Convention: Challenges and opportunities for action
Reinds	Gert Jan		CCE background data base : conversion of RIVM-CCE software to a new system for UBA
Richter	Simone		
Roth	Tobias		
Rowe	Ed	NFC	Nitrogen Futures: ambitions for reducing N pollution in a rapidly changing UK context
Sawicka	Kasia	NFC	
Schembri	Ariana		
Scheuschner	Thomas	CCE Team	Part of the CCE's contribution
Schoepp	Wolfgang		Update in the GAINS model, progress report from EMEP-CIAM
Serrano	Helena Cristina		
Sicard	Pierre		

Name	First Name	CLRTAP Role	Oral presentation
Sosa	Rodolfo		
Steingruber	Sandra		
Stevens	Carly		Revision of empirical CL for Nitrogen
Vanderheyden	Vincent	NFC	
Vowles	David		
Warnecke	Laura		
Wilkins	Kayla		
Zapala	Susan		Using critical loads in risk assessent: examples and a request for advice