Convention on Long-range Transboundary Air Pollution

Working Group on Effects

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

Co-chair: Alice James Casas, Laurence Rouïl

Coordination Centre for Effects hosted by the German Environment Agency; headed by a transition team consisting of:
Simone Richter, Markus Geupel, Thomas Scheuschner, and Christin Loran

Report of the 35th ICP M&M Task Force Meeting on assessments of impacts of air pollution, and interactions with climate change, biodiversity and ecosystem services

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Introduction of the ICP and objectives of the 2019 meeting

The International Cooperative Programme on Modelling and Mapping of Critical Levels and Loads and Air Pollution Effects, Risks and Trends (ICP M&M) is a programme under the Executive Body of the Convention on Long-Range Transboundary Air Pollution.

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 International Cooperative Programme on Modelling and Mapping of Critical Levels and Loads and Air Pollution Effects, Risks and Trends (ICP Modelling and Mapping) was established in 1988.

The objectives of the ICP Modelling and Mapping are to: 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; to map pollutant depositions and concentrations which exceed critical thresholds; and to establish appropriate methods as a basis for assessing potential damage, e.g. via dynamic modelling.
Various European databases on soil, land, climatic and other variables are used to calculate critical loads for those countries that are unable to provide national data. The maps are used for integrated assessment modelling by the Task Force on Integrated Assessment Modelling (TFIAM).

The programme is planned and coordinated by a Task Force 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) at the German Environment Agency (UBA).

The work achieved by CCE and the national contributions on ongoing activities held since early 2018 were presented during the 35th Annual Meeting ICP Modelling and Mapping in Madrid (Spain) from 2nd to 4th April 2019. These were mainly related to the previously defined main scientifically challenges, grouped under the following items:

- Steady state modelling
- Empirical Critical Loads
- Critical Load for biodiversity

The main discussions and conclusions as regard these scientific challenges on which it was chosen to focus during the meeting are presented hereafter in Chapter 2, after the current status of the CCE work is presented (Chapter 1).
Summaries of presentations (proceedings) and the discussions (minutes) directly associated to those are given in the Chapter 3.

Chapter 1 – Current status of the databases underlying CL and CL exceedance calculations

The UBA is hosting the CCE since 2018 and therefore is still in a transition phase consisting in information and data retrieval from the previous contributors (RIVM). The CCE Critical Load database (DB) is structured as an MS SQL DB. Beside the national input sent by NCFs (2015 – 2017 call for data was extended until February 2019), the CCE uses its own modelling results (the so-called "Background DataBase", BGDB) in order to fill in the gaps when NFC did not submit any data. CCE is currently working on rebuilding of this background DB and setting up the data frame for the database. Furthermore, CCE is working on the Web Map Service (WMS) in order to make the CL maps accessible on the CCE homepage. Integration of external deposition data (e.g. from EMEP) is not fully implemented yet, but first contact to exchange technical specifications with EMEP is already established and work is in progress.
A new website has been launched already, making available general information on the ICP M&M, data and models, publications, as well as the initial and last version of the Mapping Manual. It can be reached at the following address :
https://www.umweltbundesamt.de/en/Coordination_Centre_for_Effects.

Chapter 2 – Meeting discussions and conclusions for next steps and workplan

Following the discussions held within the break-out groups dealing with the 3 scientific issues, i.e. steady-state modelling, empirical CL and CL for biodiversity, main conclusions were wrapped up by CCE and ICP M&M chair to build on future workplan.

For all topics, **coordination** is assumed by CCE, except for Dynamic Modelling item which will be coordinated by TF M&M and JEG.

The work should be as **collaborative** as possible with:

i. encouragement of NFCs by CCE to actively contribute to the work for, e.g. provision of data, methodological developments,
ii. intensive exchanges with other ICPs and monitoring working groups outside the CLRTAP
iii. support from WGE in launching Call for Data for more efficiency.

The whole **schedule** of the ICP M&M activities will have to be consistent with the timeline of the Gothenburg Protocol possible Review (potentially for 2022). To this aim, provision of data should be foreseen for 2021.

The following workplan items were decided:

Topic	Coordination	Resources	Collaboration
Update of Steady State Models (BGDB and NFC CL)	**CCE**	**CCE**	**Invitation to NFCs to participate in reviewing the method**
Review and revision of Empirical Critical Loads	**CCE**	**CCE, NFC**	**Countries, ICPs**
Further developments of CL for biodiversity	**JEG / TF M&M**	**JEG**	**NFC, CCE, ICPs, monitoring groups**

As regards review and revision of empirical CL, it was decided that it should be based on a literature review of existing data, but that no production of new data was foreseen for this activity. Attenders agree on the fact that since last review was proceeded, a lot of data were produced and published, especially data from gradient studies (rather experimental ones), and definition of new habitats. The main aim of this review will therefore be to collate new data from e.g. gradient studies to aim at a higher reliability level and to study comparison with modelling effects on diversity. In addition, understanding and refinement of modifying factors will be crucial.

NFCs will be encouraged to contribute to this action by providing data and review will be interconnected with other ICPs (e.g. Vegetation, Integrated Monitoring or Forest) as much as possible.

As regards review and revision of empirical CL, it was decided that for launching the review in the near future, **the next steps were the following:**

i. The Task Force of ICP M&M recommends the WGE to include the review and revision of the empirical critical loads for nitrogen into the work plan 2020/2021 and also recommends to launch a call for national contributions to this review (via letter of the CCE to NFCs)

ii. ICP M&M will launch **intensive collaboration with other ICPs** (e.g. use of ICP Waters National lake survey 2019 to update CLemp)

As regards communication aspects, to enhance collaborative work, it was decided that CCE would

i. CCE will call on contacts again to complete the list as much as possible

ii. CCE will think further on the modalities of a newsletter and make some proposals (frequency, format, way of dissemination via e-mail or portal, etc.)

iii. CCE is currently restructuring the web page to make inter alia the TF visible

Chapter 3 – Meeting proceedings & minutes

Session 1 – Opening and Keynote session – Chair : Laurence Rouïl

Welcome to CIEMAT

Fernando Martín welcomes all participants to CIEMAT and presents the Department of the Environment and the Atmospheric Pollution Modelling and Ecotoxicology Unit at which Isaura Rabago Juan-Aracil, chairwoman of the WGE, is working. This unit mainly deals with studies on deposition processes and ecotoxicology of air pollutant, with some focus on impacts of air pollution on Mediterranean vegetation. The list of participants is available in Annex II of this document.

Introduction and Objectives of the meeting

Laurence Rouïl, EMEP chairwoman and interim chairwoman of the ICP M&M in 2017 and 2018, introduces changes in personnel within ICP M&M chairing and *via* new CCE team. CCE is being operated by the German Environment Agency (UBA) since end 2017, and Alice James Casas will be chairing the ICP M&M from now on.
Laurence Rouïl also stresses that 2019 will be a special year also at the convention level, as the possible review of the Gothenburg Protocol will be decided. She finally introduces the agenda (Annex I of this document) of the meeting.

Update on WGE and Convention issues

Isaura Rabago Juan-Aracil, chair of the Working Group on Effects (WGE), presents the latest news from the convention and the WGE (meetings held since last ICP M&M meeting, and topics addressed herein) and the follow-up of the WGE workplan 2018-2019, with latest news from ICP M&M and ICP waters (publication of the thematic report 2018 on regional assessment of acidification).
She presents the WGE portal, which aim is for the group to have a common web page where to download documents and current work, but also to be able to communicate towards policy makers on how the work is structured (see www.unece-wge.org).
Isaura Rabago Juan-Aracil recalls the current status of revision of mandates within WGE, with provisional adoption of mandates from ICP waters, ICP Forests, ICP Vegetation, ICP Integrated Monitoring, ICP Materials and TF on Health. Revised mandates from ICP Modelling and Mapping and JEG on Dynamic Modelling are waited for 2019. All these need to be consistent with the priorities of the convention, according to a number of already existing documents.
Next steps for possible collaboration between LifeWatch ERIC and the WGE are also presented, as well as collaboration with the work on Ecosystem Monitoring within the NECD. As regards this latter item, she stresses that after close cooperation with the COM for the production of a guidance document in 2017, a gap occurred in 2018 to be linked to changes within the COM team. Year 2019 is promising with the holding of a meeting of the "Ecosystem Monitoring Subgroup" of the NECD (2 April), to which some ICP M&M colleagues are currently attending. This meeting is going to deal with technical issues and next steps for consideration of inter alia how critical loads (e.g. CL on N is an indicator within NECD assessment) are included as one of the tools to assess impacts of air pollution on ecosystems within the NECD.
EU is a CLRTAP Party attending the convention meetings, but WGE should foresee a way to have it more engaged on some CLRTAP issues, e.g. by actually participating to some ICPs.
Isaura Rabago Juan-Aracil finally presents financing issues and indicates the amount of ca. 2 million $ as resources for core activities for 2019, the distribution being 35% from the trust fund and 65% from in-kind countries contributions.

Laurence Rouïl asks if WGE portal should be discussed during the present meeting. Jesper Bak and Filip Moldan, who are implied in the WGE portal developments, agree that it is maybe too early to discuss concrete work as regards the portal during the present meeting, but indicate that a contact person should be designated from TF MM in order to feed the portal.

Laurence Rouïl reminds how important is the collaborative work to be launched with EU and that one needs to keep thinking how to contribute to that in the near future.

Keynote "Supporting modelling and mapping activities through LifeWatch ERIC infrastructure"

Jesús Miguel Santamaría and Antonio José Sáenz-Albanés present LifeWatch ERIC infrastructure and how it can support Modelling and Mapping activities. LifeWatch ERIC is a European e-Science distributed Infrastructure focused on how to measure the impact of Global Climate Change issues on Earth Biodiversity and Ecosystem Research, which final aim is to support policy decision making addressing Societal Challenges which demand scientific knowledge in a Global Climate Change context, including Citizen Science activities. Its core mission is to provide access to a multitude of data sets, services and tools enabling the construction and operation of Virtual Research Environments which provide the environments for integrating data, software and computation as developed in pan European infrastructure cooperation.

Some issues were raised such as (i) how could the collaboration between ICP M&M and LifeWatch ERIC could concretely be held, (ii) how could a unique platform integrate models that are so different between each other's or (iii) the complexity caused by the fact that some models are being fed by data, but in turn models outputs feed the datasets. Answering these issues was not straightforward. The timeline of the possible collaboration was also not so clear.
Finally, it was clarified that LifeWatch platform could be foreseen to make the ICP M&M models available, but that LifeWatch output tools were not meant to be completely free of charges. Data will be made available free of charge, but some output tools and services will have to be paid over time.

Presentation of the CCE Team and Current status of the CCE database

Simone Richter (UBA), presents UBA and the unit II.4.3. "Air pollution and terrestrial ecosystems" as the structure now hosting the new CCE since 2018. The CCE is still in the transition phase and recruiting the staff is still an ongoing process. That's why the CCE is operated by a transition team. Simone Richter introduces the transition team and their background within the CLRTAP work at different levels and in different contexts (ICP M&M and outside the group, e.g. within TFIM, TFRN). Currently the team consists of Thomas Scheuschner, Christin Loran, Markus Geupel and Simone Richter.
Simone Richter also reports the state of play of the Memorandum of Understanding between UBA and CLRTAP secretary which is now ready for signature and explains that the common mandate of ICP M&M and CCE is now being drafted for revision by ICP M&M chairs and CCE.
Simone Richter reports the meeting which have been held since 2018 for the transition period and setting up of the new CCE: meetings with INERIS chairing ICP M&M, meeting with ex CCE representatives, and also several informal technical meetings (e.g. with ICP Vegetation Programme Coordination Centre (PCC), with US-EPA for presentation of the CL-Mapper tool, with JRC for discussions on use of CL as indicator for biodiversity strategy, discussion on common WGE portal).

Thomas Scheuschner then presents the work already achieved by CCE on the technical side. He introduces how the CCE Critical Load database (DB) is structured (MS SQL DB) and how the input of the National Focal Centres (NFC) (e.g. via Calls for data) is integrated in to this DB. Beside the national input the CCE uses own modelling results (the so-called "Background DB") in order to fill in the gaps

when NFC did not submit any data. Nowadays, data export is possible as ".csv" files and the software used to deliver graphs and maps is "R" (aggregation on the regular grid to produce the results as maps and figures). CCE is currently working on setting up the data frame for the database. Furthermore, working on the Web Map Service (WMS) in order to make the CL maps accessible on the CCE homepage. Thomas Scheuschner indicates that the integration of external deposition data (e.g. from EMEP) is not fully implemented yet. First contact to exchange technical specifications with EMEP is already established.

Christin Loran presents the new website and the results of the 2015 – 2017 call for data (extended until February 2019). During this call for data, 14 countries reported to CCE. All 14 countries submitted 'classical' critical loads data for eutrophying N and Acidification, and 7 submitted also data for effects on biodiversity. (*N.B.: CZ is missing in the presentation, but this will be further corrected*). Furthermore, 3 countries updated new data in 2019 (BE, GB, PL).

Thomas finally presents technical issues for the near future, such as how to extend DB schema to deal with NFC data import, how to design deposition data import and create exceedance calculation in R framework (fund needed). He also stresses that NFC feedback will be needed on many challenges such as Web Mapping Service design and level of information check, content of website check, WGE website web content preparation, etc.

To the question on whether there was information regarding previous exceedance calculation and deposition data transferred to the new CCE, Thomas Scheuschner indicates that regarding the exceedance calculation the CCE starts at the very beginning and a meeting is foreseen in the very near future with EMEP to exchange technical details and start with this work. Markus Geupel also explains that a side meeting was held in Laxenburg between ICP M&M chairs, Isaura Rabago Juan-Aracil, CCE, CIAM and MSC-W where use and storage of deposition data was discussed as well as production of CL exceedance maps. During this discussion, it was agreed that CL exceedance maps would continue to be produced by CCE based on EMEP deposition data.

Filip Moldan asks what the meeting with US-EPA on CL Mapper tool was meant for and Thomas Scheuschner answers that it was deemed interesting to have a deeper insight of the tool in order to foresee how to gather and display data within CCE DB in general. He clarifies that CCE is not aiming at creating such a tool in the mid-term but is planning to provide a WMS tool in order to feed Critical Load data in such kind of software.

Common vision of future TF – CCE – NFC collaboration under ICP M&M

Markus Geupel presents the common TF – CCE vision for future work. The time seems suitable for refreshing some activities with new ideas and/or visions, galvanising collaboration. The first task to discuss is a common mandate to build up a stable basis and a long-term continuity ahead workplan.
CCE presents common priority tasks such as, first of all, keeping ICP M&M data relevant to describe threats for ecosystems by air pollution, keeping in mind that these are meant for several goals, the first of which being policy making (upcoming GP review), but also the interested public (reports, brochures) and the scientific community (publications).
He also recalls that the mandate in its current version (see Terms of reference before revision, see EB.AIR/WG.1/2000/4, Annexes II-VIII) corresponds to a common mandate of TF and CCE which was drafted 2017. In September 2019 the mandate should be discussed and approved by WGE. Markus Geupel indicates that as it is being revised, it should include key objectives and functions of the task forces and centres. The Task Force (TF), which is represented by the community of NFCs must organize and evaluate the Programme's activities, review and assess methodologies and databases. NFCs play an important role as they are the basis for contributions to ICP M&M activities i.e. data

collection and development of methodologies. Besides TF, CCE is in charge of collaboration with other convention and research groups, reports, database, clearing house, workshops, development of methodologies and databases for the calculation of critical loads and their exceedances. To this aim, it receives annual funds from the CLRTAP Trust Fund.
The budget amounted to 52.900 $ in 2018 and is now 73.200 $ for 2019. This budget can be used for projects, development and reports (layout), and may be completed by in-kind contribution by NFC activities. CCE stresses that these in-kind contributions are welcome, even needed.
CCE now proposes its new vision of the work it has been discussing with ICP M&M chairs previously to the meeting. **The first vision** is to enhance the collaborative character of the ICP M&M by proposing to appoint "Expert Panels" dealing with dedicated methodological issues, e.g. SMB-Modelling, Empirical Critical Loads, and CL for biodiversity. A stronger separation of the different topics being scientifically challenging is proposed. **The second vision** is to achieve a mid-term continuity of the assessment and the exceedance data**,** in order to avoid discrepancies between different studies/reports. In this regard, CCE understands a possible new *modus operandi* within the ICP should be designed in order to include new national findings continuously. Finally, CCE proposes stronger involvement of NFCs within this ICP M&M publication tasks and the publication of a brochure explaining the role of ICP M&M for the interested public.
Such an active collaboration cannot be anticipated without interactions through-out the year and regular sharing of current scientific forthcomings. To this aim, the set-up of a mailing list and/or the set-up of a common working space is proposed (e.g., CL Wiki).
As a conclusion to this vision and these numerous proposals, the most urgent scientific questions seem to be **(i) Cross-border harmonisation of SMB-Critical Loads and set-up of background database** to fill gaps; **(ii) Update of empirical Critical Loads** (and clarification of possible future application in IAM); **(iii)** How to move on with **CL for biodiversity** (WGE still expects developments policy relevant indicators)? And **(iv)** What shall be done with respect to **Critical Levels**?

During the discussions, the idea of the common vision issues presented by CCE is welcomed and the fact that the new start is a good opportunity to think about the future is agreed upon. In principle, the idea of having expert panel is a very good thing for the work to progress efficiently, but one should be aware that experts and NFCs are not all represented in the list of ICP M&M members and at the meeting. Therefore, one should prevent from the risk of structuring around such subgroups during the meeting, because it would mean losing people and their expertise behind. How structuration of the groups should be made is not so straightforward. Other recall that in the past, there were some informal subgroups (so-called "*ad hoc* groups") funded *via* national resources but that these were finally dissolved by themselves. As regards such future remit, it is proposed that every persons' mandates on specific topics (e.g. SMB modelling, CL biodiversity, etc.) is reported on the map already produced by CCE where NFCs can be mapped.

The idea of stabilising assessment data aiming at having stable arguments for policy makers is not fully understood and validated by the participants. Some favour that the idea of freezing CL for some years while work will focus on methodologies in the meantime, while others stress that there is a need for a new body of evidence to be made available as frequently as possible in order to feed policy making decisions accordingly.
Another remark made against this proposal is that "a year without the call is a year without the money" and that if ever national funds are allocated to other work in the time being, expertise will also be lost in the meantime. To this warning sign, CCE answers that this is the reason why there is a need to better understand what the national priorities are so that their work can fit in with the ICP M&M workplan and call for contributions/data. Laurence Rouïl also adds that there may be different level of formalization of call for data, such as "scientific input call for data" *versus* "formal call for CL data". This would give some flexibilities to NFCs to submit data as much as possible still even if it does not serve the CL re-calculation each year. This last idea is welcome, and suggestion is made that the "informal" call should be dedicated to a specific terminology (e.g. "call for testing samples").

Session 2 – Scientific session

Introduction to the Session 2.1

CCE circulates a paper containing a list asking attenders to sign in if they have the mandate to be NFC and asking them to give their consent as regards storage and use of their data following the entry into force of the General Data Protection Regulation (EU) 2016/679.

Session 2.1. Review of the SMB model approaches – Chair: Markus Geupel

Within this session, 4 presentations have been given:

- Introduction to Session 2.1 – by CCE (Thomas Scheuschner)
- "ICP M&M activities in Switzerland" – by Reto Meier
- Critical Loads in the United States: Update on NADP-CLAD Activities – by Jennifer Phelan
- Report of Regional assessment of the current extent of acidification of surface waters in Europe and North America – by Kari Austnes

*The abstracts of these are available in the present document here below and the presentations themselves are made 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 presents the **state of play of CCE's work as regards databases issues**. He indicates that the background DB retrieved from RIVM does not offer the full level of detail. He also urges the NFCs to join the process of reviewing and updating the background DB. To this aim, a project funded by UBA will soon be finalized (2019-2020) and NFCs are welcome to the process by sharing their expertise. Then, Thomas Scheuschner, as being NFCs for Germany, introduces session 2.1 by quickly presenting national activities on reviewing calculation methods of several parameters of the Simple Mass Balance (SMB) approach in Germany.

Reto Meier presents "**An update on ICP M&M activities in Switzerland**", which firstly includes information on results on soil solution measurements in Swiss forests, showing that there is equal contributions of N-deposition and drought increase to N-leaching, and indicating some hypothesis for explanation of the observed acidification trends (e.g. decrease in base cations concentrations combined with increasing aluminium in uppermost soil). Then, Reto Meier presents some results of POPs biomonitoring in lichens, where clear decreasing trends for banned chemicals (e.g. DDT, lindane, dioxins and furans) and some increasing trends for "new" used chemicals (e.g. brominated flame retardants) are observed, as well as a good correlation between lichen concentrations and emission data. Finally, the presentation addresses the most recent policy developments which were made in Switzerland, including the fact that Swiss Parliament agreed unanimously the 2012 amendments of the Gothenburg Protocol early 2019, and that two ammonia abatement measures are currently under consultation process (i.e. mandatory low emission slurry application and mandatory cover of slurry storage, for details, see presentation).

Some participants welcome the abatement measures already in place and to the question of the emission reduction of these, Reto Meier answers that the additional reduction potential of mandatory low emission slurry application is 4% of agricultural ammonia emissions in Switzerland; the potential of mandatory cover of slurry storage 1-2%.

Jennifer Phelan then presents "**Critical Loads, Deposition, and Exceedances in the United States – Transitions**". National Critical Load Database (NCLD) of the National Atmospheric Deposition Programme (NADP) is constituted of forest soil acidification CLs, surface water acidification CLs, and 5 Empirical nitrogen CLs, which represent 2,989,920 geographically-referenced data. The NLCD is currently in its version 3.0 but is being updated constantly. Jennifer Phelan presents a list of new scientific studies which feed the NCLD on e.g. herbaceous species richness, surface waters acidification, trees species or lichens communities.
The NCLD is used by U.S. Federal Agencies to support policy development and review, as well as natural resource management. U.S. Federal Agencies that use CLs for different reasons (e.g., air quality standards, but also management plans development and status, trends report, support review of new sources of pollution). Aiming at such diverse goals implies that expectations may be different. In this way, it can be that CL need to be stabilized as much as possible or, on the contrary, need to be updated as frequently as possible. Facing such challenges, the Critical Load of Atmospheric Deposition scientific committee (CLAD) is structured in several working groups, some of which address e.g. Critical Loads Synthesis (WG-3), or uncertainty in deposition estimates (WG-4). Jennifer Phelan presents some of the issues that are being dealt with in these working groups (for details, see presentation). She finally introduces NADP-CLAD next objectives, which are to discuss, support, and advance current and emerging issues regarding the science and use of critical loads for effects of atmospheric deposition on ecosystems in the U.S., as well as to develop and "house" NCLD, and serve within CLRTAP context as "non-official" U.S. National Focal Centre (NFC) to WGE-CCE. Finally, Jennifer Phelan informs of her stepping out from NADP-CLAP programme manager in May 2019 and indicates the corresponding interim contact to be used until the position is filled.

Kari Austnes presents the "**Regional assessment of the current extent of acidification of surface waters in Europe and North America**" which results have recently been published in a report by ICP Waters. This assessment focused on the spatial distribution and current state of acidification. A range of information sources were used – submitted concentration data, Water Framework Directive data, critical loads and exceedances, and literature. ICP Waters NFCs also produced separate country reports. Acidification is still widespread, but in some countries, it is a regional issue, while in others it is limited to certain hot-spots. The level of information is highly variable, and some regions were identified as potentially having issues with acidification, but with no or little recent data. The WFD data on acidification status had limited value, both due to the focus on larger water bodies, and because of inconsistencies and unclear and variable assessment criteria. Further emission reductions are needed, both to reach non-exceedance of critical loads and to speed up recovery. Critical loads for surface waters from more countries would be beneficial.

Among the remarks made after the presentation, it is interesting to notice that monitoring under the WFD is deemed not sufficient and it is asked what are, based on this remark, the expectations of the NECD. Kari Austnes explains that, apart from water bodies' large scale, one of the main cons of WFD methodology for diagnosis of surface waters acidification status for data use under CLRATP context are ambiguities in the definitions of this acidification status and the fact that within WFD context, acidification status should be reported whenever acidification has previously been considered relevant in the classification of ecological status. Therefore, one should firstly expect from NECD that it does not focus on acid-sensitive water bodies.
About questions on whether ICP Waters will lead a similar study on eutrophication, Kari Austnes answers that such a work is foreseen for 2020.

Picking up on the title of the sub session 2.1, Kari Austnes, points out that ICP Waters would favour interest on "steady-state models", rather than Simple Mass Balance (so-called "SMB") only. This is further emphasised in the discussion, stressing that one should be aware that SMB favours terrestrial CL assessment a lot and tends to leave out waters issues aside.

General discussions on sub-session 2.1

In the general discussions after last presentation, it is stated that N-leaching is still the most relevant policy factor and that further work should undoubtfully be oriented towards issues such as application of CL uncertainty in deposition data at national levels or a better reporting of data to ICP waters for acidification assessment. Besides these interests, it is also stressed that there is still a need for more work on developing CL for biodiversity. It is agreed that these topics will be taken up to session 3.

Session 2.2. Review of empirical critical loads for nitrogen – Chair: Ed Rowe

Within this session, 4 presentations have been given:

- Introduction to Session 2.2 – by CCE (Thomas Scheuschner)
- "Critical loads for the Netherlands: combining modelled and empirical critical loads" – by Gert Jan Reinds
- "Update on Critical Loads in Czech Republic" – Thomas Chuman
- "Responses to N deposition in the southernmost European fir forests: implications for critical loads under a warming climate" – José Antonio Carreira de la Fuente

The abstracts of these are available in the present document here below and the presentations themselves are made 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 presents the **state of play of ICP M&M work as regards empirical CL issues**. He recalls that the main source of current empirical CL is the output of the expert workshop held in The Netherlands (Noordwijkerhout, 23-25 June 2010) entitled "Review and Revision of Empirical Critical Loads". In this report, empirical critical loads were structured following the classification used in the European Nature Information System (EUNIS) and 47 values are provided for 6 different habitat types (A, B, C, D, F, G), 4 of them being classified as "reliable". As a follow-up to this work made 9 years ago, an update of empirical CL seems reasonable and there may also be room for improvement for *inter alia* some methodological issues such as quantification of modifying factors for assessments on broad regional scales, to improve the national application of these values.

As regards the state of play of CCE's work on this issue specifically, Thomas Scheuschner indicates that the most recent dataset was last published in 2015, based on habitat classification made by Cinderby 2007 (updated Slootweg 2009) and that CCE merged CLempN with CLnutN within the current Call for Data (CfD 2015-2019).

According to CCE, update of CLemp would need to be linked to SMB project in order to renew the Habitat map, to review the current CLempN table[1], to carry out a gap analysis for underrepresented EUNIS Habitat types and to carry out research on linking both (modifying factors – e.g. soil, climate). Following these aims and the former recommendation by the Task Force to review CLempN (EMEP SB/WGE joint session 2018), CCE is planning to lead a literature review project starting mid-2019, as a preparatory task for the review of CLempN, funded by CCE, but it is known already that this will not be enough for a complete review of CLempN and a more extensive review should be foreseen.

Finally, as regards CLempN in general, a non-exhaustive list of remaining questions is raised by CCE:

- Should we keep CLnutN and CLempN merged?
- How to improve the modifying factors? or regionalization

[1] The "SMB project" (UBA-funded) has the main goal to update the background CL database of the CCE. This update will also include an update of the receptor map which then can be used to update the CLemp data.

- Could CLempN give indication for CLbiodiv?
- Is there any new publication available? (ICP forests)

Following this presentation, Ignacio González Fernández, representing ICP Vegetation, introduces the willingness of the group to contribute to the revision of empirical CL for nitrogen, indicating that this willingness was agreed at their last meeting in February 2019. He reminds everyone that up to now, most of the work was done on experiments carried out with nitrogen.
All views expressed favour the idea of launching review and possible revision of empirical CL for N, and some remarks are made as regards how this should be carried out. Firstly, some specific questions emerge on whether countries would be able to allocate resources to this task or not, and how this should be defined (call for contribution / call for data), keeping in mind that since 1992, contributions as regard reviewing empirical CL for N have always been driven by a few number of countries (CH, DE, NL, UK, SE) but hardly ever more. Furthermore, answering the question of CCE on whether CLnutN and CLempN should be kept merged, it is recalled that this has been done up to now for policy reasons, rather than scientific reasons.

Gert Jan Reinds presents "**Critical loads for the Netherlands: combining modelled and empirical critical loads**" in which model output were used within CLempN range. The work carried out shows that combining VSD+ modelled CL and CLempN increases robustness of the predictions and that an accurate parametrisation of VSD+ model is key to obtain plausible results, although some systems need an update of inputs. Finally, using pH and N availability provides 'biodiversity' based CL (field measurements pH based). As an outlook, it will be further studied (i) how N availability may be replaced by another N parameter, although attempts to replace critical N-availability by nitrate concentration have failed so far and (ii) how PROPS model derived functions use may help to define the abiotic requirements (PROPSclf).

Several questions of clarification are asked, firstly if it was planned to improve on denitrification assessment running VSD+ model. To this, Gert Jan Reinds answers that this would be a difficult task.
Then, it is discussed that the model data were checked specifically when falling outside the range of the CLempN Also, it is noted how interesting it would be to estimate variability of the model prediction within the range as regards modifying factors.
It is then added that caution should be taken using pH availability to provide "biodiversity" based CL as long as it is known that pH varies a lot within the buffer ranges.
Finally, it is also indicated how interesting it would be to compare modelling results between countries because experience has shown that models generally give higher predictions than CLempN in NL, but the contrary was observed in DE. pH does not always give the best correlation with species.

Thomas Chuman presents "**Maps of empirical critical loads of N for ecosystems in the Czech Republic and their exceedances**". A new map of ecosystems for CZ area with consolidated layers of biotopes has been developed. Using this new tool, ecosystems were converted to EUNIS Habitat and then subdivided for habitats corresponding to the new CZ map of ecosystems. Maps of N-deposition, CLempN (set for 58% of the land) and their exceedances are shown. There are 43% of the areas with defined CLempN, where mean CLempN is exceeded. No clear correlation picture could be shown between oligotrophic species diversity and N total deposition, maybe because the changes have occurred in species diversity already.

José Antonio Carreira de la Fuente presents "**Responses to N deposition in the southernmost European fir forests: implications for critical loads under a warming climate**". Elevated atmospheric N-deposition alters soil N-availability, which triggers profound changes in forest biogeochemical

cycles and tree nutritional stoichiometry. Current biogeochemical theory on the consequences of N-deposition in forest ecosystems has mainly developed from studies on temperate regions. However, research on the issue is scarce for Mediterranean regions. An overview of the responses of the southernmost European fir-forests (*Abies pinsapo*; S. Spain) to atmospheric N-deposition is presented, highlighting the remarkable singularities in the way these relic fir-forests, currently subjected to a Mediterranean-type climate seasonality, respond to N-deposition (e.g., intrinsically leaky N-cycles and high nitrification even under relatively low N-inputs and in aggradative forests, role of the induction of P limitations in triggering the transitions to a N saturation state). There are implications of these findings, in terms of CL and increasing vulnerability of temperate conifer forest to N deposition in a warming Europe.

General discussions on sub-session 2.2

The utility of the empirical Critical Load seems to be extended, since it is used in several modelling exercises (Switzerland, Netherland) to provide a frame for the upper and lower boundaries of the modelled (SMB, Biodiv) Critical Load.
It seems essential to answer the question how a review of CLempN should be envisaged in the near future and the question is asked to the attenders whether they have an opinion on this, as it is foreseen to be an expensive activity.

Many views are clearly expressed in favour of the review to start with.

To this aim, several questions, suggestions and/or cautions signs are mentioned:

- *What?*
  If a revision is proposed, it will be based on a literature review of existing data, but no production of new data is foreseen for this activity.
  Attenders agree on the fact that since last review was proceeded, a lot of data were produced and published, especially data from gradient studies (rather experimental ones), and definition of new habitats.
  The main aim of this review should be to collate new data from e.g. gradient studies to aim at a higher reliability level and to study comparison with modelling effects on diversity.
  In addition, understanding and refinement of modifying factors would be crucial.
  It is to be noted that some Northern countries (e.g. Iceland) show “flat maps” (i.e. CLempN not protective enough). This issue should be dealt with “climate CLempN” should be envisaged.

- *How?*
  How could and should NFCs contribute to this action by providing data, recalling that in the past, very few countries reacted to the call for contribution?
  Review should be interconnected with other ICPs (e.g. Vegetation, Integrated Monitoring or Forest)
  An expert panel or workshop should be organized (e.g. on low deposition effects < 2 kg)

- *When?*
  What should the timeline look like?

The sub-session is concluded with the confirmation that CLempN review is needed and that the break out session planned in the afternoon will allow to specify possible ways and means to proceed with this activity.

Session 2.3. Further developments of critical loads (including biodiversity) – Chair: Reto Meier

Within this session, 6 presentations have been given:

- Introduction to Session 2.3 – by CCE (Thomas Scheuschner)
- "Effects of N deposition and temperature on vegetation and potential consequences for butterfly diversity" – by Lukas Kohli
- "Linking biogeochemical indicators in soil and vegetation to species change" – by Ed Rowe
- "The relationship between N deposition and bryophyte N concentration in boreal forests" – by Sirkku Manninen
- "Heathlands in the Cantabrian Mountains as a scenario to analyse the effects of atmospheric nitrogen deposition" – by Leonor Calvo
- "ICP Modelling and Mapping: Future challenges: integrating resource use, industrial development and transboundary air pollution on a global scale" – by Harald Ulrik Sverdrup

The abstracts of these are available in the present document here below and the presentations themselves are made 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 presents the **state of play of ICP M&M work as regards methodological developments of CL**. He recalls that history of CL for biodiversity have shown many discrepancies (different countries, different scales, etc.) and that "Background CL DB" was developed using the PROPS model, based on bioscore data, which was first used to create vegetation releves. Thomas Scheuschner addresses several questions to the participants, such as

- Does the parameter choice of PROPS fit to ecological thinking?
- Does the use of recent deposition create a moving target?
- Which HSI threshold is valid?
- How to bring the different approaches together?
- Is the whole thing too complex for policy support and for NFC?
- Is this the protection of Biodiversity as we mean it?

Lukas Kohli presents "**Effects of N deposition and temperature on vegetation and potential consequences for butterfly diversity**". Switzerland presents high N-deposition levels compared to other countries and a rather clear negative correlation between N-deposition and altitude is observed. Further, the negative correlation observed between N-deposition and butterfly diversity would partially be due to impact of N-deposition on flora diversity (more eutrophic plant species, which have high local survival probabilities even at sites with low N-deposition). In addition, it was shown that species with lower indicator values for temperature are replaced with species with higher values. Finally, study of the temporal change of butterfly diversity shows that some butterfly species benefit from one situation to another (different factors, including e.g. temperature and altitude).

Ed Rowe presents "**Linking biogeochemical indicators in soil and vegetation to species change**". The use of combination of MADOC-MultiMOVE models allows providing a Habitat Quality Index (HQI) to predict biodiversity responses (for details, see presentation). HQI responses to N and S in turn allow to define a CL biodiversity function. Threshold for "damage" can then be assumed to be the HQI value when N-deposition is set to the CLempN. Ed Rowe indicates that talking about biodiversity has often to do with talking about extinction. Indeed, it is admitted that some species matters more than

others. This is the reason why a biodiversity metric such as "positive indicator species" (i.e. a small set of typical species for each EUNIS class) is relevant because it reflects appropriately this concern.
As ways forward in developing matters for CL for biodiversity, Ed Rowes pushes for an HQI for "positive indicator species" as a useful summary metric of biodiversity and suggest that maps of CLbiodiv exceedance be used to support policy development. He also stresses that focus should be done on (i) midpoint indicators, i.e. biogeochemical indicators that the system is changing (soil pH, Ca/Al ratio, available N, foliar N, etc.) and (ii) particular species that people appreciate and are affected by air pollution

Ed Rowe adds that the important question to answer is "how much impact should we allow"? This can be answered by giving importance to the weight of evidence approach use, and the choice of typical species.
As regards how biodiversity reference conditions may be defined, Ed Rowe answers that these are defined already, but under the conditions of climate change, this target should probably change, and the way out on this issue is not straightforward.

Sirkku Manninen presents "**The relationship between N deposition and bryophyte N concentration in boreal forests**", with results on the relationships between bryophyte total N concentration and N deposition in forest openings (bulk deposition) *versus* forests (throughfall deposition) in Finnish background areas, where the total N deposition is < 5 kg N/ha/yr. The results show that inorganic N compounds (ammonium and nitrate) in bulk deposition explain the bryophyte N concentration in forest openings, while in forests dissolved organic N (DON) washed / leached from conifer canopies is also taken up by the bryophytes and contribute significantly to their total N concentration. A critical load of 3-4 kg N/ha/yr for boreal forests is proposed based on total N and ammonium accumulation in bryophytes as well as other studies on the activity and/or abundance of N fixing symbiotic cyanobacteria in bryophytes.

Sirkku asks whether cyanobacteria could be foreseen as a good topic for studying CL issues. Answers to this are given that cyanobacteria are undoubtfully important for ecosystem functioning (very sensitive and good indicators species), but to answer this question, it should be decided first what the protection objectives are.

Leonor Calvo presents "**Heathlands in the Cantabrian Mountains as a scenario to analyse the effects of atmospheric nitrogen deposition**". She indicates that heathlands in Cantabrian mountains retain 72% of atmospheric N deposition in the short term, indicating that these environments are not N saturated yet. There is no correlation between N dep and species composition nor species richness.

Harald Ulrik Sverdrup presents "**ICP Modelling and Mapping: Future challenges: integrating resource use, industrial development and transboundary air pollution on a global scale**".
Fast better than good: develop a methodology, implement it, get some results to start with, and then improve the methodology. A good recipe to achieve goals is to get successful results in the 3 arenas that are: scientific, media and politics. Harald Ulrik Sverdrup adds that it is not sure the second one (communication) is being really addressed by the group and asks how far is the third one well handled? He comments that there is a need for redefining the strategy in order to convince on the political side

Discussions in break-out groups corresponding to each sub-session topics

Steady-state models (Markus Geupel, Thomasz Pecka, Maximilian Posch, Susan Zappala)

It was stated the individual workshops dealing with different Critical Limits or cross border harmonization of data was a successful praxis and should be continued where necessary. The main priority was identified in building up the new background database (to make CCE able to respond on EB tasks and to provide data until 2021). Ongoing exchange with and contribution by National Focal Centres on methodological questions during this build up, how the methods are applied was welcomed. Such questions involve issues like criteria to calculate CL_{ac}, the involvement of empirical CL in the background database (merged BGDB) or the update of Corine Land Cover data.

With regards to update of national CL SMB Data a 2-year Call for data is proposed. In a 1st step countries should be able to revise their data report on the willingness to do and how to do; in a 2nd step the update would be elaborated. Furthermore, the Call for data should include a component for contribution/involvement of that countries in that the BGDB is going to be applied used for.

Empirical CL (Kari Austnes, Roland Bobbink, Allessandra De Marco, Ika Djukic, Ignacio González Fernández, Alice James Casas, Lukas Kohli, Christin Loran, Elena Marcos, Reto Meier, Jennifer Phelan, Simone Richter)

Roland Bobbink extensively indicated how the review was previously done. A consortium of scientists was mobilised for it and the activity was funded by Germany, The Netherland, Switzerland (and United Kingdom). Ecosystems were identified and a literature review was carried out, with definition of criteria for quality assessment (one of which was publication at least in the grey literature). Draft summaries were sent to (funded) external specialist to comment on and final draft was prepared to be available one month before the meeting. In June 2010, a workshop with specialists was organised by the CCE, which ended with updated CLemp tables. After submission to the CLRTAP Executive Body, the document was finalised in November 2010. It is to ne noted that gradient studies were hardly integrated in this previous review, but that many such studies being now available, these should be included.

As regards call for contribution / funding

- There is already some trust fund allocated to this task by CCE but it will not be enough
- There is a need to design a call for contribution first: should it be sent to NFCs? Not necessarily them, but countries will be encouraged to provide funds or to fund experts
- **In order to invite all countries to contribute to this call for contribution, there is a need to take this decision upward to next WGE meeting**

As regards how to organize a new review?

- The updated review should use the findings from the Noordwijkerhout workshop in 2010 as a starting point
- There is a need for an ICP *ad hoc* subgroup for review and revision of CLemp
- There is a need to clearly define which role should other ICP play in the process (e.g. previous contribution of ICP waters, wish of ICP vegetation to contribute)
- A kick-off meeting should be organized to launch the review early 2020
- The previous process should be like a first stone to base the new review on

Specific questions were also asked:

- What ecosystems are we looking at?
- How should gradient studies be included in the next review and potential revision?

- How to include specific technical questions like including marine ecosystems?
- Could CLemp be used as indicator for biodiversity?
- How can it be concrete when it comes to looking at modifying factors?

CL for Biodiversity (Jesper Bak, Gert Jan Reinds, Ed Rowe, Thomas Scheuschner)

During the discussions within the group, it was stated that the work on CL for biodiversity should go on because there is a wish at EB level to do so, with a strong support to include the activity in the workplan. Up to date, the main involvement on this topic has been carried out by the JEG, and former CCE (RIVM), but it cannot currently be on the new CCE (UBA) priority list given the situation, gap filling of the background database being now the main priority work.
Some recommendations are mentioned for future work:

- the methodological developments should consist in an iterative process because it is still under testing phase (no inclusion in the revision of the Gothenburg Protocol).
- the proper application and the utility of the Critical Load should be communicated much better to policy makers and the necessity of properly protected ecosystems be highlighted much more.
- It does not necessarily have to do with dynamic modelling. Other models may serve the purpose of CL biodiversity (e.g. PROPS model)
- other NFC should be involved *via* training sessions
- reach out and inclusion of monitoring data from other ICPS should be carried out

Some questions are pending at the end of the discussions:

- how can other NFCs be involved by communicating on these models?
- Should CL for biodiversity only be applied on sites or areas if a specific national or international program with a defined ecological protection target exists?

Session 3. Cooperation with other groups, Mandate and Further work – Chair: Markus Geupel & Alice James Casas

Kari Austnes presented an "**Update on ICP Waters activities**". ICP Waters has a change in leadership, with Heleen de Wit as chair and Kari Austnes as head of the programme centre. The work comprises regular activities, thematic reports and contributions to related, international agreements, e.g. the Minamata Convention and the NEC Directive. Last year's thematic report was an assessment of the spatial extent of acidification. This year's report is a trend report. Nitrogen impacts is one suggested topic for the thematic report in 2020. Work on mercury is being published. The next task force meeting is in Helsinki 4-6 June.

On behalf of the ICP Vegetation, Ignacio González Fernández reported "**Achievements of ICP Vegetation in 2018 and future workplan (2019-21)**", including modelling ozone fluxes in soil moisture limited areas; global flux-based risk assessment of crop yield losses due to ozone pollution; ozone flux-effect relationships for (semi-)natural vegetation; results of the 2015/16 survey on heavy metals, nitrogen and POPs concentrations in mosses and contributions to the implementation of ecosystem monitoring as part of the EU National Emissions Ceilings Directive (Directive (EU) 2016/2284). Workplan items for 2019 – 2021 (as discussed at the 32nd ICP Vegetation Task Force meeting, 18 – 21 February 2019 in Targoviste, Romania) were presented, including collaboration with ICP Modelling and Mapping on a potential review of empirical critical loads for nitrogen and developing new chapters for Scientific Background Document B of Chapter III ('Mapping critical levels for vegetation') of the Modelling and Mapping Manual of the LRTAP Convention.

Ignacio González Fernández mentions that, in 2020, ICP vegetation wishes to contribute to the potential review of nitrogen impacts on vegetation (with a focus on experimental data) and potential need for updating empirical critical loads for nitrogen and critical levels for NOx, within the ICP M&M activities. It should be explored how ICP vegetation work can contribute to this.

Thomas Scheuschner presents a "**Brief information on ICP Forests 2018**", with its recent changes and new structure and a recent update of their work, on behalf of Alexa Michel and coll. which could not attend the meeting. A new head of Programme Coordinating Centre has been designed: Dr Kai Schwärzel, a soil scientist and forest hydrologist. Thomas Scheuschner presents the recent publications as well as the recent developments made within ICP Forests (release of an open data dataset, revision of the database including harmonization of data and data structures over time, development of a new interactive map module (in progress), development of a new ICP Forests webpage (in progress)). He finally adds on presenting the ICP Forest new brochure which is deemed a well displayed way of communicating on the scientific work done. Thomas Scheuschner thinks that such communication medium should be envisaged by ICP M&M to disseminate information on its activities.

Maximilian Posch, representing the Centre for Integrated Assessment Modelling (CIAM/EMEP), presents a brief information on "**CIAM activities**", which summarises the latest developments concerning integrated assessment (modelling) in the context of the Convention. In particular, he reports the integration of the approved 2017 critical loads for acidity and eutrophication into the GAINS model. He also reports on the split-up of the air pollution transfer matrices with respect to the Serbia-Montenegro-Kosovo region, as well as other progress (e.g., resolution) in atmospheric transport modelling conducted at EMEP.

Salar Valinia gives a presentation (*Videoconferencing*) on "**JEG – Options for a new format**". He firstly recalls the work done up to date within the context of the CLRTAP since it started in 1999: feedback on calls (before and after), development of target loads and critical loads on biodiversity, co-operations within WGE, with some links to EMEP, including CL methodology but broader than that and goes to underlying processes (nitrogen modelling), related issues (climate change), other pollutants (heavy metals, ozone), and, finally, outreach from CLRTAP to other national experts/EU projects. The next JEG DM meeting is planned in October 2019, for modelling community and monitoring community. In 2019, JEG is still in place, financed by Sweden, but with no long-term commitment possible. Hence, a change in status is necessary if JEG DM should continue (as suggested in September 2018, EB asked Bureau to come up with a plan). How to proceed is discussed at the present moment with the different bureaux within the convention and the ICPs/Centres. It was suggested that JEG DM should be redefined, keeping the focus on dynamic modelling and widening the responsibility for several common work items agreed in Long Term Strategy of WGE. The opportunity to become a standalone ICP was discussed at the Executive Body meeting (December 2018), and at the Extended Bureau meeting (March 2019, Vienna). It is foreseen that a new mandate / role / name should be defined, and that delimitation with activities of ICP M&M, CCE, and other ICPs, should be discussed.

Salar Valinia also presents LTS issues common to all ICPs which could – for part of them – be included into the new JEG mandate (e.g. communication on achievements and remaining challenges, coordinate modelling and monitoring with health and ecosystem impact assessment to show progress and highlight remaining issues, etc.), further improvements of cooperation between monitoring, mapping and modelling).

Salar Valinia and Filip Moldan finally present a 3 item proposal for inclusion in the new JEG mandate: (i) monitor and critically evaluate DM done by ICPs, synthesise the outcomes and identify gaps (biodiversity), develop, promote and co-ordinate use DM within CLRTAP including other nature types & Biodiversity modelling, (ii) responsibility for the common WGE web, common access to monitoring and modelling data, (iii) responsibility for co-operation with LTER, LifeWatch and other relevant organisations outside the convention.

Laurence Rouïl clarifies that during the discussion of the Extended Body meeting in March 2019, it was clearly stated that a single proposal should be submitted for opinion at the next Joint WGE/EMEP steering meeting in September (Geneva). It should give suggestions on how to envisage the future, and how the JEG should be involved.

Discussion are then held between participants and address the main following points, with associated decisions:

- JEG DM could fit under the umbrella of both ICP IM and ICP M&M, but many participants stress that as JEG has always been involved in dynamic modelling developments *per se* and is not involved in any data collection, ICP M&M seems the best place to fit in.

- There is a need for development of CL for biodiversity and JEG should be responsible for biodiversity modelling developments

- As CCE main tasks for the near future are to update background database, organize new data collection and envisage review of empirical CL, and as CL for biodiversity methodology is not ready to be implemented yet, it is agreed among participants that JEG DM activities should be dissociated from the CCE for the time being.

Laurence Rouïl presents "**Draft revised mandate**" for discussion (for details, see Annex III to the present document). She recalls this document is common to the TF and the CCE of the ICP M&M. It therefore addresses functions and activities of both bodies, as well as the deliverables they are due to submit to the WGE.

It is clarified during the discussions that if JEG DM integrates ICP M&M, as development of biodiversity indicators and dynamic modelling will not be taken over by CCE but by the new JEG group. To clarify this, the mandate will need to be updated and completed with the JEG *ad hoc* group functions and activities (e.g. gathering scientific knowledge and to develop models), while CCE will still be in charge of collecting data, implementing agreed methodology (including that on biodiversity indicators) and computing it.

It is asked to clarify the timeline and after discussion, it is convened that ICP M&M chair will circulate two proposals of the mandate, one including the draft revised TF and CCE of the ICP M&M mandate as previously presented, and one including in this document new proposals corresponding to functions and activities of the JEG DM.

Discussions and proposals: next steps for workplan, call for data, future collaboration

CCE and ICP M&M chair have prepared a brief presentation wrapping-up the discussions held during the meeting on the main scientific topics (i.e. steady-state models, review of CLemp, and CL for biodiversity, Dynamic Modelling) and how they should be integrated in the work-plan in the near-future or on the long-term within ICP M&M activities.
For all topics, **coordination** is assumed by CCE, except for Dynamic Modelling item which will be coordinated by TF M&M and JEG. The work should be as **collaborative** as possible with (i) encouragement of NFCs by CCE to actively contribute to the work (provision of data, methodological developments), (ii) intensive exchanges with other ICPs and also with monitoring working groups outside the CLRTAP and (iii) support from WGE in launching Call for Data for more efficiency. The whole **schedule** of the ICP M&M activities will have to be consistent with the timeline of the Gothenburg Protocol possible Review (potentially for 2022). To this aim, provision of data should be foreseen for2021.

The following workplan items are decided:

Topic	Coordination	Resources	Collaboration
Update of Steady-state Models (BGDB and NFC CL)	**CCE**	**CCE**	**Invitation to NFCs to participate in reviewing the method**
Review and revision of Empirical Critical Loads	**CCE**	**CCE, NFC**	**Countries, ICPs**
Further developments of CL for biodiversity	**JEG / TF M&M**	**JEG**	**NFC, CCE, ICPs, monitoring groups**

Further discussions are then conducted on several topics, for which the main following agreements should be retained:

- **As regards CLemp review and revision:**
  - **agreement for launching the review in the near future**
    - (i) the Task Force of ICP M&M recommends the WGE to include the review and revision of the empirical critical loads for nitrogen into the work plan 2020/2021 and also recommends to launch a call for national contributions to this review (via letter of the CCE to NFCs)
    - (ii) should be carried out with intensive collaboration with other ICPs (e.g. use of ICP Waters National lake survey 2019 to update CLemp)

- Communication aspects
  - **(i)** Stressing on collaborative aspects of the ICP M&M work needs for a thorough **update of the NFCs list**
  - **CCE will call on contacts again to complete the list as much as possible**
  - (ii) Collaboration issues and newsletter proposal taken over by CCE
  - **CCE will think further on the modalities of this newsletter (frequency, format, way of dissemination via e-mail or portal, etc.)**
  - (iii) Need for displaying the UNECE and/or WGE logo on the CCE website
  - **CCE is currently restructuring the web page to make *inter alia* the TF visible**

Annexes I

Annex I – Final Agenda

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

Convention on Long-range Transboundary Air Pollution

Working Group on Effects

35th ICP M&M Task Force Meeting

on assessments of impacts of air pollution, and interactions with climate change, biodiversity and ecosystem services

Tuesday 2nd – Thursday 4th April 2019

CIEMAT, Madrid (Spain)

FINAL AGENDA

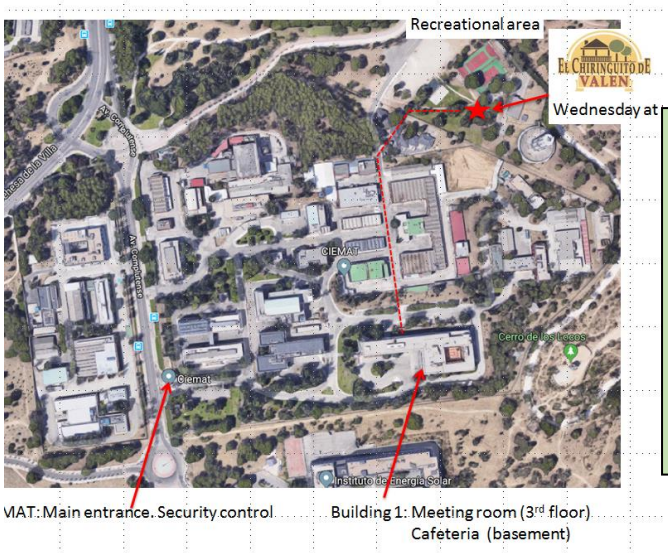
Session 1 (2nd April afternoon) – Opening and Keynote session Chair: Laurence Rouïl		
14.00 – 14.15	Registration	
14.15 – 14.30	Welcome to CIEMAT	CIEMAT
14.30 – 15.00	Introduction and Objectives of the meeting	Laurence ROUÏL
15.00 – 15.15	Update on WGE and Convention issues	Isaura RABAGO J.-A.
15.15 – 15.45	Keynote “Supporting modelling and mapping activities through LifeWatch ERIC infrastructure”	Antonio José SÁENZ-A.
15.45 – 16.15	**Coffee break**	
16.15 – 17.00	Presentation of the CCE Team and Current status of the CCE database	CCE
17.00 – 17.30	Common vision of future TF – CCE – NFC collaboration under ICP M&M	Chair M&M / CCE

Session 2 (3rd April, whole day) – Scientific session		
9.00 – 9.10	Wrap-up of session 1 and introduction to the Session 2	Chair M&M / CCE

Session 2.1 Review of the SMB model approaches Chair: Markus Geupel		
9.10 – 9.20	Introduction and methodological state of play	CCE
9.20 – 9.40	ICP M&M activities in Switzerland	Reto MEIER
9.40 – 10.00	Critical Loads in the United States: Update on NADP-CLAD Activities	Jennifer PHELAN
10.00 – 10.20	Report of Regional assessment of the current extent of acidification of surface waters in Europe and North America	Kari AUSTNES
10.20 – 10.40	Discussions	All
10.40 – 11.00	Coffee break	

Session 2.2 Review of empirical critical loads for Nitrogen Chair: Ed Rowe		
11.00 – 11.10	Introduction and methodological state of play	CCE
11.10 – 11.30	Critical loads for the Netherlands: combining modelled and empirical critical loads	Gert Jan REINDS
11.30 – 11.50	Update on Critical Loads in Czech Republic	Thomas CHUMAN
11.50 – 12.10	Responses to N deposition in the southernmost European for forests: implications for critical loads under a warming climate	José A CARREIRA DE LA F.
12.10 – 12.30	Discussions	All
12.30 – 14.00	Lunch break	

Session 2.3 Further developments of critical loads (including biodiversity) Chair: Reto Meier		
14.00 – 14.10	Introduction and methodological state of play	CCE
14.20 – 14.40	Effects of N deposition and temperature on vegetation and potential consequences for butterfly diversity	Lukas KOHLI
14.40 – 15.00	Linking biogeochemical indicators in soil and vegetation to species change	Ed ROWE
15.00 – 15.20	The relationship between N deposition and bryophyte N concentration in boreal forests	Sirkku MANNINEN
15.20 – 15.40	Heathlands in the Cantabrian Mountains as a scenario to analyse the effects of atmospheric nitrogen deposition	Leonor CALVO
15.40 – 16.00	ICP Modelling and Mapping: Future challenges: integrating resource use, industrial development and transboundary air pollution on a global scale	Harald Ulrik SVERDRUP
16.00 – 16.30	Discussions	All
16.30 – 17.00	Coffee Break	
Summary of Session 2.1, 2.2 and 2.3		
17.30 – 18.30	Wrap-up of session 2	Chair M&M / CCE / All



Evening event

CIEMAT is happy to offer some tapas and a beer at their recreational area
"*El Chiringuito de Valen*"
after end of session 2.

See the map alongside.

Session 3 (4th April morning) – Mandate, Further work and Cooperation with other groups Chair : Markus Geupel / Laurence Rouïl		
9:00 – 9:15	Update on ICP Waters	Kari AUSTNES
9:15 – 9:30	Update on ICP Vegetation	Ignacio GONZÁLEZ F.
9:30 – 9:45	Presentation on CIAM activities	Maximilian POSCH
9:45 – 10:00	JEG – Options for a new format (*Videoconferencing*)	Salar VALINIA/ Filip MOLDAN
10:00 – 10:30	Coffee break	
10:30 – 11:15	Presentation of and discussion on Draft revised mandate	Chair M&M / CCE
11:15 – 12:30	Discussions and proposals: next steps for workplan, call for data, future collaboration See also questions below	All

Relevant questions to be addressed during the meeting:

1. Next ICP M&M scientific challenges within the workplan 2020-2021 and in the perspective of the Gothenburg protocole review

1.1. What are the next scientific challenges?

1.2 How should these be prioritized?

1.3 How could NFCs contribute to any future ICP M&M workplan items?

2. What are the next ICP M&M financial / resources challenges?

3. Which interactions should be enhanced with outside ICP M&M community (e.g. other WGE ICP/TF/JEG or with any EMEP TF)?

Please return any comment to:

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Laurence Rouïl – laurence.rouil@ineris.fr

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Annex II – List of participants

Name	First Name	Country	Affiliation	Oral presentation #	Oral presentation Title
Aherne	Julian	Canada	Trent University		
Alonso	Rocio	Spain	CIEMAT		
Austnes	Kari	Norway	Norwegian Institute for Water Research (NIVA)	2.1_3 3_1	2.1_3 : Regional assessment of the current extent of acidification of surface waters in Europe and North America 3_1 : Updates from ICP Waters
Bak	Jesper	Denmark	Aarhus University		
Bermejo-Bermejo	Victoria	Spain	CIEMAT		
Bobbink	Roland	The Netherlands	B-WARE Research Centre Radboud University		
Calvo	Leonor	Spain	University of León	2.3_4	Heathlands in the Cantabrian Mountains as a scenario to analyse the effects of atmospheric nitrogen deposition
Carreira de la Fuente	José A	Spain	UNIVERSITY OF JAÉN	2.2_3	Responses to N deposition in the southernmost European fir forests: implications for critical loads under a warming climate
Chuman	Tomáš	Czech Republic	Czech Geological Survey	2.2_2	Map of empirical critical loads of N for ecosystems in the Czech Republic and their exceedences
De Angelis	Elena	Italy	University of Brescia (PhD student in Technology for Health)		
De Marco	Allessandra	Italy	ENEA		-
Djukic	Ika	Austria	Environment Agency Austria		
Elvira Cozar	Susana	Spain	CIEMAT		

Name	First Name	Country	Affiliation	Oral presentation #	Oral presentation Title
Fornassier	Maria Francesca	Italy	ISPRA		
Héctor	García-Gómez	Spain	CIEMAT		
Geupel	Markus	Germany	German Environment Agency (UBA) ; CCE	1_5 2.1_0 2.2_0 3_6	1_5 : Common vision of future TF – CCE – NFC collaboration 2.1_0 : Intro and methodological state of play (SMB) 2.2_0 : Intro and methodological state of play (emp CL) 3_6 : Conclusions of the 35th ICPMM, Workplan items and Scientific challenges
González Fernández	Ignacio	Spain	CIEMAT	3_2	ICP-Vegetation update
James Casas	Alice	France	INERIS ; co-chair		
Kohli	Lukas	Switzerland	Hintermann & Weber AG	2.3_1	Effects of N deposition and temperature on vegetation and potential consequences for butterfly diversity
Konopka-Górna	Emilia	Poland	Warsaw Ministry of Environment		
Loran	Christin	Germany	German Environment Agency (UBA) ; CCE	1_4	Presentation of the current status of the CCE website
Manninen	Sirkku	Finland	Faculty of Biological and Environmental Sciences	2.3_3	The relationship between N deposition and bryophyte N concentration in boreal forests
Marcos	Elena	Spain	University of León		
Meier	Reto	Switzerland	Swiss Federal Office for the Environment	2.1_1	Update on ICP M&M activities in Switzerland
Moldan	Filip	Sweden	IVL		

Name	First Name	Country	Affiliation	Oral presentation #	Oral presentation Title
Pecka	Tomasz	Poland	Institute of Environmental Protection – National Research Institute (IOS-PIB)		
Phelan	Jennifer	United States of America	NADP-CLAD	2.1_2	Critical Loads, Deposition, and Exceedances in the United States – Transitions
Posch	Maximilian	Austria	IIASA/CIAM	3_4	CIAM activities
Rabago Juan-Aracil	Isaura	Spain	CIEMAT	1_2	WGE and convention issues
Reinds	Gert Jan	The Netherlands	Wageningen Environmental Research	2.2_1	Critical loads for the Netherlands: combining modelled and empirical critical loads
Richter	Simone	Germany	German Environment Agency (UBA) ; CCE	1_4	Presentation of the CCE Team
Rouïl	Laurence	France	INERIS ; co-chair	1_1	Introduction of the 35th ICP MM meeting agenda
Rowe	Ed	Untited Kingdom	Centre for Ecology & Hydrology	2.3_2	Linking biogeochemical indicators in soil and vegetation to species change.
Sáenz-Albanés	Antonio José	Spain	LIFEWATCH ERIC	1_3	Supporting modelling and mapping activities through LifeWatch ERIC infrastructure
Scheuschner	Thomas	Germany	German Environment Agency (UBA) ;CCE	1_4 2.3_0 3_3	1_4 : Presentation of the current status of the CCE database (IT-infrastructure and workflow, CfD, technical issues for the future) 2.3_0 : Intro and methodological state of play (Further developments of critical loads) 3_3 : Brief information on ICP Forests 2018
Sosnowska	Agnieszka	Poland	Ministry of the Environment		
Sverdrup	Harald Ulrik	Iceland	University of Iceland, Industrial Engineering	2.3_5	ICP Modelling and Mapping: Future challenges: integrating resource use, industrial development and transaboundary air pollution on a global scale

Name	First Name	Country	Affiliation	Oral presentation #	Oral presentation Title
Valinia	Salar	Suède	Naturvårdsverket	3_5	JEG DM future (Videoconferencing)
Zappala	Susan	United Kingdom	JNCC		

Annex III – Revised mandate for the Task Force and the Coordination Centre for Effects of the International Cooperative Programme on Modelling and Mapping of Critical Levels and Loads and Air Pollution Effects, Risks and Trends

Revised mandate for the Task Force and the Coordination Centre for Effects of the International Cooperative Programme on Modelling and Mapping of Critical Levels and Loads and Air Pollution Effects, Risks and Trends

1. Introduction

1. The current terms of reference (mandates) for International Cooperative Programmes (ICPs) and the Task Force on the Health Aspects of Air Pollution had been specified in document *Future Development of Effects-Oriented Activities* (EB.AIR/WG.1/2000/4, Annexes II-VIII) approved by the Working Group on Effects (WGE) and the Executive Body in 2000. ~~The mandates need to be revised and updated to make them consistent with the current provisions and priorities of the Convention and of WGE set in the following documents:~~

~~(a) Long-term Strategy for the Convention on Long-range Transboundary Air Pollution (ECE/EB.AIR/106/Add.1);~~

~~(b) The 2016 scientific assessment of the Convention[2];~~

~~(c) Policy response to the 2016 scientific assessment of the Convention (ECE/EB.AIR/WG.5/2017/3, ECE/EB.AIR/WG.5/2017/3/Corr.1 and ECE/EB.AIR/2017/4 forthcoming);~~

~~(d) Guidelines for reporting on the monitoring and modelling of air pollution effects (ECE/EB.AIR/2008/11, ECE/EB.AIR/WG.1/2008/16/Rev.); and~~

~~(e) Draft 2018-2019 workplan for the implementation of the Convention (ECE/EB.AIR/2017/1, forthcoming).~~

~~The revised mandates will include key objectives and functions of the task forces and centres. The mandates are expected to be in force for the next 5 to 10 years. Specific activities and related deliverables on a shorter timeframe will be included in the bi-annual workplans for the implementation of the Convention.~~

2. Highlights of achievements of the Task Force and the Coordination Centre for Effects of the International Cooperative Programme on Modelling and Mapping of Critical Levels and Loads and Air Pollution Effects, Risks and Trends are:

(a) ~~Since its set up in 1988, ICP on Modelling and mapping of critical levels and loads and air pollution effects, risks and trends (ICP Modelling and Mapping) has developed~~ Developing and maintaining critical loads and critical levels methodologies and databases to assess the risk to ecosystems of acidification, eutrophication and heavy metals. The approach has been extended to include dynamic modelling methodologies to enable the simulation and evaluation of the temporal development of these risks to future policy target years.

(b) ~~Since 2008, scientific work under ICP Modelling and Mapping includes the~~ Exploring methodologies for the development of critical loads for biodiversity to assess the impact of sulphur and nitrogen deposition on endpoints for biodiversity in general and the occurrence of plant species in particular;

[2] See Rob Maas and Peringe Grennfelt, eds., Towards Cleaner Air: Scientific Assessment Report 2016 (Oslo, 2016) and United States Environmental Protection Agency and Environment and Climate Change Canada, Towards Cleaner Air: Scientific Assessment Report 2016 – North America (2016, online report).

(c) Compilation by the CCE of national critical loads data submitted by national focal centres, into a Database of critical loads for acidification, eutrophication and biodiversity, applying gap filling methods and compiling information for European parties that do not provide their own information. Data from North America (Canada and the United States of America), can also be collected and compiled by the Programme Centre, to complete the geographic coverage of the ECE region;

(d) Development by the ICP Modelling and Mapping of modelling and mapping methodologies and guidance, which are documented in CCE report, publications in the scientific literature, and in formal documents submitted under the Convention to the annual joint sessions of WGE and EMEP Steering Body. ~~The Programme Centre compiles national data, submitted by national focal centres, into a Database of critical loads for acidification, eutrophication and biodiversity, while applying methods and compiling information for European parties that do not provide their own information. Data from North America (Canada and the United States of America), can also be collected and compiled by the Programme Centre, to complete the geographic coverage of the ECE region~~;

~~(c) ICP Modelling and Mapping activities are based on the contributions of the participating parties, either through their national focal centres or, in some cases, through informal submissions. These parties develop and maintain national databases and indicators and challenge their results with those from other countries. They also participate in model development. At annual meetings and CCE workshops, different approaches are compared, discussed, and modified with an aim to reach consensus on methods that should be used by all parties. In this process, methods and data of the CCE have been essential since it began its work in 1990. Demonstrating that no clear trends of impacts of ozone on vegetation have been observed in the last two decades, hence ozone pollution remains of global concern with background concentrations rising in Europe, contributing to impacts on vegetation~~;

(e) Publication and update of ~~Modelling and mapping methodologies are described in~~ the Manual on Methodologies and Criteria for Modelling and Mapping Critical Loads and Levels and Air Pollution Effects, Risks and Trends[3] where modelling and mapping methodologies are described. It provides a description of harmonized indicators to establish critical levels and loads and methods to assess the impacts of acidification, eutrophication, heavy metals, ozone and particulate matter on terrestrial and aquatic ecosystems, crops or building materials. ~~This document was first published in 1993 and since then~~ It has been updated in collaboration with the ICP on Effects of Air Pollution on Natural Vegetation and Crops (ICP Vegetation) and the International Cooperative Programme on Effects of Air Pollution on Materials, including Historic and Cultural Monuments (ICP Materials~~). It provides a description of harmonized indicators to establish critical levels and loads and methods to assess the impacts of acidification, eutrophication, heavy metals, ozone and particulate matter on terrestrial and aquatic ecosystems, crops or building materials~~;

(f) ~~The information used to elaborate critical levels and critical loads is based on national databases and monitoring programs that feed into the work of the national focal centres, including work carried out by other ICPs.~~ Evaluation in collaboration with the Centre for Integrated Assessment Modelling, Meteorological Synthesizing Centre-East and Meteorological Synthesizing Centre-West ~~to enable~~ of i) ~~the identification and mapping of~~ ECE- and national regions as well as (nature) areas where depositions exceed critical loads and ii) ~~establish~~ the magnitude of these exceedances. ~~This information is then used for the assessment of pollution abatement scenario alternatives that are identified by the Working Group on Strategies and Review and Executive Body and subsequently analysed by the Centre for Integrated Assessment Modelling in the Task Force on Integrated Assessment Modelling. The CCE can generate series of exceedance maps for ecosystems in ECE countries, as for instance listed in~~

[3] A first version of the Mapping Manual was published in 1993. It has since been updated three times: in 1996, 2004 and again in 2016. The full text of the 2016 version is available as online, by chapter, from the website of the International Cooperative Programme on Modelling and Mapping of Critical Levels and Loads and Air Pollution Effects, Risks and Trends: http://icpmapping.org/Latest_update_Mapping_Manual.

~~European Environment Agency's European Nature Information System (EUNIS), for the European Union's Natura 2000 areas and for a number of European and North American habitats on different spatial scales, as appropriate.~~ ~~These~~ Exceedance maps provide comprehensive information of air pollution policy trends and efficiency and are used in benefit analysis;

(g) Data produced under by ICP Modelling and Mapping are made available according to the Convention data rules (Decision 2006/1, ECE/EB.AIR/89/Add.1);

(h) ~~The collaborative work of ICP Modelling and Mapping community results in the Critical Load Database, which has proven to be an important part of the scientific support of air pollution abatement policies of the Convention and of the European Union. In Europe and North America, ICP Modelling and Mapping community contribute to assess past and future impacts of air pollution on ecosystems~~.

3. The mandates for the task forces and centres under the Working Group on Effects need to be revised and updated to ensure that they are consistent with the provisions of the amended protocols to the Convention, as well as its strategic priorities as set out in the following documents~~:~~

(a) Revised long-term Strategy for the Convention on Long-range Transboundary Air Pollution (ECE/EB.AIR/2018/1);

(b) The 2016 scientific assessment of the Convention[4]; and

(c) Policy response to the 2016 scientific assessment of the Convention (ECE/EB.AIR/WG.5/2017/3, ECE/EB.AIR/WG.5/2017/3/Corr.1 and ECE/EB.AIR/2017/4 forthcoming).

4. the revised mandate

5. The lead country

6. The task force and the Centre

7. The task Force will

8. Meetings of the task force

9. In the event that

2. Revised mandate for the Task Force and the Coordination Centre for Effects of the International Cooperative Programme on Modelling and Mapping of Critical Levels and Loads and Air Pollution Effects, Risks and Trends

10. France leads the Task Force of ICP Modelling and Mapping while its Programme Centre - the Coordination Centre for Effects (CCE), is led by Germany and hosted by UBA Germany in Dessau.

11. The task force and the Centre report on their activities and deliverables to the Working Group on Effects.

12. The functions of the Centre and the task Force are to:

(a) provide for the guidance of – and collaboration with – its national focal centres comprehensive information:

(i) On critical loads and levels and the risk of exceedances for selected pollutants and effects on appropriate endpoints of the natural environment;

(ii) On the development and application of methods for effect-based approaches, including dynamic modelling and the modelling of impacts on suitable indicators of biodiversity and of possible impacts on selected ecosystem services;

(iii) On the modelling and mapping of the present status and trends of impacts of air pollution on terrestrial and aquatic ecosystems for the ECE region.

[4] See Rob Maas and Peringe Grennfelt, eds., Towards Cleaner Air: Scientific Assessment Report 2016 (Oslo, 2016) and United States Environmental Protection Agency and Environment and Climate Change Canada, Towards Cleaner Air: Scientific Assessment Report 2016 – North America (2016, online report).

(b) Organise annual meetings, and workshops as appropriate, to share knowledge on critical loads and modelling methodologies addressing the risk of impacts on terrestrial and aquatic ecosystems with all parties, in particular with the Parties in Eastern Europe, the Caucasus and Central Asia. ~~and for reporting their activities and deliverables to WGE and to the other bodies and groups in the Convention, as required. The Task Force of ICP Modelling and Mapping and the Programme Centre receive guidance and instructions from WGE and the Executive Body concerning priorities, tasks and timetable. They also assist bodies and groups under the Convention as appropriate~~.

(c) Collaborate with other ICPs to develop understanding and dose response relationships for terrestrial and aquatic ecosystems.

(d) Collaborate with the Centre for Integrated Assessment Modelling and the Task Force on Integrated Assessment Modelling in the elaboration and assessment of pollution scenarios, and with the Meteorological Synthesizing Centre-East and Meteorological Synthesizing Centre-West from EMEP to compile deposition maps to enable the calculation of critical loads and their exceedances.

(e) Collaborate with external partners, in particular the Arctic Monitoring and Assessment Programme and the United Nation Environment Programme; Convention on Biological Diversity ~~and in North America and in the European Union~~ to help produce critical load exceedance maps and help conduct scenario analysis of computed emission abatement alternatives.

(f) Carry out tasks adopted in the adopted in the science related part of the workplan of the Convention established by WGE and the Executive Body.

(g) The Task Force of ICP Modelling and Mapping

i. Plans, organises and evaluates the Programme's activities; reviews and assesses methodologies and databases on critical loads and levels, and their exceedances, as well as (trends of) the risk of impacts on suitable indicators for the health of terrestrial and aquatic ecosystems;

ii. Documents modelling and mapping methodologies in the Modelling and Mapping Manual which is maintained and kept available via ICP Modelling and Mapping website;

iii. Makes recommendations on the further development of effect-based approaches, and on future modelling and mapping requirements.

:

(h) The functions of the programme Centre (CCE) are to

2. ~~The Task Force of ICP Modelling and Mapping plans, organises and evaluates the Programme's activities. It reviews and assesses methodologies and databases on critical loads and levels, and their exceedances, as well as (trends of) the risk of impacts on suitable indicators for the health of terrestrial and aquatic ecosystems. It documents modelling and mapping methodologies in the Modelling and Mapping Manual which is maintained and kept available via ICP Modelling and Mapping website. The Task Force makes recommendations on the further development of effect-based approaches, and on future modelling and mapping requirements.~~

i. Develop and Implement databases for the calculation of critical loads, their exceedances and their mapping at ECE scale under ICP Modelling and Mapping and provide technical advice regarding the use and interpretation of critical loads and exceedances;

ii. Implement established knowledge on effects of major air pollutants on the natural environment in modelling methodologies, including information exchanges with other Convention and Research Groups on available dose response relationships assessed in order to protect ecosystems;

iii. Develop and apply methods for effect-based approaches, including dynamic modelling and the modelling of impacts on suitable indicators of biodiversity and its services in collaboration with other ICPs and the Joint Expert Group on Dynamic Modelling;

iv. Conduct periodic training sessions and workshop to assist national focal centres in their work;

v. Maintain and update relevant databases and serve as clearing house for data collection and exchanges regarding critical loads and levels amongst Parties and bodies under the Convention;

vi. Produce information and data necessary for the implementation of the Convention and its protocols in relation to indicators for the health of natural ecosystems including critical loads and their exceedances.

4. ~~Parties are encouraged to for collecting and electronically archiving national data on critical loads and levels and effects risks and trends of air pollution according to the Modelling and Mapping Manual guidelines, and collaborate with the Programme Centre so that their data can be integrated in the Programme Centre database. Parties also contribute to the development of critical load calculations and mapping methodologies and share knowledge through, in particular, workshops.~~

5. ~~ICP Modelling and Mapping Task Force and its Programme Centre endeavour to share knowledge on critical loads and modelling methodologies addressing the risk of impacts on terrestrial and aquatic ecosystems with all parties, in particular with the Parties in Eastern Europe, the Caucasus and Central Asia. For that purpose, the Modelling and Mapping Manual is proposed to be translated into Russian~~.

~~6. ICP Modelling and Mapping Task Force and its Programme Centre collaborate with other ICPs to develop understanding and dose response relationships for terrestrial and aquatic ecosystems. The Programme Centre collaborates closely with Centre for Integrated Assessment Modelling and the Task Force on Integrated Assessment Modelling in the elaboration and assessment of pollution scenarios. Deposition data from EMEP (Meteorological Synthesizing Centre–East and Meteorological Synthesizing Centre–West) are made available in a format that is appropriate to enable the calculation of critical loads and their exceedances~~.

7. ~~ICP Modelling and Mapping Task Force and its Programme Centre can collaborate with relevant organisations under the United Nations (e.g. Arctic Monitoring and Assessment Programme; United Nation Environment Programme; Convention on Biological Diversity) and in North America and in the European Union to help produce critical load exceedance maps and help conduct scenario analysis of computed emission abatement alternatives. The Programme Centre can participate in research programmes in order to develop knowledge and understanding of ecosystem responses to air pollution on regional and continental scales.~~

8. ICP Modelling and Mapping Task Force and its Programme Centre carry out tasks that have been adopted in the science related part of the workplan of the Convention established by WGE and the Executive Body, provided that sufficient funding is available.