

Economic Commission for Europe

Executive Body for the Convention on Long-range
Transboundary Air Pollution

**Steering Body to the Cooperative Programme for
Monitoring and Evaluation of the Long-range
Transmission of Air Pollutants in Europe**

Working Group on Effects

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**Progress in activities in 2017 and further development
of effects-oriented activities**

Informal Document

(agenda - item 4)

Dynamic modelling – 17th Joint Expert group Meeting

Report by the Chair of the Joint Expert Group on Dynamic Modelling

Summary

The present report is submitted for the consideration by the 4th joint session of the Steering Body to the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe and the Working Group on Effects in accordance with the request of the Executive Body for the Convention on Long-range Transboundary Air Pollution in the 2016–2017 work plan for the implementation of the Convention (ECE/EB.AIR/133/Add.1 item 1.1.1.24).

The report presents a summary of the progress in dynamic modelling of ecosystems effects by acidification, heavy metals and nutrient nitrogen including the interactions between climate change and air pollution, biological responses and terrestrial carbon sequestration from the 17th meeting of the Joint Expert Group on Dynamic Modelling (Sitges, Spain, 25–27 October 2017).

I. Introduction

1. The 17th meeting of the Joint Expert Group on Dynamic Modelling under the Working Group on Effects (WGE) was held from 25 to 27 October 2017 in Sitges, Spain.
2. Twelve experts from the following Parties to the Convention on Long-Range Transboundary Air Pollution (LRTAP Convention) attended the meeting: the Czech Republic, Denmark, Germany, the Netherlands, Norway, Spain, Sweden, the United Kingdom of Great Britain and Northern Ireland, and United States of America. The International Cooperative Programme (ICP) on Assessment and Monitoring of the Effects of Air Pollution on Rivers and Lakes (ICP Waters), the International Cooperative Programme on Integrated Monitoring of Air Pollution Effects on Ecosystems (ICP Integrated Monitoring), the International Cooperative Programme on Modelling and Mapping of Critical Levels and Loads and Air Pollution Effects, Risks and Trends (ICP Modelling and Mapping), and the Bureau of the Working Group on Effects were also represented.
3. The meeting was chaired by Mr. F. Moldan (Sweden). It was organized by IVL Swedish Environmental Research Institute (Sweden).

II. Aims and organization

4. The aims of the Joint Expert Group (JEG) meeting were to examine progress in dynamic modelling of ecosystem effects by acidification, heavy metals and nutrient nitrogen including the interactions between climate change and air pollution, biological responses and terrestrial carbon sequestration. The aims were in accordance with the 2016–2017 work plan for the implementation of the Convention (Addendum) (ECE/EB.AIR/133/Add.1 item 1.1.1.24).

III. Conclusions and recommendations

5. The JEG supports the need for long-term funding for the WGE and its bodies.
6. The JEG is concerned about the future of the CCE, and hopes that a new Lead party will be functioning as soon as possible, perhaps under the auspices of the German UBA. The CCE is the link between the effects work and the policy work.
7. The JEG supports the long-term recommendations for the WGE included in the 2016 Assessment Report. Among these are: empirical ecosystem research on dose-response functions for ozone and nitrogen; links between climate change and nitrogen biogeochemistry and POP/HM biogeochemistry. Furthermore JEG recognises the utmost importance of keeping up monitoring activities.
8. The JEG encourages further work on determining and modelling CL for biodiversity.
9. The JEG is pleased that the EU will make use of expertise in the WGE for the monitoring mandated by the new National Emission Ceiling (NEC) Directive. The JEG notices that the current monitoring programmes under the ICPs may need to be expanded to meet the needs and requirements of the NEC Directive. Additional funding to the ICPs may be called for. Further, the JEG urges that modelling and mapping be included in the NEC monitoring in order to put the data into useful perspective for policy makers and to fill gaps

in the observed data coverage. The JEG believes that modelling needs should be assessed in 2018 after the new monitoring is in place.

10. The current structure for monitoring within WGE was established with prime focus on the loss of fish and damage to forest. The JEG notes that ICP-vegetation deals largely with crops, ICP-forests with forests, whereas the current call for CL biodiversity dealt primarily with non-forested (semi) natural ecosystems. Neither of these ICPs appears to focus on the effect of N deposition on biodiversity. Biodiversity in aquatic ecosystems is currently covered by ICP-Waters.

11. The JEG noted that lack of the sufficient coverage for natural ecosystems (such as represented among Natura 2000 sites, examples are alpine and mountainous areas, dunes, bogs) is in particular with respect to the needs for monitoring and modelling the effects of N deposition. Activities (monitoring) do exist in several countries and expertise is available, but there is no formal forum within the WGE for these ecosystems. The JEG urges the WGE to discuss means by which to fill in this gap in ecosystem coverage.

12. The JEG notes clear scientific and policy aspects that are common to both LRTAP and the Biodiversity convention (CBD). There are, however, some important differences. WGE has ongoing monitoring and modelling of biodiversity. The CBD lacks both and does not have major focus on effects of air pollution.

A. Impact of nitrogen as a nutrient in terrestrial and freshwater systems including the impact on biodiversity

13. The JEG applauds further progress with NA-PROPS in modelling biodiversity in the United States.

14. The JEG applauds the efforts made to evaluate the success of the model simulations vs. observed data and stress that such model evaluations are reality checks that are necessary for model development. To evaluate models with observations is also vital for building up model credibility and ultimately for usefulness of the model calculations for policy purposes. The JEG applauds the testing of DM for biodiversity against observed data in an ongoing study in the UK based on long-term data from the "Countryside Survey". The goal is to predict species changes in response to changes in S+N deposition.

15. The JEG recognises the continued difficulty in determining a good predictor for nitrogen as a driver of biodiversity changes.

16. The JEG is encouraged by further developmental work on several terrestrial biodiversity models (VSD-veg; PROPS).

17. The JEG is pleased by the constructive cooperation between biodiversity modellers in several countries in North America and Europe and also across ICPs, such as ICP-IM and ICP-Forests.

18. The JEG sees that the new development of uncertainty estimates is a useful step in applications of biodiversity models.

19. The JEG applauds the project conducted by The Netherlands which will compare three different ways to determine the dose-response functions for N deposition.

20. The JEG applauds the Austrian project which uses biodiversity models to explore the combined effects of N deposition and climate change.

21. The JEG recognise that there is a need for simple and clear messages on the results of biodiversity modelling to policy makers, environmental managers and the general public.

22. The JEG urges additional studies that compare methods to set CL for N deposition with respect to changes in biodiversity (that is, the goal of “no net loss of biodiversity”).

23. The JEG is happy to hear that the CCE has been assured “emergency” short-term funding for its operations to the end of 2017, and thereby was able to synthesise the results from the recent “call for CL data”. The JEG applauds the use of a new CL database (prepared by the CCE) for integrated assessment and policy. The JEG is pleased that the results from the 2015-2017 call have been processed and the European-wide maps (created in cooperation with Alterra, the Netherlands) and summaries will be included in the next CCE report, and that the data have been passed on to the CIAM for future use in possible new protocols. The JEG also acknowledges the work of Alterra that has been maintaining the European background database which has been used in the calculations.

24. The JEG concurs with the ICP M&M TF recommendations that:

- o The 2017 biodiversity CLs be used for ‘research purposes’ only (not used in Integrated Assessment);
- o Research on biodiversity CL methodology and thresholds to be continued, following a call of the WGE to Parties under the LRTAP Convention and their NFCs;
- o more NFCs become involved in this research.

25. The JEG also concurs with the recommendations of WGE for use of the biodiversity modelling results, namely:

- o further development and research on biodiversity CLs to be done by NFCs;
- o there has been a considerable progress made over the last few years on methodology thanks to the work of several Parties;
- o the continuation of the development of the related methodology and its use the data for sensitivity analysis and scientific purposes.

26. The JEG stresses that many aspects of ecosystem response show significant time lags and hysteresis relative to the steady-state conditions which lie behind the critical loads calculations

27. The JEG notes that the way the CL function for biodiversity is derived from “habitat suitability index” (HIS) values is dependent on choices of protection level, and therefore could result in more or less stringent CL values relative to Cleut. The JEG also noted that with the protection level chosen this far there is a general tendency for CL biodiversity to result in less exceedance of CL than Cleut for the same N deposition.

28. The JEG is pleased to see that there are now three separate independent European scale maps of CL for S+N: based on acidification, eutrophication and biodiversity. These give three different assessments of adverse effects on ecosystems, and offer means by which a single amalgamated CL function of S and N could be constructed. JEG applauds to CCE for their efforts in this direction.

B. Interactions between N, C and P

29. The JEG stresses the great value in long-term whole ecosystem experiments with acid deposition, climate and land-use to obtain “ground truth” observations that can be used to constrain models, including the DM for biodiversity as well as BGC models. The ongoing NITREX experiment at Gårdsjön, Sweden is a good example of experiments demonstrate lag times, hysteresis and asymmetry in ecosystem responses to changes in S and N deposition.

30. The JEG applauds experiments conducted in the Czech Republic aimed at unravelling the interactions between S+N deposition and C cycling, including C sequestration in forest ecosystems. These interactions could be taken into account by UN-IPCC earth system models. Better cooperation and collaboration between scientists working on air pollution effects and scientists working on climate change models may facilitate positive developments for both groups.

31. The JEG encourages new experiments aimed at providing data addressing key processes in DM. The JEG encourages further development of DM, in particular with respect to the linked carbon and nitrogen cycles in ecosystems, the direct accommodation of climate change in acidification models, and new models for biological recovery. The JEG emphasises that combination of experiments, models and monitoring data is the most powerful mean of achieving further scientific progress to address the effects of air pollution on ecosystems.

C. Recovery of air pollution affected ecosystems

32. The JEG urges that monitoring continues (national programmes, ICPs, NEC directive), in particular to document ongoing biological recovery.

33. The JEG encourages new research aimed to explain processes (both terrestrial and aquatic), in particular with respect to:

- o DOC trends in surface waters;
- o N accumulation and loss in terrestrial ecosystems in general and in soils in particular.

34. The JEG emphasises that DM are useful in exploring the synergistic effects of S+N deposition, land use and climate change on aquatic and terrestrial ecosystems. The JEG stressed that future assessments of the effects of air pollution on ecosystems should include consideration of climate change and land-use.

35. The JEG applauds to ICP-Waters for providing a regional database on effects of air pollution on biodiversity in aquatic ecosystems

36. The JEG notes that there are as yet few documented cases of biological recovery following the decrease in S+N deposition of the past several decades. This may be the results of time lags in both chemical and biological recovery.

37. The JEG notes that ICP-Waters is currently working on an updated overview of the current state of surface water acidification in Europe (and hopefully also North America). This is aimed at filling in the gaps in the ICP-Waters monitoring. ICP-Waters will be using DM in this work, and the JEG hopes that DM approaches can help fill in the gaps, both spatially and temporally. The JEG hopes that perhaps additional parties not currently participating in ICP-Waters may be brought into this work, perhaps via the monitoring mandated under new NECD as well as the WFD.

38. The JEG notes that there is a need for dynamic modelling development for mercury (Hg) cycling in terrestrial and aquatic ecosystems.

39. The JEG applauds the extensive and detailed work carried out in the US on mapping CL for acidification in streams in the eastern US. This work entails new techniques in modelling and extrapolation and scenario analysis including interactions between acidification and climate parameters such as temperature.

D. Extending the range of modelled ecosystems: interfacing with Natura 2000

40. The JEG notes that the WGE is currently assessing the current monitoring of ecosystems, and agrees that several types of sensitive ecosystems may not be adequately included in the monitoring programmes. The assessment will evaluate the coverage in:

- o Processes
- o Parameters
- o Ecosystem types
- o Geography
- o Possibilities for expanding this where needed.

42. The JEG will continue efforts to involve Natura 2000 and national habitat experts in the dynamic modelling work.

43. The JEG is pleased to see that DM are used to assess surface water sensitivity and CL and the risk of future effects of air pollution on ecosystems in South Africa.

E. National support for dynamic modelling

44. The JEG is encouraged that new monitoring is planned in several countries. The JEG applauds the advanced plans of Germany for new monitoring to fulfil the mandate of the NEC Directive. This monitoring is in part aimed at obtaining valuable ground-truth data necessary for application of DM and determination of CL.

45. The JEG is pleased that new national monitoring can be used to evaluate the results from DM, both for CL as well as phytotoxic ozone dose (POD)

46. The JEG notes that ICP-IM continues to generate new data useful in application of DM, and applauds the efforts of IM to make such data available for DM applications.

IV. Future of the JEG DM and work plan for JEG in 2018

47. The JEG notes that funding on all fronts is necessary to continue ongoing and new work on DM related to the LRTAP Convention and urges policy makers to provide funding in support of the science-based work asked for.

48. The JEG concluded that further meeting will be useful but that the agenda could be shortened and compressed and that the meeting should be organised together with TF meeting of ICP M&M to enhance communication and knowledge transfer between the groups. The meeting is planned for April 2018.

49. In the future JEG can play a role within work in the LRTAP convention:

- o Continue the traditional focus on waters and forests;
- o New focus on other natural ecosystems;
- o Assisting and critically assessing future CCE calls for CL data (e.g. for calls for new CL under combined scenarios of future CC and air pollution);
- o Help with revisions or new use of the CL concept for HM and POPs, in the event that these will be the subject of new protocols;

o Advise on synergies between DM applications within the UN IPCC, UN CBD and the UN LRTAP convention.

50. The JEG hopes to enhance outreach activities by holding joint meetings (such as the upcoming meeting with ICP M&M)
