

**Economic and Social Council**Distr.: General
26 September 2013

Original: English

Economic Commission for Europe**Executive Body for the Convention on Long-range
Transboundary Air Pollution****Thirty-second session**

Geneva, 9–13 December 2013

Item 8 of the provisional agenda

**Action Plan for the Implementation of the Long-term Strategy
for the Convention****Review of the International Cooperative Programmes of the
Working Group on Effects****Report of the ad hoc group of experts***Summary*

At its thirty-first session in December 2012, the Executive Body for the Convention on Long-range Transboundary Air Pollution requested its Bureau to appoint a time-limited ad hoc expert group to exclusively review the International Cooperative Programmes under the Working Group on Effects (ECE/EB.AIR/113, para. 48). The ad hoc group was to make recommendations to the Executive Body with respect to a future organization of the International Cooperative Programmes (ICPs) (including the Joint Expert Group on Dynamic Modelling) in the light of the objectives and priorities expressed in the Long-term Strategy for the Implementation of the Convention (ECE/EB.AIR/106/Add.1).

The present report was drafted by the ad hoc ICP review group. It includes the recommendations for the future organization and functioning of the ICPs.

Contents

	<i>Paragraphs</i>	<i>Page</i>
I. Introduction	1–3	3
II. Review of Working Group on Effects/International Cooperative Programme operations	4–26	3
A. Conclusions	9–13	4
B. Recommendations.....	14–26	5
III. Review of the International Cooperative Programmes.....	27–73	8
A. International Cooperative Programme on Effects of Air Pollution on Natural Vegetation and Crops	29–34	8
B. International Cooperative Programme on Assessment and Monitoring of Acidification of Rivers and Lakes	35–40	9
C. International Cooperative Programme on Integrated Monitoring of Air Pollution Effects on Ecosystems.....	41–47	10
D. International Cooperative Programme on Assessment and Monitoring of Air Pollution Effects on Forests.....	48–53	11
E. International Cooperative Programme on Effects of Air Pollution on Materials, including Historic and Cultural Monuments.....	54–59	13
F. International Cooperative Programme on Modelling and Mapping of Critical Loads and Levels and Air Pollution Effects, Risks and Trends	60–69	14
G. Joint Expert Group on Dynamic Modelling.....	70–73	16
 Annex		
Note on the informal meeting of International Cooperative Programme lead and host country representatives.....		17

I. Introduction

1. At its twenty-ninth session (Geneva, 12–16 December 2011), the Executive Body for the Convention on Long-range Transboundary Air Pollution (Air Convention) adopted decision 2011/14, Action Plan for the Implementation of the Long-term Strategy for the Convention (see ECE/EB.AIR/109/Add.1). As part of this decision, an ad hoc group of experts was tasked with reviewing the organization and operational structure of the Convention (para. 4 (a) of the Action Plan). The report of the expert group (ECE/EB.AIR/2012/15) was adopted at the thirty-first session of the Executive Body (Geneva, 11–13 December 2012) and included a recommendation that the Executive Body initiate a review of the International Cooperative Programmes (ICPs).

2. The expert group report, while noting the essential role played by the ICPs in identifying air pollution problems and developing an effects-based approach to emissions controls, recommended that further possibilities for simplification and streamlining, consistent with the Long-term Strategy for the Convention (LTS) (ECE/EB.AIR/106/Add.1, decision 2010/18),¹ should be considered. However, as most areas of the effects-related work were identified as priorities in the LTS, the expert group recommended that the Executive Body initiate a review of the ICPs that took into account: “the needs as defined in the LTS and the strategy adopted in 2009, the overall needs of the Convention as defined in this document (including issues such as outreach), the needs of the Parties (in particular those in Eastern Europe, the Caucasus and Central Asia as well as Southeast Europe), the scientific relevance and the possibilities for achieving what is needed from the current ICPs” (ECE/EB.AIR/2012/15, para. 23). The review was to be objective, but take account of work being done under the other main subsidiary bodies to provide a forward-looking plan for the effects-related work under the Convention.

3. In this context it is noted that there is a huge amount of relevant and synergistic scientific activity in the area of air pollution impacts and effects mostly not centrally funded via Convention channels. At the same time, much of the data collected are unique and of importance outside of the Convention. The same applies to harmonized methodologies for monitoring and modelling which constitute international standards. The goal of this review is to establish how best to obtain the most value added for the Convention.

II. Review of Working Group on Effects/International Cooperative Programme operations

4. Early in the discussions on the Convention it was recognized that a good understanding of the harmful effects of air pollution was a prerequisite for reaching agreement on effective pollution control. To develop the necessary international cooperation in the research on and the monitoring of pollutant effects, the Working Group on Effects was established under the Convention in 1980, i.e., immediately after the establishment of the Convention.

5. The Working Group on Effects provides information on the degree and geographic extent of the impacts on human health and the environment of major air pollutants, such as sulphur and nitrogen oxides, ozone and heavy metals. Its six ICPs, the Joint Expert Group on Dynamic Modelling and the Joint Task Force the Health Aspects of Air Pollution (Task Force on Health) of the World Health Organization (WHO) European Centre for

¹ Available from http://www.unece.org/fileadmin/DAM/env/lrtap/conv/long-term_strategy.pdf.

Environment and Health (ECEH) and the Convention's Executive Body identify the most endangered areas, ecosystems and other receptors by considering damage to human health, terrestrial and aquatic ecosystems and materials. An important part of this work is long-term monitoring. The work is underpinned by scientific research on dose-response, critical loads and levels and damage evaluation.

6. The Working Group meets annually to discuss the results of the ICPs and the current and future needs of the Convention. It considers its future work and that of the Programmes and prepares a workplan for the coming year for consideration by the Executive Body. Important results and recommendations are brought to the attention of the Executive Body; results are also published in the scientific literature and disseminated to the public through the publication of reports and through United Nations Economic Commission for Europe (ECE) press releases. The Working Group also publishes substantive reports summarizing and assessing the most important results of the activities of the ICPs. Specific activities are coordinated and implemented by the task forces of the ICPs, the Task Force on Health, and the Joint Expert Group on Dynamic Modelling.

7. The Long-Term Strategy of the Effects-Oriented Activities (ECE/EB.AIR/2009/17/Rev.1),² including objectives, priorities and methods, was approved by the Executive Body at its thirty-first session (ECE/EB.AIR/113, para. 32 (b)).

8. The Extended Bureau of the Working Group is responsible for implementing the workplan. The Extended Bureau comprises the Bureau of the Working Group, the Chairs of the individual task forces and the Joint Expert Group on Dynamic Modelling, and the representatives of the Programme Centres of the ICPs.

A. Conclusions

9. It is recognized that nationally funded activities must continue and that without them the Convention (and the EU) would not be able to fulfil its aims regarding the abatement of air pollution effects. Such multiple uses of outputs from scientific projects is clearly beneficial; but there is also necessary to ensure that research priorities, data collection and availability, reporting, organizational requirements and policy messages meet the needs and requirements of the Parties to the Convention. For example, annual reports may be needed to meet contractual requirements of funders, but are not otherwise necessary for the Convention; annual meetings of networks and programmes are useful for maintaining the participation of the relevant science community, but are not essential for the Convention. The Convention requires that appropriate, well-founded messages the highest scientific quality are delivered at the policy level (i.e., to the Working Group on Strategies and Review and the Executive Body). However, as the capacity at the political level is limited, too much information provided to the policy bodies can cause information overload. This can lead to the key messages being overlooked. It is important, therefore, that the ICPs, together with the Working Group on Effects, ensure clear communication focused on the most appropriate messages. This is only possible, however, if the Executive Body and Working Group on Strategies and Review are clear on their expectations.

10. Capacity is not seen as an issue by any of the ICPs, but this depends on continued funding at levels similar to or greater than at present. By implication, reduced funding will lead to reduced capacity for activities. This needs to be carefully managed by the ICPs to

² Informal documents Nos. 18 and 19 for the thirty-first session; available from <http://www.unece.org/index.php?id=28315>.

ensure that the expectations of the Executive Body and other Convention bodies regarding delivery of outputs is well managed.

11. The success of the ICPs and the Working Group on Effects in delivering the needs of the Executive Body with respect to the effects-oriented activities relies on the active participation of the Parties in monitoring and data delivery to the respective ICP following the agreed scope and format.

12. All ICPs share a view of a “one-sided” communication with the Executive Body and other Convention Bodies. The ICPs see little or no feedback on whether the outputs delivered fulfilled the requirements, what impact the outputs had on policy or activities elsewhere in the Convention or on how outputs could be developed to further assist in the work of the Convention. As a result of this lack of “downwards” communication, the ICPs mostly make their own interpretation of what is needed. This is often presented in a scientific manner rather than in a more appropriate language for policymakers.

13. Communication between the various bodies of the Convention and the ICPs would be greatly improved through appropriate involvement and presentations at Working Group on Effects meetings. It is also important that when an output is requested by the Executive Body or another Convention body, there is a clear obligation on that body to take note of it and to provide feedback on its effectiveness, use, etc.

B. Recommendations

14. There should be an obligation for the Working Group on Strategies and Review and the Executive Body to take note of any output requested from the Working Group on Effects or its ICPs and to provide appropriate feedback.

15. The extent to which the Convention is able to steer the work and organization of the ICPs depends upon the funding received by the Programme Centres and task force members from other external organizations, lead Parties and other Parties. This issue was discussed in detail at the informal meeting of ICP lead/host country representatives (Berlin, 2 October 2012) (see annex). It is clear that the co-funding of activities and broader participation of the Programme Centres and Parties involved in the ICPs adds significant value to the work of the Convention and provides for essential “horizon scanning” that will ultimately inform the Convention, particularly in alerting policymakers to new threats or issues. The funding profile needs for each ICP needs to clearly identify the activities, recommendations and outputs requested by the Executive Body, enabling progress to be monitored against the funding allocated.

16. The ICPs are different in scope of activity, mode of operation and policy influence. Some are more monitoring oriented (e.g., the International Cooperative Programme on Assessment and Monitoring of Air Pollution Effects on Forests (ICP Forests), the International Cooperative Programme on Assessment and Monitoring of Acidification of Rivers and Lakes (ICP Waters), the International Cooperative Programme on Integrated Monitoring of Air Pollution Effects on Ecosystems (ICP Integrated Monitoring) and the International Cooperative Programme on Effects of Air Pollution on Materials, including Historic and Cultural Monuments (ICP Materials)) and others are more modelling/scenario oriented and therefore closer to immediate policy needs (International Cooperative Programme on Effects of Air Pollution on Natural Vegetation and Crops (ICP Vegetation), International Cooperative Programme on Modelling and Mapping of Critical Loads and Levels and Air Pollution Effects, Risks and Trends (ICP Modelling and Mapping)). It is, therefore, difficult for them all to have the same level of policy links. Those that are monitoring oriented have a key role in demonstrating (“ground-truthing”) the impacts of air pollution and the outcome of emission reductions and their sufficiency, whereas those that

are policy oriented have an additional key role in advising policy for future emission abatement strategies and providing spatial coverage. There is further differences in the ICPs in that some are “media” or “multi-media” oriented (i.e., ICP Forests, ICP Waters, ICP Materials and ICP Integrated Monitoring), ICP Modelling and Mapping and the Joint Expert Group on Dynamic Modelling are interpretive and ICP Vegetation is oriented towards certain pollutants. These differences make it difficult to prescribe a one-size-fits-all management and organizational model. What is essential, however, is that clear objectives are defined for each ICP within the workplan.

17. The production of integrated thematic reports is a good development and there are now several examples of these (e.g., *Benefits of air pollution control for biodiversity and ecosystem services* and *Impacts of air pollution on ecosystems, human health and materials under different Gothenburg Protocol³ scenarios*).⁴ Since these are produced by the combined efforts of several or all ICPs, they are rightly delivered as Working Group on Effects outputs. In the future, following the LTS and other recent Convention documents, there will be an increased need for both tailored reports and broader assessments. Some of them could be written solely by the Working Group on Effects community, but these should more often be a result of combined efforts, in particular between the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) and the Working Group on Effects, but also sometimes involving other groups under the Convention. There is a need to define, in discussion with the Executive Body and other Convention bodies, in particular EMEP and Working Group on Strategies and Review, subject areas for future thematic or synthesis reports and communications.

18. Convention bodies should also assist Parties in their implementation of (international) air pollution strategies. For this, it is important that information and knowledge are easily accessible. A significant obstacle to that and for the production of these integrative/interpretive reports is the lack of a common entry point for data from the ICPs. Programme Centres tend to hold the data for individual ICPs but this is not made easily available on the web. The use of common data standards has been discussed within the Working Group on Effects, but formal adoption of agreed common standards is required, building on the 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.16).⁵ A portal approach is an appropriate way forward to web access to data and the EMEP data system should be explored as a possible template. The Working Group on Effects should take steps to develop and adopt appropriate common data standards for all ICPs and develop a portal approach to facilitate and improve data access via the web. The Working Group on Effects should develop a work and time plan for this activity.

19. Easily accessible maps and common presentation formats would further facilitate the production of consistent outputs. The production of integrative reports is important as these reports provide a (relatively) clear view of the scientific research and latest knowledge in a coherent way. To increase the effectiveness of these integrative reports they should be accompanied by short summaries (brochures) which provide the key messages aimed at policymakers and other Convention bodies.

³ Protocol to Abate Acidification, Eutrophication and Ground-level Ozone to the Convention on Long-range Transboundary Air Pollution.

⁴ Both online publications are available from the Working Group on Effects website at <http://www.unece.org/env/lrtap/WorkingGroups/wge/welcome.html>.

⁵ Adopted by the Executive Body at its twenty-sixth session in December 2008 (ECE/EB.AIR/96/Add.1, decision 2008/1, para. 1).

20. The publication of synthesis papers in scientific journals have proved useful in communicating the value of the monitoring programmes to the wider scientific community and also provide a degree of scientific legitimacy to the Convention. There are also good examples of scientific papers being produced describing serendipitous scientific discoveries (e.g., the trends in dissolved organic carbon in surface waters). These provide important added value to the work of the ICPs. There is a need to continue to publish scientific papers as well as interpretive reports as this provides the Convention with scientific legitimacy.

21. Several ICPs engage in the production of annual data/progress reports. These are perhaps less important than the interpretive/integrative reports and their frequency should be reduced. This should free up resources for producing a schedule of thematic reports. The responsibility for leading the production of a thematic report is currently voluntarily assumed and there are rarely additional resources available for the activity. To ensure that this responsibility is appropriately distributed to the ICPs, the Working Group on Effects should compose a plan on a two-year (minimum) timescale. ICPs should therefore only produce biannual data/progress reports and the Working Group on Effects should develop a workplan/schedule for producing interpretive reports as part of the two-year workplan.

22. National needs can also provide a requirement for thematic assessment and data interpretation. The National Focal Centres in individual countries need to be engaged more fully in this respect to reinforce national and international issues at the level of the Executive Body.

23. The Parties should be more actively involved in the interpretation of data and preparation of assessment reports on themes/issues rather than just the Programme Centres. Parties should be encouraged to present their national work related to effects during the Working Group on Effects sessions.

24. Details of the activities undertaken by ICPs and Task Forces are not required by the Executive Body, and should not be reported to it. Instead, the current practice should be continued whereby the Working Group on Effects submits one to three reports annually to the Executive Body, making clear statements of policy relevance. One of these reports should be the joint report that would include highlights from all (or selected — on a rotational basis) ICPs. Options should also be considered concerning country-level reporting to Working Group on Effects and opportunities for increasing the cooperation between the National Focal Centres of different ICPs at the national scale.

25. The requirement for integrated working, reporting and assessments in future calls into question the current structure and timetable of task force meetings. These are currently undertaken in isolation from each other and from the Working Group on Effects annual meeting. Options for establishing integrated science and task force meetings and for reinvigorating the annual Working Group on Effects meeting should therefore be explored. Such meetings may be organized as joint (Convention or Working Group on Effects) scientific meetings or as topical workshops, e.g., in response to a specific request from the Executive Body.

26. As the scientific and technical work of the subsidiary bodies under Working Group on Effects depends on a voluntary trust fund, there is risk that they will receive only limited support to cover the overall costs for running the centres. A mandatory financial mechanism has repeatedly been discussed within the Convention, but has always been rejected. Even if there does not seem to be an immediate threat, there is a need to consider how a long-term mechanism could work. It is, however, important that Parties that finance ICP Centres and task force chairs signal well in advance any substantial changes in financial support. The Executive Body should further consider a more stable long-term financial mechanism for the Working Group's subsidiary bodies.

III. Review of the International Cooperative Programmes

27. The international cooperative effects-related activities under the Convention are:
- (a) ICP Vegetation, led by the United Kingdom of Great Britain and Northern Ireland;
 - (b) ICP Waters, led by Norway;
 - (c) ICP Integrated Monitoring, led by Sweden;
 - (d) ICP Forests, led by Germany;
 - (e) ICP Materials, led by Sweden and Italy;
 - (f) ICP Modelling and Mapping, led by France;
 - (g) The Joint Expert Group on Dynamic Modelling, led by the United Kingdom and Sweden.
28. The Task Force on Health contributes to the effects-oriented activities under the auspices of the Working Group on Effects, but is not considered as part of this review.

A. International Cooperative Programme on Effects of Air Pollution on Natural Vegetation and Crops

29. The potential for damage to crops by air pollution in many areas of Europe is high and the annual economic cost may be considerable. ICP Vegetation was therefore established to consider the underlying science for quantifying crop damage, but later its scope was expanded to also include semi-natural vegetation.
30. The objectives of ICP Vegetation are to:
- (a) Evaluate the effects of air pollutants and other stresses on crops and non-wood plants by monitoring the onset of injury and reductions in the yield/biomass of sensitive species;
 - (b) Identify realistic dose-response functions, incorporating modifying (level II) factors for a range of economically important crops and for crops at risk from pollution;
 - (c) Validate and substantiate critical levels of ozone for crops, non-wood plants and trees including incorporation of level II factors;
 - (d) Facilitate the production of European maps showing where critical levels for ozone are exceeded;
 - (e) Assist in assessing the economic loss due to ozone pollution;
 - (f) Conduct literature reviews and specific experiments on the accumulation of atmospheric deposition of heavy metals and other substances via moss monitoring.

ICP Vegetation is planned and coordinated by a task force led by the United Kingdom and supported by a coordination centre at the Centre for Ecology and Hydrology in Bangor, United Kingdom.

31. Over the last 25 years, ICP Vegetation has developed dose-response relationships for the impacts of ozone on vegetation. Based on these, critical levels of ozone for vegetation were defined, initially based on the ground-level ozone concentrations in the air, but more recently based on the ozone “taken up” by vegetation (ozone flux). Since 2006, ICP Vegetation has developed, in close collaboration with the EMEP Meteorological Synthesizing Centre-West and in consultation with the Task Force on Integrated

Assessment Modelling, simplified flux-based methods for application in integrated assessment modelling. Over the past year, the flux-based method has been provisionally integrated into the Greenhouse Gas and Air Pollution Interactions and Synergies (GAINS) model.⁶

32. Whereas in earlier years the focus has been on monitoring and experimental work to collate field-based evidence on spatial patterns and temporal trends on the impacts of ozone on vegetation, more recently information has been collated and reported on other policy-relevant indicators applying the flux-based method, for example the impacts of ozone on food security (2011), carbon sequestration (2012) and ecosystem services and biodiversity (2013). ICP Vegetation will continue this focus on policy-relevant indicators in the future.

Conclusions

33. The structure of ICP Vegetation and the approaches used to assess the effect of ozone on crops provides a good starting point to assess the impacts of other air pollutants such as nitrogen, particulate matter and black carbon. The ICP maintains an emphasis on research and new science to establish an appropriate scientific basis for quantifying ozone effects, particularly damage to crops. In addition, it has hosted the European moss monitoring survey, with a focus on heavy metal deposition and has established that concentrations have decreased and are largely stable in Western Europe but not in Eastern Europe. Air pollution impacts on biodiversity and ecosystems services are difficult to monetize but are clearly important and relevant to the LTS. In future, the ozone issue will need to be considered at hemispheric scale, and should be seen as a key component in the global food security issue.

Recommendations

34. ICP Vegetation should:

- (a) Expand its focus from ozone to include other air pollutants, particularly nitrogen;
- (b) Pursue the reorganization of moss monitoring to focus on the countries in Eastern Europe, the Caucasus and Central Asia where heavy metal pollution continues to be a major air pollution issue;
- (c) Look for opportunities for further cooperation with EMEP;
- (d) Look to further cooperate with ICP Forests with respect to ozone impacts on forests, including carbon sequestration.

B. International Cooperative Programme on Assessment and Monitoring of Acidification of Rivers and Lakes

35. Acidification of freshwater systems provided some of the earliest evidence of the damage caused by sulphur emissions. The sensitivity of these systems suggested that they were ideal for studying the effects of, responses to and changes in pollution deposition. The objectives of ICP Waters are to assess, on a regional basis, the degree and geographical extent of acidification of surface waters. The data collected should provide information on dose-response relationships under different conditions and correlate changes in acidic deposition with the physical, chemical and biological status of lakes and streams.

⁶ See <http://gains.iiasa.ac.at/models/>.

36. The ICP is planned and coordinated by a task force under the leadership of Norway. Chemical and biological data from more than 200 catchments in 24 countries in Europe and North America are available in the database of the Programme Centre at the Norwegian Institute for Water Research in Oslo. This data set represents the largest and most comprehensive information on acidification and recovery of freshwaters in the world, and has been widely used as a research resource. These data will be vital to future research projects focused on recovery from air pollution impacts and interactions with climate change.

37. ICP Waters has clearly demonstrated that surface waters show strong signs of chemical recovery in response to reduced acid deposition; that biological recovery is, so far, slow and patchy; that climate change will affect acidification and recovery in the future; and that heavy metals and persistent organic pollutants are found in fish, sediments and waters in remote areas.

38. In future, ICP Waters will continue to document the effects of the implementation of the Protocols to the Air Convention, as well as the remaining ecosystem damage due to air pollution, and to assess the need for further reductions in emissions as part of the ongoing protocol review process.

Conclusions

39. ICP Waters provides a unique synthesis of studies on trends in recovery from acidification of surface waters and cooperation in dynamic modelling efforts to assess the delay times to biological recovery. There is, however, an apparent lack of broad participation of Parties across the ECE region and ICP Waters would benefit from more stream and river sites. ICP Waters collaborates extensively with other ICPs and the Joint Expert Group on Dynamic Modelling. The ICP Waters monitoring programme already includes nitrogen, phosphorus and dissolved organic carbon, which provides a good starting point to assess nutrient enrichment and eutrophication impacts.

Recommendations

40. It is recommended that ICP Waters:

- (a) Shift the focus of its activity from acidification to a more comprehensive assessment of the impacts of nitrogen, heavy metals and persistent organic pollutants;
- (b) Maintain periodic trend assessments;
- (c) Consider stronger links with the river sites monitored as part of ICP Integrated Monitoring;
- (d) Pursue interaction with other international waters monitoring programmes, such as the United Nations Global Environment Monitoring System Water Programme.

C. International Cooperative Programme on Integrated Monitoring of Air Pollution Effects on Ecosystems

41. Investigations of air pollutants acting on particular receptors have shown that an integrated approach is needed to understand the mechanisms of damage and the resulting effects. Thus, the impacts of acidic deposition may take place in the soil, but effects are more likely to be seen in vegetation growing in the soil or in the water draining from the system. Furthermore, while biological impacts are of prime concern, it is the chemical processes and the physical parameters in the various parts of the ecosystem that determine its suitability for biota.

42. The objective of ICP Integrated Monitoring is to determine and predict the state of ecosystems (or catchments) and their changes from a long-term perspective with respect to the regional variation and impact of air pollutants, especially nitrogen, sulphur, ozone and metals, including effects on biota.

43. The Programme task force is led by Sweden, while the Programme Centre at the Finnish Environment Institute in Helsinki is entrusted with collecting, storing, processing and analysing data from countries taking part in the programme. The network currently covers some 50 sites in 19 countries.

44. ICP Integrated Monitoring aims to:

(a) Monitor the state of ecosystems (catchments/plots) and provide an explanation of changes in terms of causative environmental factors, in order to provide a scientific basis for emission controls;

(b) Develop and validate models for the simulation of ecosystem responses;

(c) Estimate responses to actual or predicted changes in pollution stress, and in concert with survey data to make regional assessments;

(d) Carry out bio-monitoring to detect natural changes, in particular to assess effects of air pollutants and climate change.

45. The objectives of the ICP Integrated Monitoring are firmly focused on long-term effects and on long-term monitoring. In the short term, however, mathematical models are being developed which can simulate ecosystem response to specific pollutant stress. The data collected in the Programme are used to calibrate and test models that can then be used to predict ecosystem changes under a variety of bio-geophysical conditions and pollution scenarios.

Conclusions

46. ICP Integrated Monitoring focuses on whole catchments, and so must integrate and understand other factors that are driving changes, including air pollution. This, perhaps necessarily, leads to the work tending to focus on looking for and analysing ecosystem effects rather than quantifying and attributing them to anthropogenic drivers. The data collected at some sites have proven extremely useful for testing dynamic and process-based models. The data have also provided the basis for studies of chemical input-output budgets at catchment scale. It is apparent, however, that the number of active sites is declining. This is the only ICP that is process-oriented in approach and as such is capable of identifying feedbacks and multiple stresses.

Recommendations

47. The Executive Body should consider merging the activities (in particular, interpretations) of ICP Integrated Monitoring with ICP Waters and/or ICP Forests, and increasing the focus of its activity to cover carbon and nitrogen pools and fluxes, more specifically.

D. International Cooperative Programme on Assessment and Monitoring of Air Pollution Effects on Forests

48. ICP Forests was set up to monitor the effects of air pollution on Europe's forests. The specific objectives of ICP Forests are to monitor the effects of anthropogenic (in particular air pollution) and natural stress factors on the condition and development of forest ecosystems in Europe, and to contribute to a better understanding of cause-effect

relationships in forest ecosystem functioning in various parts of Europe. The Programme is planned and coordinated by a task force under the leadership of Germany with the cooperation of a Programme Coordinating Centre at the Johann Heinrich von Thunen Institute in Germany. There are currently 41 countries participating in the work.

49. Since 1986, ICP Forests has conducted an annual transnational survey of forest condition in Europe; from 1991 this has been done in close cooperation with the European Commission. This transnational survey aims to document the development of forest condition at the European level rather than on the national scale. This is accomplished by means of annual large-scale monitoring of tree vitality (6,000 sample plots with about 130,000 sample trees) and a number of site parameters on a uniform 16 kilometre (km) x 16 km transnational grid of sample plots (known as “level I” monitoring). In addition to tree vitality surveys, soil and foliar analyses are performed on parts of these level I plots.

50. In order to contribute to a better understanding of air pollution and other factors which may influence forest ecosystems, a programme for intensive and continuous monitoring of forest ecosystems (level II) has been implemented. In this context, 860 permanent observation plots for intensive monitoring of forest ecosystems have been established across Europe. The intensive monitoring includes the assessment of crown condition, increment and chemical composition of foliage and soils on all plots. Additional measurements on a limited number of plots include: (a) atmospheric deposition (60 per cent of the plots); (b) meteorological parameters (20 per cent of the plots); (c) soil solution chemistry (30 per cent of the plots); (d) ground vegetation assessments (expected on 70 per cent of the plots); and (e) ambient air quality. The data from the level II intensive monitoring plots are currently stored and maintained at the Programme Coordinating Centre.

51. In the future, the Programme aims to undertake further studies on the links between air pollution (mainly nitrogen, ozone, heavy metals and sulphur) and observed effects (on soil condition, tree nutrition, forest health and forest growth); to extend studies on critical loads and exceedances to the large scale (level I); and to study the relationships between air pollution, carbon fluxes, climate, forest health and biodiversity.

Conclusions

52. ICP Forests is the biggest ICP, with a broad focus on forest monitoring in general rather than specifically on the impacts of air pollution. It has a wide geographical scope. The extent to which this ICP is a forest monitoring programme or an air pollution impacts monitoring programme requires specification. The wide network of level I and II plots have provided unique data to support dynamic model assessments and to disentangle air pollution and climate effects, including on biodiversity. There seems to be little interaction with other ICPs (e.g., ICP Waters).

Recommendations

53. The activities of ICP Forests should be streamlined to focus on the air pollution policy-related issues identified by the Executive Body, to assess and coordinate deposition monitoring in relation to the data collected as part of EMEP and should possibly be expanded in scope to include integrated monitoring. A comprehensive assessment should be undertaken as to whether and to what extent the level I monitoring is still relevant and useful for air pollution impact assessment. ICP Forests and ICP Vegetation should increase their cooperation with respect to ozone impacts on forests, including carbon sequestration.

E. International Cooperative Programme on Effects of Air Pollution on Materials, including Historic and Cultural Monuments

54. Several studies of materials have indicated that atmospheric corrosion influenced by acidifying pollutants is costly. Extensive damage has also been observed on historical and cultural structures and monuments, calcareous stones, medieval glass and metals. For these reasons, ICP Materials was launched in 1985 to fill some of the major gaps in scientific knowledge in this area, with two objectives: to perform a quantitative evaluation of the effect of sulphur and nitrogen compounds and other major pollutants, including the effects of low concentrations of these pollutants, on the atmospheric corrosion of important materials; and to assess the trends of corrosion and pollution.

55. The ICP Materials task force is led by Sweden, which provides the Main Research Centre at the Corrosion and Metals Research Institute in Stockholm. Since 2005, Sweden and Italy (via its National Agency for New Technologies, Energy and Sustainable Economic Development) have been co-chairing the Programme. Austria, the Czech Republic, Germany, Norway, Switzerland and the United Kingdom are responsible for sub-centres, which prepare and distribute specimens of particular materials and evaluate corrosion attack after exposure. A network of 30 exposure sites across 18 ECE countries covers a broad band of geographic zones in Europe and North America. At these sites, atmospheric pollution is characterized by measuring the concentrations of the following gases: sulphur dioxide, nitrogen dioxide and ozone. The reduction of the sulphur pollution has created a new multi-pollutant situation where sulphur dioxide is no longer the dominating corrosive pollutant. Therefore, a second “multi-pollutant programme” was carried out in 1997–2001 using a subset of test sites and materials from the original programme, along with some new test sites. A new set of dose-response functions was developed describing the deterioration of material in the new mixture of pollutants.

56. The concept of a threshold of harmful pollution, a critical load or level is not applicable to materials, as any amount of pollution leads to some deterioration. Instead an “acceptable” deterioration rate has been defined as a multiple (e.g., 1.5) of the background deterioration rate. Acceptable levels of pollution can be calculated using dose-response relations for the individual materials and the acceptable deterioration rate. This concept is now used for mapping of areas with exceedances and, together with assessments of the stock of materials, especially cultural heritage objects, at risk for cost-benefit analyses in different pollution scenarios.

57. Future key activities for ICP Materials are:

- (a) Maintaining scientific excellence on the effect of air pollution and confounding factors, such as climate change, on materials and cultural heritage;
- (b) Strengthening of the geographical coverage and outreach activities, especially to countries in Eastern Europe, the Caucasus and Central Asia;
- (c) Further developing policy-relevant information on the effect of key pollutants on materials, including particulate matter, black carbon, ozone and acidifying pollutants;
- (d) Further developing United Nations Educational, Scientific and Cultural Organization (UNESCO) cultural heritage sites as user-friendly indicators and for cost assessments.

Conclusions

58. The focus on dose-response for economic evaluation and damage assessment, including at UNESCO sites, is an important, high profile activity for the Convention. The work on economic assessment is an important contribution to the assessment of air

pollution impacts. Monitoring activities related to particulate matter and black carbon, as short-lived climate forcers, can potentially broaden interaction with other bodies of the Convention.

Recommendations

59. ICP Materials should:

(a) Consider a possible future call for data, with advice from ICP Mapping and Modelling;

(b) Take appropriate actions to communicate directly with other bodies of the Convention and not only via the Coordination Centre for Effects (CCE)/ICP Modelling and Mapping;

(c) Maintain the focus on improving the assessment of the economic costs of air pollution impacts on a regional scale;

(d) Consider, at least from time to time, holding common workshops and/or meetings with CCE and ICP Modelling and Mapping.

F. International Cooperative Programme on Modelling and Mapping of Critical Loads and Levels and Air Pollution Effects, Risks and Trends

60. The objectives of ICP Modelling and Mapping are to determine critical loads and levels and their exceedances for selected pollutants, to develop and apply other methods for effects-based approaches, such as dynamic modelling, and to model and map the present and projected status of and trends in impacts of air pollution. A Programme task force led by France is responsible for the detailed planning and coordination of activities, in collaboration with CCE. The task force uses available and accepted data, drawing on the work of other task forces, ICPs and EMEP.

61. CCE, at the National Institute for Public Health and the Environment in Bilthoven, the Netherlands, provides scientific and technical support to the task force and to other effects-related activities. It develops methods and models for calculating critical loads and levels and for other effects-based approaches, and produces maps of critical loads and levels and their exceedance and other risk parameters related to potential damage and recovery.

62. CCE also provides assistance to National Focal Centres in participating countries, helping them to develop methods and data for calculating and mapping critical loads, critical levels and exceedances as a basis for developing potential abatement strategies for sulphur, nitrogen and other relevant pollutants. While CCE is charged with compiling European critical loads/levels maps and databases, National Focal Centres are responsible for producing the national data on critical loads/levels and maps for inclusion in the European maps. At present, 30 countries have contributed national data.

63. CCE uses various European databases on soil, land, climatic and other variables to calculate critical loads for countries that are unable to provide national data. It maintains a database of critical loads data, which is used for integrated assessment modelling by the Task Force on Integrated Assessment Modelling and the Centre for Integrated Assessment Modelling.

64. A Modelling and Mapping Manual,⁷ incorporating the results of years of methodological development and refinement, was published first in 1986, and thoroughly updated in 1995 and 2004, with several partial updates thereafter. The Modelling and Mapping Manual details the methods for calculating and mapping critical levels and loads that have been agreed at workshops organized under the auspices of the Executive Body for the Convention and task force meetings. The Manual, and its major updates, have been adopted by the Executive Body and are explicitly referred to in the amended Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (Gothenburg Protocol) (see annex 1). The Manual integrates policy-relevant methods and outcomes from different ICPs and contributes to the harmonization of methods.

65. The critical loads and levels approach for pollution abatement has been successfully applied to strategies for emission reductions under the 1994 Protocol on Further Reduction of Sulphur Emissions and the Gothenburg Protocol.

66. Close collaboration with the Task Force on Integrated Assessment Modelling and integration of methods and data has resulted in the integration of critical loads in the Regional Air pollution INformation and Simulation (RAINS)⁸ and GAINS models and in the use of GAINS output for scenarios analysis with available indicators (ex-post assessment for the revision of the Gothenburg Protocol). ICP Modelling and Mapping has produced indicators and model results to demonstrate the impact of air pollution in the context of climate and biodiversity changes.

67. In the future, nitrogen impacts, and wider air pollution impact, on biodiversity will remain a focus and acidification will remain a topic of vigilance to enable assessment of the efficiency of the Convention's protocols. Increasing attention will be focused on the identification of novel biodiversity endpoints and related indicators that can be used on broad spatial scales for the identification of (adverse) effects of emission reduction strategies under climate change. Additionally, systems analysis and modelling will be undertaken to understand the processes by which short-lived climate forcers may affect the environment, and whether it is useful to seek options to include these in integrated assessment.

Conclusions

68. The interaction between CCE and the National Focal Centres in developing and applying methodologies and in developing, undertaking and assessing the calls for data, have been instrumental to the work of the Convention. CCE has undertaken a range of activities for the Working Group on Effects in support of the needs of the Working Group on Strategies and Review and the Executive Body. The focus has appropriately moved from acidification to nitrogen effects, including biodiversity changes, and assessment of critical loads for heavy metals.

Recommendations

69. ICP Modelling and Mapping should focus its activity on supporting the National Focal Centres in Eastern Europe, the Caucasus and Central Asia and pursuing the extension

⁷ Till Spranger, Ullrich Lorenz and Heinz-Detlef Gregor, eds., *Manual on Methodologies and Criteria for Modelling and Mapping Critical Loads and Levels and Air Pollution Effects, Risks and Trends* (Berlin, German Federal Environmental Agency, December 2004). Available from http://wge-ccc.org/Publications/Mapping_Manual.

⁸ See http://www.iiasa.ac.at/web/home/about/achievements/scientificachievementsandpolicyimpact/cleaning_europeair/The-RAINS-Model.en.html.

towards biodiversity and nature conservancy issues and the identification of (adverse) effects of emission reduction strategies under climate change (especially short-lived climate forcers).

G. Joint Expert Group on Dynamic Modelling

70. The Joint Expert Group on Dynamic Modelling was established in 2000 by the Working Group on Effects to provide a forum for progressing dynamic modelling of ecosystem effects. The development, testing and application of dynamic models was, at that time, being undertaken by scientists operating across ICPs and using data from many ICPs. In addition, a great deal of dynamic modelling was being undertaken outside of the Convention-funded activities. The mission of the Joint Expert Group was to bring the time dimension of the ecosystem effects into the work of Working Group on Effects and to complement the static concept of critical loads with time-dependent effect-based indicators. The Joint Expert Group gave a focus to the dynamic modelling requirement of the Working Group on Effects and provided the opportunity to operate without institutional, programmatic or funding barriers and constraints.

71. Since its formation, the Joint Expert Group on Dynamic Modelling has underpinned the development of the ECE-wide dynamic modelling system, currently administered by CCE. It has developed the “target loads” concept, providing a timescale to ecosystem recovery in response to emission reductions. The Joint Expert Group has assisted in the further development of the dynamic models, has prompted their consistent testing against observations, and has provided the opportunity for integration of data from across all ICPs and sources outside of the Convention. The focus of the Group has shifted over the years: from addressing recovery from acidification to eutrophication, biodiversity change and also to interactions between air pollution, and climate change. This development was directly driven by the evolving needs of Working Group on Effects.

Conclusions

72. The Joint Expert Group on Dynamic Modelling has provided a unique forum for scientific discussion, bringing together experts from within and outside of the Convention and from many ICPs. It has contributed substantially to the Convention in developing the European-scale dynamic modelling framework and in the assessment of time delays to recovery from air pollution effects. It has no centre and no National Focal Centres, *sensu strictu*; however, it tests, discusses and reviews methodologies at an annual meeting and reports to the Working Group on Effects annually.

Recommendation

73. The Joint Expert Group on Dynamic Modelling should consider the options for integrating its meetings into a broader Working Group on Effects science meeting to enhance collaboration between all ICPs through the participation of all ICPs.

Annex

Note on the informal meeting of International Cooperative Programme lead and host country representatives

Berlin, 2 October 2012

1. Mr. Till Spranger (Germany) and Mr. Peringe Grennfelt (Sweden) chaired the informal meeting of International Cooperative Programme lead and host country representatives, held in Berlin on 2 October 2012. They welcomed the participants, who represented:

(a) The organizations in lead and host Countries of the ICPs under the Convention responsible for the financial support and contracts for the ICPs;

(b) Some ICP task force chairs and heads of Programme Centres.

2. The meeting was announced during the fiftieth session of the Working Group on Strategies and Review (and during the proceedings of the Working Party on International Environmental Issues meeting for EU countries). Although the meeting was informal its results would be reported to the Executive Body Bureau and to the ad hoc group of experts (see para. 3 below). Participants representing EU member States would report at the EU coordination meeting on 9 October 2012, with the aim of informing discussions during the thirty-first session of the Executive Body in December 2012.

Background and objective of the meeting

3. The LTS and the Action Plan for implementing it were adopted by the Executive Body in 2010 and 2011, respectively. One of the items was to:

Conduct an **evaluation of the Convention subsidiary bodies, task forces and other groups** to review their mandates and activities, streamline and rationalize operations, increase transparency, reduce the length and number of official documents, and critically assess the number and frequency of meetings. The evaluation will look at increasing the operational efficiency of subsidiary body meetings, as well as more effective use of Executive Body resources (emphasis added) (ECE/EB.AIR/109/Add.1, decision 2011/14, annex, para. 4 (a))

An ad hoc group of experts was tasked with the evaluation, in consultation with expert group and task force lead countries.

4. The ad hoc group of experts, in its report (ECE/EB.AIR/2012/15), was convinced of the need for a well-designed and focused system for monitoring, modelling and evaluation of air pollution effects. The present system had been of crucial importance and had served the Convention's needs in an appropriate way. The group had, however, concluded that the present system was complex and that there might be a need for some structural and/or operational changes in future in order to streamline the work and make it more transparent and visible and to increase the possibilities for wider use of the results, both scientifically and in policy-oriented syntheses and assessments. The Group had, therefore, in line with the recommendations in the Action Plan, recommended an evaluation of the ICP work.

5. The success of the effects-related work was to a large extent dependent on the support and engagement of a few countries taking responsibility for ICP centres (including CCE) and ICP Chairs. Before taking any further steps with respect to changes in the organizational structure, it was considered appropriate to have a meeting between those

countries that over the years had taken and still took a key responsibility for the effects work.

6. The objective of the meeting was to provide information and discuss the support to the ICP task forces and Programme Centres over the coming years in view of the recommendations in the LTS and the Action Plan. The following issues were the main discussion items:

- (a) What were the reasons for countries taking their responsibilities?;
- (b) What would the financial support look like over the coming years?;
- (c) Were countries willing to support increased collaboration between certain ICPs if an evaluation recommended it?;
- (d) Did the suggestion of possibly merging the Working Group on Effects and EMEP affect the countries' position?;
- (e) Should the envisaged review of ICPs be performed before or after an Executive Body decision on whether to merge the Working Group on Effects and the Steering Body to EMEP?

7. An additional discussion item included options for funding the effects. That could be done via: (a) an obligatory funding mechanism in addition to the present EMEP funding mechanism; and/or (b) by participation in the present EMEP budget (with a resulting lower level of funding for the centres presently funded by the EMEP mechanism). The first option was considered desirable but not politically enforceable; the second was not favoured because the presently funded EMEP centres would not then be able to continue to operate as agreed by the Executive Body.

Main conclusions and recommendations

8. The main conclusions and recommendations drawn from the meeting were:

(a) In general, there was an agreement to continue to support the ICP work at similar levels as today; however, budgets were under stress in most countries. Therefore, funding at the current level should not be taken for granted in the future. Lead or host country funding seemed safe at least for the next few years. One country, however, stipulated prerequisites/caveats;

(b) The participants were positive concerning a further development of collaboration between ICPs and ICP centres, but that collaboration should not be limited to structural organization. Streamlining and optimization of potential should also be identified with regard to organization of activities (e.g., reporting);

(c) Lead countries were interested in funding relevant work rather than a specific part of the Convention structure, and therefore organizational change was not seen as a barrier to continued funding. Most lead countries made clear that financial support was provided through earmarked funding mechanisms, directly to local organizations. Organizational changes to the Convention could pose a risk for this manner of financing. Some lead countries emphasized the need to keep the work funded by national sources visible;

(d) Any decision on merging centres would need to be considered very carefully. As most countries supported activities through directly funding specific institutes, any decision on that issue would need to consider the consequences with respect to funding;

(e) Regarding the task forces, there was value in the further integration of the work between ICPs, to take forward the vision of the LTS, reduce administrative burdens, increase the clarity of scientific messages and aid periodic integrated assessment reports.

However, before doing so it was necessary to carefully consider how that might influence the participation of countries in monitoring and networks, and the organization of communication between scientists, practitioners and policymakers regarding certain issues (e.g., forest monitoring);

(f) A majority but not all countries were of the opinion that a possible decision on merging EMEP and the Working Group on Effects should not be taken until after an evaluation of the ICPs;

(g) Regular production of EMEP and Working Group on Effects assessment reports, as pointed out in the report from the ad hoc group of experts, was welcomed as one means to promote two-way communication between science and policy. However, there was a need to find a suitable organization, as well as a financing mechanism, for that;

(h) The Working Group on Effects should look for additional long-term support for its work. In particular, there was a need to provide support for participation by the countries in Eastern Europe, the Caucasus and Central Asia, as well as for outreach activities, e.g., the need for ICP input to the work of the Task Force on Hemispheric Transport of Air Pollution;

(i) Much of the collected data were unique and of importance outside the Convention. The same applied to harmonized methodologies for monitoring and modelling, which constituted international standards. Examples included long-term monitoring methods and results in forests, inland waters and other ecosystem types, as well as physicochemical and biological modelling, such as critical loads;

(j) EU countries in general were well represented in several of the ICPs (see table 1) and the European Commission might consider that in its ongoing work to revise its Thematic Strategy on Air Pollution;

(k) Several of the ICP activities were of importance for several EU policies and results from the ICPs had been widely used to support those policies. Such policies included the Habitat Directive,^a including Natura 2000 areas, EU energy policies (potential for forest-based biomass) and adaptation strategies to climate change;

(l) Finally, closer contact between the funding countries would be of benefit for the long-term development of the effects-oriented activities.

^a Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.

Table 1
Participation of — or data contribution in the past/present by — European Union member (accession) States (as of February 2012)

	<i>ICP Forests</i>	<i>ICP Waters</i>	<i>ICP Materials</i>	<i>ICP Vegetation</i>	<i>ICP Integrated Monitoring</i>	<i>ICP Modelling and Mapping</i>	<i>Task Force on Health</i>	<i>JEG on DM^a</i>
Austria	X	X	X	X	X	X	X	
Belgium	X			X		X	X	
Bulgaria	X		X	X		X		
Croatia ^b	X			X		X		
Cyprus	X					X		
Czech Republic	X	X	X	X	X	X		
Denmark	X	X		X	X	X		
Estonia	X	X	X	X	X	X		
Finland	X	X		X	X	X	X	
France	X	X	X	X		X	X	
Germany	X	X	X	X	X	X	X	
Greece	X	X	X	X			X	
Hungary	X	X				X	X	
Ireland	X	X			X	X	X	
Italy	X	X	X	X	X	X	X	
Latvia	X	X	X	X	X			
Lithuania	X			X	X	X		
Luxembourg	X							
Malta								
Netherlands	X	X			X	X	X	
Poland	X	X	X	X	X	X	X	
Portugal	X							
Romania	X			X		X		
Slovakia	X			X		X		
Slovenia	X	X		X	X	X	X	
Spain	X	X	X	X	X	X		
Sweden	X	X	X	X	X	X	X	
United Kingdom	X	X	X	X	X	X	X	

Note: Shade cells with an “X” indicate a contribution was made. The table will be extended to include all Parties.

^a The Joint Expert Group on Dynamic Modelling. This body does not have a data-compilation task. Participation in yearly Joint Expert Group meetings includes experts in dynamic modelling from many, but not necessarily the same, EU member States.

^b Becoming effective as of July 2013; participation depending on financial resources, but these activities are established.

Table 2

List of participants

<i>ICP Task Forces/Programme Centres</i>	<i>Participants</i>
ICP Forests	Ms. Sigrid Strich, Germany Mr. Martin Lorenz, Germany
ICP Waters	Ms. Eli Mari Aasen, Norway Ms. Berit Kvaeven, Norway Ms. Heleen de Wit, Norway
ICP Materials	Ms. Anna Engleryd, Sweden
ICP Integrated Monitoring	Ms. Anna Engleryd, Sweden Mr/ Martin Forsius, Finland
Task Force on Mapping and Modelling	Ms. Fantine Lefevre, France
Coordination Centre for Effects	Mr. Roald Wolters, the Netherlands Mr. Jean-Paul Hettelingh, the Netherlands
ICP Vegetation	Ms. Sarah Honour, United Kingdom
Executive Body Bureau and ad hoc group of experts	Mr. Till Spranger, Germany
Chair of the Working Group on Effects and the ad hoc group of experts	Mr. Peringe Grennfelt, Sweden