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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 2021/22 and further development of effects-oriented activities: air pollution effects on materials, the environment and crops: air pollution effects on waters and integrated monitoring of air pollution effects on ecosystems

Integrated monitoring of air pollution effects on ecosystems*

Report by the Programme Centre of the International Cooperative Programme on Integrated Monitoring of Air Pollution Effects on Ecosystems

Summary

The present report is submitted to the Working Group on Effects as requested by the Executive Body for the Convention on Long-range Transboundary Air Pollution in accordance with the 2022–2023 workplan for the implementation of the Convention (ECE/EB.AIR/148/Add.1, items 1.1.1.25 and 1.1.1.26) and the Revised mandate for the International Cooperative Programme on Integrated Monitoring of Air Pollution Effects on Ecosystems (Executive Body decision 2019/18).

The report of the International Cooperative Programme on Integrated Monitoring of Air Pollution Effects on Ecosystems presents the results of the activities undertaken since its 2021 report (ECE/EB.AIR/GE.1/2021/15− ECE/EB.AIR/WG.1/2021/8).

* The present document is being issued without formal editing.

I. Introduction

1. The present report of the International Cooperative Programme on Integrated Monitoring of Air Pollution Effects on Ecosystems (ICP Integrated Monitoring) is submitted to the Working Group on Effects in accordance with the 2022–2023 workplan for the implementation of the Convention (ECE/EB.AIR/148/Add.1, items 1.1.1.25 and 1.1.1.26) and the Revised mandate for the International Cooperative Programme on Integrated Monitoring of Air Pollution Effects on Ecosystems (Executive Body decision 2019/18).[1] The report presents the results of the activities carried out between May 2021 and June 2022, including an evaluation of the eutrophication of European forest bryophyte communities as a result of the atmospheric deposition of nitrogen.

2. The Programme, which involves some 100 scientists and 48 active sites in 15 countries, has a Task Force led by Sweden and a Centre hosted by the Swedish University of Agricultural Sciences (SLU) in Uppsala.[2]

3. During the reporting period, ICP Integrated Monitoring held one meeting: the thirtieth Task Force meeting, and a scientific workshop jointly with ICP Waters (hybrid meeting held at Miraflores de la Sierra, Spain, and online, 10-12 May 2022).

4. Key topics discussed at the 2022 meeting included the move of the ICP Integrated Monitoring Programme Centre, principles for data availability, the reports to be prepared under the Convention's workplan, cooperation with other bodies and activities and the future workplan of ICP Integrated Monitoring. The scientific workshop focused on current work on the key scientific topics of the Programme (see section IV below). The minutes of the meetings are available from the programme website at SLU.[3]

II. Outcomes and deliverables during the reporting period

5. In 2021–2022, ICP Integrated Monitoring produced or contributed to the following reports:

(a) Integrated monitoring of air pollution effects on ecosystems (ECE/EB.AIR/GE.1/2021/15–ECE/EB.AIR /WG.1/2021/8);

(b) The 2021 joint progress report on policy-relevant scientific findings (ECE/EB.AIR/GE.1/2021/3−ECE/EB.AIR/WG.1/2021/3);

(c) The 2021 ICP Integrated Monitoring annual report;[4]

(d) A revised (in format and layout only) version of the IM manual;[5]

(e) A scientific paper on effects of eutrophication on European bryophyte communities.[6]

6. In addition to these reports, the Programme Centre:

(a) successfully completed its move from the Finnish Environment Institute to the Swedish University of Agricultural Sciences, including moving the database and the website; and

[1] Available at www.unece.org/env/lrtap/executivebody/eb_decision.html.
[2] See www.slu.se/en/icp-im.
[3] See www.slu.se/en/icp-im.
[4] Sirpa Kleemola and Martin Forsius, eds., *Thirtieth Annual Report 2021: Convention on Long-range Transboundary Air Pollution. International Cooperative Programme on Integrated Monitoring of Air Pollution Effects on Ecosystems*, Reports of the Finnish Environment Institute, No. 37/2021 (Helsinki, Finnish Environment Institute, 2021). Available at http://hdl.handle.net/10138/333713.
[5] See https://www.slu.se/en/Collaborative-Centres-and-Projects/integrated-monitoring/monitoring-manual/.
[6] James Weldon, Julian Merder, Marco Ferretti and Ulf Grandin, "Nitrogen deposition causes eutrophication in bryophyte communities in central and northern European forests", *accepted for publication by Annals of Forest Science.*

(b) started the operationalisation of the Extended IM monitoring program.

III. Expected outcomes and deliverables over the next period and in the longer term

7. In the second half of 2022 and in 2023, ICP Integrated Monitoring will contribute to or produce the following deliverables, as indicated in the Convention workplan:

(a) A scientific paper on the impacts of internal catchment-related nitrogen parameters on total inorganic nitrogen leaching, currently in draft stage;

(b) Scientific paper on modelling and assessment of biodiversity and ecosystem impacts, in cooperation with the Centre for Dynamic Modelling;

(c) Operationalise and advertise the extended IM as an attractive monitoring protocol, aiming at adding more ecosystem types in the IM monitoring;

(d) A scientific paper on heavy metal trends in concentrations and fluxes across ICP Integrated Monitoring sites in Europe, currently in draft stage;

(e) The thirty first annual ICP Integrated Monitoring report (covering activities in 2021/22);

(f) Contribution of ICP Integrated Monitoring to the review process of the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (Gothenburg Protocol).

IV. Cooperation with other groups, task forces and subsidiary bodies, including synergies and possible joint approaches or activities

8. ICP Integrated Monitoring has established useful cooperation with the following bodies under the Working Group on Effects: the International Cooperative Programme on Modelling and Mapping of Critical Levels and Loads and Air Pollution Effects, Risks and Trends (ICP Modelling and Mapping) – on critical load calculations; the Centre for Dynamic Modelling – on changes in biodiversity; the International Cooperative Programme on Assessment and Monitoring of the Effects of Air Pollution on Rivers and Lakes (ICP Waters); and the International Cooperative Programme on Assessment and Monitoring of Air Pollution Effects on Forests (ICP Forests) – on long-term trends, calculations and effects indicators. ICP Integrated Monitoring also uses emission scenario data from the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe.

V. Strengthening the involvement of countries of Eastern and South-Eastern Europe, the Caucasus and Central Asia in work under the Convention

9. A participant from the Russian Federation took part in the ICP Integrated Monitoring Task Force meeting in 2022.

VI. Scientific and technical cooperation activities with relevant international bodies

10. ICP Integrated Monitoring cooperates closely with the European Long-term Ecosystem Research in Europe network (eLTER)[7] and many sites are common to both

[7] See www.lter-europe.net.

bodies. With the approval of two projects with funding from the European Union Horizon 2020 programme totalling €14 million for eLTER, the development of a permanent infrastructure for long-term ecosystem, critical zone and socioecological research in Europe will advance greatly. This funding will enable significant development of the eLTER Research Infrastructure, in areas such as the Research Infrastructure's organization, business model and legal basis. It will also give a major boost to scientific work done at eLTER/ICP Integrated Monitoring sites and platforms. Altogether, 34 partners from 24 countries are involved in these projects. ICP Integrated Monitoring was represented at the eLTER "Mars" meeting 20–22 October 2021(online) and the eLTER Mallorca Integrated Progress Meeting 16-20 May 2022.

VII. Highlights of the scientific findings: policy-relevant issues

11. The following findings of ICP Integrated Monitoring are of particular scientific relevance:

Elevated atmospheric deposition of nitrogen has long been recognised as a threat to biodiversity and, despite declines in European emission levels, will remain a threat in the future. However, it has proven difficult to show clear large-scale impacts of nitrogen deposition on vascular forest understorey species, and few studies have looked at impacts on forest bryophytes. The impact of nitrogen deposition on forest bryophyte communities was assessed. Data from 187 plots included in European monitoring schemes (ICP Integrated Monitoring and ICP Forests) were used to analyse the relationship between levels of throughfall nitrogen deposition and bryophyte taxonomic and functional diversity, and community nitrogen preference. The results showed that nitrogen deposition is significantly associated with increased bryophyte community nitrogen preference and decreases in species evenness. These results indicate that nitrogen deposition is likely to adversely affect forest bryophyte communities, having negative impacts in terms of increased dominance of nitrophylic species at the expense of nitrogen sensitive species and a decrease in species evenness. These findings will contribute to future assessments of critical loads for nitrogen deposition.

12. The results indicate the importance of long-term monitoring and research sites for detecting long-term ecosystem impacts, particularly on the components of ecosystems which are most sensitive to the effects of atmospheric pollutants.

VIII. Publications

13. A list of ICP Integrated Monitoring publications and references for the present report has been posted on the ICP Integrated Monitoring website at SLU.[8]

[8] See https://www.slu.se/en/icp-im/.