United Nations ECE/EB.AIR/GE.1/2016/15–ECE/EB.AIR/WG.1/2016/8

Economic and Social Council

Distr.: General
31 August 2016

English only

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

Second joint session*
Geneva, 13–16 September 2016
Item 14 of the provisional agenda
Progress in activities in 2016 and further development of effects-oriented activities

Integrated monitoring of air pollution effects on ecosystems**

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

Summary

The present report is being submitted for the consideration of 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 workplan for the implementation of the Convention (ECE/EB.AIR/133/Add.1, items 1.1.1.13, 1.1.1.14 and 1.1.1.23) and, the informal document approved by the Executive Body for the Convention at its thirty-fourth

* The Executive Body to the Convention agreed that, as of 2015, the Working Group on Effects and the Steering Body to the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe should meet jointly, to achieve enhanced integration and cooperation between the Convention's two scientific subsidiary bodies (ECE/EB.AIR/122, para. 47 (b)).

** The present document is being issued without formal editing.

GE.16-15069(E)
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session, “Basic and multi-year activities in the 2016–2017 period” (items 1.1.1–1.1.3, 1.1.6, 1.1.7 and 1.8.1–1.8.3).

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 2015 report and details, in particular, work on dynamic modelling of the impacts of nitrogen deposition on changes in ground vegetation, and long-term trends in the retention and release of sulphur and nitrogen compounds in the catchments. The report also presents summary of the discussions at and results from the twenty-third Task Force meeting and a scientific workshop (Minsk, Belarus, 6–8 May, 2015) and the twenty-fourth Task Force meeting and a scientific workshop (Asker, Norway, 24–26 May, 2016). The meeting in Asker was a joint Task Force meeting with the International Cooperative Programme on Assessment and Monitoring of the Effects of Air Pollution on Rivers and Lakes (ICP Waters).

I. Introduction

1. The present report of the International Cooperative Programme on Integrated Monitoring of Air Pollution Effects on Ecosystems (ICP Integrated Monitoring) is being submitted for the consideration of 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 workplan for the implementation of the Convention (ECE/EB.AIR/133/Add.1, items 1.1.1.13, 1.1.1.14 and 1.1.1.23) and, the informal document approved by the Executive Body for the Convention at its thirty-fourth session, “Basic and multi-year activities in the 2016–2017 period” (items 1.1.1–1.1.3, 1.1.6, 1.1.7 and 1.8.1–1.8.3). The report presents the results of the activities undertaken between May 2015 and May 2016 and details, in particular, work on dynamic modelling of the impacts of nitrogen deposition on changes in ground vegetation, and long-term trends in the retention and release of sulphur and nitrogen compounds in the catchments.

2. The programme Task Force is led by Sweden, while the Programme Centre is hosted by the Finnish Environment Institute in Helsinki. The Programme involves some 150 scientists in 16 countries.

3. During the reporting period, ICP Integrated Monitoring held two meetings, the twenty-third Task Force meeting and a scientific workshop (Minsk, Belarus, 6–8 May, 2015) and twenty-fourth Task Force meeting and a scientific workshop (Asker, Norway, 24–26 May, 2016). The meeting in Asker was a joint Task Force meeting with the International Cooperative Programme on Assessment and Monitoring of the Effects of Air Pollution on Rivers and Lakes (ICP Waters).

4. Key topics discussed at the most recent Task Force meeting included the status of the ICP Integrated Monitoring database, reports to be prepared according to the Convention’s 2016–2017 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 two Programmes (see section IV below regarding ICP Integrated Monitoring topics). The minutes of the meetings are available on the ICP Integrated Monitoring website.[1]

II. Outcomes and deliverables in the reporting period

5. In 2015–2016, ICP Integrated Monitoring produced or contributed to the following reports:

(a) The 2015 joint progress report on policy-relevant scientific findings (ECE/EB.AIR/GE.1/2015/3–ECE/EB.AIR/WG.1/2015/3);

(b) Integrated monitoring of air pollution effects on ecosystems (the 2015 report by the Programme Coordinating Centre of the International Cooperative Programme on Integrated Monitoring of Air Pollution Effects on Ecosystems to the Working Group on Effects) (ECE/EB.AIR/GE.1/2015/16–ECE/EB.AIR/WG.1/2015/9);

(c) 24th Annual Report 2015 of ICP Integrated Monitoring;[2]

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[1] See www.syke.fi/nature/icpim.

[2] Sirpa Kleemola and Martin Forsius, eds., *24th Annual Report 2015, 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. 31 (Helsinki,

(d) A progress report on dynamic vegetation modelling at ICP Integrated Monitoring sites;[3]

(e) A scientific paper on sulphur and nitrogen mass balances at ICP Integrated Monitoring sites in Europe in 1990–2012 (submitted manuscript);[4]

(f) A progress report on report on heavy metal trends at ICP Integrated Monitoring sites;[5]

(g) A progress report on trend assessment for bulk deposition, throughfall and runoff water chemistry and climatic variables at ICP Integrated Monitoring sites. [6]

6. The main results of the carried out activities is the ICP Integrated Monitoring contribution to the Trends in Ecosystem and health responses to long-range transported atmospheric pollutants.[7] The report was presented at the thirty-fourth session of the Executive Body in December 2015.

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

7. In the second half of 2016 and in 2017, ICP Integrated Monitoring is going to contribute to or produce the following deliverables indicated in the 2016–2017 workplan:

(a) The 2016 joint progress report on policy-relevant scientific findings to the second joint session of Steering Body to the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) and the Working Group on Effects (ECE/EB.AIR/GE.1/2016/3–ECE/EB.AIR/WG.1/2016/3);

(b) The twenty-fifth annual ICP Integrated Monitoring report (covering activities in 2015–16);

(c) A report on mercury in the aquatic environment — a joint report together with ICP Waters (2016–2017 workplan item 1.1.1.8, in 2017);

(d) A report on connections between calculated critical loads exceedances and observed impacts of nitrogen (workplan item 1.1.1.14, in 2017);

(e) The twenty-sixth annual ICP Integrated Monitoring report (covering activities in 2016–17).

2015). Available from http://hdl.handle.net/10138/156295.

3 Maria Holmberg and Thomas Dirnböck, “Progress report on dynamic vegetation modelling at ICP IM sites” in Sirpa Kleemola and Martin Forsius, eds., 24th Annual Report 2015, chapter 2 of pp. 23–27.

4 Jussi Vuorenmaa and others, “Long-term sulphate and inorganic nitrogen mass balance budgets in European ICP Integrated Monitoring catchments (1990–2012)”, manuscript, in review (*Ecological Indicators*).

5 Staffan Åkerblom and Lars Lundin “Progress report on heavy metal trends at ICP IM sites” in Sirpa Kleemola and Martin Forsius, eds., 24th Annual Report 2015, pp. 32–36.

6 Jussi Vuorenmaa, Sirpa Kleemola and Martin Forsius, “Progress report on trend assessment for bulk deposition, throughfall and runoff water chemistry and climatic variables at ICP IM sites in 1990–2013” in Sirpa Kleemola and Martin Forsius, eds., 24th Annual Report 2015, pp.28–31.

7 See http://www.unece.org/index.php?id=42868.

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

8. ICP Integrated Monitoring has established useful collaboration 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 (on critical load calculations); the Joint Expert Group on Dynamic Modelling (on changes in biodiversity); the ICP Waters; and the International Cooperative Programme on Assessment and Monitoring of Air Pollution Effects on Forests (on long-term trends calculations on effects indicators). ICP Integrated Monitoring also uses emission scenario data of EMEP.

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

9. The twenty-third ICP Integrated Monitoring Task Force meeting and scientific workshop was held in Minsk, Belarus, 6–8 May, 2015.

VI. Scientific and technical cooperation activities with relevant international bodies

10. In terms of cooperation with international bodies, ICP Integrated Monitoring collaborates closely with the European Long-Term Ecosystem Research (LTER) network[8] and many of the sites are common to both bodies. A research infrastructure project (eLTER) received funding from the European Union Framework Programme for Research and Innovation (Horizon 2020) that started in June 2015.

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

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

(a) Chronic nitrogen (N) deposition poses a threat to biodiversity as a result of an eutrophication of sensitive ecosystems. Excess N may favour a few plant species causing competitive exclusion and, in the long run, loss of less competitive species. Natural ecosystems are facing the simultaneous pressure of climate warming. The monitoring activities at the sites of the ICP Integrated Monitoring and ICP Forest programmes produce high quality data that is valuable for identifying ecosystem responses. The monitoring data from selected ICP Integrated Monitoring and ICP Forest sites are used in a dynamic modelling study to evaluate vegetation responses to future nitrogen deposition. The very simple dynamic (VSD+) model has so far been applied to simulate soil chemistry at ten sites in four countries (Austria, Finland, Italy and Poland). The next steps include application and calibration at further sites and, after the soil chemistry simulations are satisfactory at all sites, the vegetation responses will be estimated with PROPS the dynamic

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

soil vegetation model. The impact on biodiversity is evaluated using the habitat suitability index;[9]

(b) Empirical evidence based on integrated environmental monitoring including physical, chemical and biological variables is essential for evaluating the ecosystem benefits of costly emission reduction policies. Site-specific annual input-output budgets for sulphate (SO_4) and total inorganic nitrogen (TIN = nitrate as nitrogen (NO_3-N) + ammonia as nitrogen (NH_4-N)) have been calculated and temporal trends for input (deposition) and output (runoff water) fluxes and net retention/net release of SO_4 and TIN have been analysed at 17 European ICP Integrated Monitoring sites in 1990 to 2012.[10] Large spatial variability in input and output fluxes of SO_4 and TIN were observed between the sites, with the highest deposition and runoff water fluxes in South Scandinavia, Central and Eastern Europe, and lowest fluxes at more remote sites in northern European regions. A significant decrease in total SO_4 (wet + dry) deposition and bulk deposition of TIN was found at 90 per cent and 65 per cent of the sites, respectively. Output fluxes of SO_4 decreased significantly at 60 per cent of the sites, while TIN output fluxes showed mixed response with both decreasing (9 sites) and increasing (8 sites) trend slopes, but trends were rarely significant;

(c) Catchments retained SO_4 in the early 1990s, but they shifted towards net loss in the late 1990s. This indicates that forest soils are now releasing former accumulated SO_4. TIN retention showed a mixed response with increasing or declining retention rates, but generally TIN was strongly retained in the catchments not affected by natural disturbances. The long-term variation of net losses for SO_4 was explained by changes in runoff and SO_4 concentrations in deposition, while variation of TIN retention was dominantly explained by changes in TIN concentrations in runoff. Net losses of SO_4 may lead to a slower recovery of surface waters than those predicted by the decrease in SO_4 deposition. Continued enrichment of N in catchment soils poses a threat to terrestrial biodiversity and may ultimately lead to higher TIN runoff through N saturation or climate change. The results confirm the effects of emission reduction measures, but large uncertainties still remain regarding many regulating ecosystem processes.

VIII. Publications

12. For a list of ICP Integrated Monitoring publications and references for the present report, please visit the ICP Integrated Monitoring website.[11]

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[9] See Footnote n°3

[10] See Jussi Vuorenmaa and others, “Long-term sulphate and inorganic nitrogen mass balance budgets in European ICP Integrated Monitoring catchments (1990–2012)”.

[11] See http://www.syke.fi/nature/icpim.