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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

Fourth joint session

Geneva, 10-14 September 2018

Item 4 of the provisional agenda

**Progress in activities in 2018 and further development
of effects-oriented activities**

Dynamic modelling*

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

Summary

The present report is submitted for the consideration by the fourth 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 2018-2019 work plan for the implementation of the Convention (ECE/EB.AIR/140/Add.1 item 1.1.1.32).

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 eighteenth meeting of the Joint Expert Group on Dynamic Modelling (Bern, Switzerland, 18-20 April 2018). The meeting was organised jointly with thirty-fourth Task Force meeting of the International Cooperative Programme on Modelling and Mapping of Critical Levels and Loads and Air Pollution Effects, Risks and Trends on assessments of

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

I. Introduction

1. The eighteenth meeting of the Joint Expert Group on Dynamic Modelling under the Working Group on Effects (WGE) was held from 18 to 20 April 2018 in Bern, Switzerland.
2. Forty-five experts from the following Parties to the Convention on Long-Range Transboundary Air Pollution (Convention) attended the meeting: Austria, Canada, Czechia, Estonia, Finland, France, Germany, Hungary, Iceland, Italy, the Netherlands, Norway, Poland, Spain, Sweden, Switzerland, 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), the Task Force on Integrated Assessment Modelling, and the Bureau of the Working Group on Effects were also represented.
3. The meeting was co-chaired by Mr. Reto Meier (Switzerland), Mr. Filip Moldan (Sweden) and Mrs. Laurence Rouïl (France). It was organized by Federal Office for the Environment (FOEN), Switzerland, French National Institute for Industrial Environment and Risks (INERIS), France, and by Swedish Environmental Research Institute (IVL).

II. Aims and organization

4. The aims of the Joint Expert Group 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 2018-2019 work plan for the implementation of the Convention (Addendum1) (ECE/EB.AIR/140/Add.1 item 1.1.1.32).

III. Conclusions and recommendations

5. The Joint Expert Group stressed that work on biodiversity modelling is ongoing, and that results are preliminary and not yet ready for use for policy purposes within the Convention. The Joint Expert Group thus noted that it is still premature to present European maps of critical loads (CL) biodiversity and exceedance outside the experts community, as the scientific procedures have not yet been agreed upon. However, the European Union encourages harmonisation of methods for determining CL biodiversity. Therefore, the Joint Expert Group urges that work on biodiversity continue within the Convention.
6. The Joint Expert Group noted that the concept of CL for biodiversity is in principle not different from the well-known CL for acidity or CL for nitrogen as nutrient. The group stressed that CL for biodiversity should be seen as a complement and refinement to the existing CL calculations and that dissimilarities in the outcome of the calculation reflects differences in the criteria used and in ecosystems focused upon. The Joint Expert Group urged the experts to continue efforts to use multiple CL calculations in an integrated way and pointed out that the ensemble modelling often used by IPCC is a good example of how multiple model calculations could be interpreted for the policy purposes.
7. The Joint Expert Group noted that for CL biodiversity a much large number of ecosystem types must be included and recommended to consider further use of the Natura 2000 areas.

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

8. The issues concerning the development and application of dynamic models for biodiversity (terrestrial ecosystems) were discussed. Thus updates on methods and implications for CL for biodiversity are work in progress, in the spirit of the phrase “according to present knowledge” in the official definition of critical load.

9. The Joint Expert Group pointed out that dynamic modelling of biodiversity is indeed very complicated, but the concept of CL for biodiversity is in principle not different from the well-known CL for acidity and CL for nitrogen as nutrient. Consequently the outcomes of CL biodiversity calculations could be used for policy purposes as soon as the robustness of the calculations is satisfactory.

10. Participants in the Joint Expert Group noted that the complexity of CL for biodiversity is in part because multiple organisms are being considered simultaneously, whereas for CL for acidity generally only one indicator organism at a time was considered (e.g. brown trout for CL acidity for freshwaters).

11. The Joint Expert Group noted that there are several evidence-based approaches available to estimate CL for biodiversity: empirical, steady-state and dynamic modelled. Together these offer more robust estimates for CL.

12. The Joint Expert Group noted that some of the difficulty may arise because there is uncertainty as to how the CL for biodiversity will be used by policymakers. The Joint Expert Group noted that part of the problem is that the complexity of the CL biodiversity has not been adequately communicated to policymakers. Several concerns had been raised at the recent Saltsjöbaden VI workshop held in Gothenburg in March 2018. The efforts to find appropriate ways how to communicate CL biodiversity must continue in parallel with development of the science behind the concept.

13. The Joint Expert Group noted that policy issues with respect to ecosystem biodiversity are in many countries split between several agencies, ministries or departments, and thus communicating results to policymakers is in itself not straightforward.

14. The Joint Expert Group stressed that changes in biodiversity occur due to air pollution effects, but are also strongly affected by management and climate change. The Joint Expert Group noted that in several studies the effects of climate change and management practices have large influence on terrestrial ecosystem biodiversity.

15. The Joint Expert Group applauded several new developments in dynamic models for biodiversity, such as the PROPS model, and the coupling of the biogeochemical model VSD+ with PROPS. This work is ongoing in several countries, including The Netherlands, Austria and Finland.

16. The Joint Expert Group encouraged comparisons of PROPS output with empirical CL estimates as the agreement between the two is an indicator of robustness of the calculation.

17. The Joint Expert Group noted with satisfaction efforts to evaluate VSD+ and PROPS results using observed data (including those from the ICPs), also for time trends. These efforts aid to the credibility of PROPS as a tool to project future changes in biodiversity given changes in N deposition.

18. The Joint Expert Group applauded recent work from France in dynamic modelling of biodiversity using an integrated process-oriented forest model for long-term sustainability assessments (ForSAFE) model coupled with a French biodiversity model in which results were compared with measurements. Such evaluations using data from independent data on

well-documented sites are essential to the strengthening of the credibility of dynamic modelling of biodiversity.

19. The Joint Expert Group noted that several dynamic models continue to be developed, including the ForSAFE model for terrestrial biogeochemistry and biodiversity.

B. Future of the Joint Expert Group on Dynamic Modelling and workplan for the Joint Expert Group in 2019

20. The Joint Expert Group notes that funding on all fronts is necessary to continue ongoing and new work on Dynamic Modelling related to the Convention and urges policy makers to provide funding in support of the science-based work asked for.

21. The Joint Expert Group discussed the planned revision of the Joint Expert Group Dynamic Modelling mandate within the Working Group on Effects and the Expert Group also discussed co-operation both within and outside the Convention.

22. The Joint Expert Group discussed future meetings. Assuming that continued funding for the Joint Expert Group chair is forthcoming, future Joint Expert Group meetings will be held annually, alternating between a joint meeting with one or more ICPs and a stand-alone meeting. The Joint Expert Group concludes that further meeting in 2019 according to work plan 2018-2019 is desirable and that Joint Expert Group should continue the effort to integrate Dynamic Modelling expertise across all Convention bodies and also to provide links to modelling groups outside the Convention. The next Joint Expert Group meeting will be stand-alone and is tentatively planned for October 2019.
