UNITED
NATIONS

E

Economic and Social Council

Distr.
GENERAL

ECE/EB.AIR/WG.1/2008/3
9 July 2008

Original: ENGLISH

ECONOMIC COMMISSION FOR EUROPE

EXECUTIVE BODY FOR THE CONVENTION ON LONG-RANGE TRANSBOUNDARY AIR POLLUTION

Working Group on Effects

Twenty-seventh session
Geneva, 24–26 September 2008
Item 4 of the provisional agenda

RECENT RESULTS AND UPDATING OF SCIENTIFIC AND TECHNICAL KNOWLEDGE

2008 JOINT REPORT OF THE INTERNATIONAL COOPERATIVE PROGRAMMES, THE TASK FORCE ON THE HEALTH ASPECTS OF AIR POLLUTION[1] AND THE JOINT EXPERT GROUP ON DYNAMIC MODELLING

Report by the Extended Bureau of the Working Group on Effects

[1] The joint Task Force on the Health Aspects of Air Pollution of the World Health Organization (WHO)/European Centre for Environment and Health (ECEH) and the Convention's Executive Body.

GE.08-23871

CONTENTS

Annexes

INTRODUCTION

1. The Executive Body, at its twenty-fifth session, decided that an annual review of the activities and results of the International Cooperative Programmes (ICPs), the joint Task Force on the Health Aspects of Air Pollution (hereinafter, Task Force on Health) and the Joint Expert Group on Dynamic Modelling would be prepared. The review is based on the information provided by the lead countries and the programme centres, in accordance with the Convention's 2008 workplan (ECE/EB.AIR/91/Add.2, item 3.1 (b)) approved by the Executive Body at its twenty-fifth session.

2. At its meeting held in Geneva on 5 and 6 February 2008, the Extended Bureau of the Working Group on Effects (the Bureau of the Working Group, the Chairs of the Task Forces, and the representatives of the programme centres of the ICPs and the Joint Expert Group on Dynamic Modelling) noted the need to report in detail on selected workplan items common to all programmes (ECE/EB.AIR/WG.1/2006/4/Rev.1 section 3.1 items (c) (ii)–(iii)) and decided to prepare a separate consolidated report, summarized in ECE/EB.AIR/WG.1/2008/15). The Extended Bureau also agreed that the 2008 joint report should continue to summarize achievements reflecting the 2008 workplan according to pollutant-specific topics, and that the workplan items common to all programmes should be reported under cross-cutting issues.

3. This report reviews the main accomplishments of the ICPs and the Task Force on Health under seven topics that follow the 2008 workplan items of the Working Group. The three workplan items common to all programmes are reported in section VII. Details of the general activities of the programmes and the relevant literature are reported in section VIII and related annexes of this document.

I. ACIDIFICATION

4. ICP Forests selected from its level II (intensive monitoring) plots where deposition was monitored, between 185 and 223 plots with complete data sets for bulk and throughfall depositions of sulphate (SO_4), nitrate (NO_3) and ammonium (NH_4) for the period 2000–2005. Mean annual SO_4 bulk (open field) deposition decreased from 6.1 to 4.6 kg ha^{-1} $year^{-1}$ (185 plots). Throughfall (below forest canopy) decreased from 7.9 to 5.9 kg ha^{-1} $year^{-1}$ (215 plots). NO_3 and NH_4 bulk depositions decreased less than SO_4 depositions. Bulk deposition decreased significantly on 18.9%, 7.8% and 10.4 % of the plots for SO_4, NO_3 and NH_4, respectively. Hardly any plots showed a significant increase in bulk deposition.

5. The 20-year report of ICP Waters concluded that lakes and rivers showed strong signs of recovery in response to reduced acid deposition and that biological recovery was slow and not widespread. Although there were signs of the decline of NO_3 in surface waters, the long-term trends of NO_3 in surface waters were poorly understood. Increases in dissolved organic carbon (DOC) were related to reduced sulphur (S) deposition. Modelled critical loads for surface waters

were supported by ICP Waters data and many sites in Europe would remain acidified after 2010. Climate change would affect acidification and recovery.

6. ICP Integrated Monitoring data could contribute significantly with respect to air pollution effects on biodiversity, in collaboration with the European Union's (EU) Alter-Net project.

7. ICP Integrated Monitoring concluded from its modelling of the effects of climate change on recovery of acidified catchments and freshwaters that the key site-specific interactions were: (a) the potentially decreased stability of soil pools of nitrogen (N) and carbon (C); (b) the changes in forest growth affecting N retention; (c) the increased variability in surface water chemistry; (d) the changes in frequency of sea-salt episodes at near-coastal sites (affecting the release of hydrogen ions and aluminium (Al) from catchment soils); and (e) the increased concentrations of organic acids in soil solution and runoff affecting water acidity.

8. ICP Integrated Monitoring has developed, in cooperation with Coordination Centre for Effects (CCE), a comprehensive model framework for assessing links between climate change and air pollution effects. It used Finnish catchment data sets for soil and water chemistry, future scenarios for anthropogenic S and N deposition, climate change and biomass harvesting. Only the maximum (technically) feasible emission reductions would result in significant recovery of soils and surface waters and bring water quality back close to pre-acidification values. Reductions in S and N depositions could potentially increase DOC concentrations that might offset the recovery in surface water pH. Climate-induced changes on DOC concentrations might have a significant influence on the future surface water chemistry.

9. ICP Modelling and Mapping received updates on critical loads and dynamic modelling from 20 and 12 countries, respectively, via the 2007/008 call for data. These data was extended with the CCE background database to cover all Europe. Its Task Force meeting recommended to use these data for the work on the revision of the Gothenburg Protocol[2].

II. NUTRIENT NITROGEN

10. ICP Forests evaluated the N deposition trends for the period 2000–2005. Mean annual bulk NH_4 deposition decreased from 5.2 to 4.2 kg ha^{-1} $year^{-1}$ in the year 2004 and again increased slightly to 4.6 kg ha^{-1} $year^{-1}$ in the year 2005 (192 plots). Throughfall decreased from 5.3 to 4.6 kg ha^{-1} $year^{-1}$ in the year 2004 and again reached 5.3 kg ha^{-1} $year^{-1}$ in the year 2005 (222 plots). Mean bulk NO_3 deposition decreased from 4.4 to 3.4 kg ha^{-1} $year^{-1}$ in the year 2003 and again increased slightly to 3.6 kg ha^{-1} $year^{-1}$ in the year 2005 (193 plots). Throughfall was fluctuating between 5.7 and 4.6 kg ha^{-1} $year^{-1}$ in the years 2000 to 2005 (223 plots).

[2] The 1999 Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone.

11. In a pilot study, three ICP Forests level II plots were selected for applying the BERN model in order to relate the vegetation changes to atmospheric deposition and soil parameters. Based on modelled changes in the soil carbon-to-nitrogen ratio (C/N) and the base saturation, the natural vegetation was predicted to change on all three sites. On two of the sites, the change from beech to spruce stands in the first half of the 1900s and a subsequently high input of eutrophying N led to nutrient imbalances that were predicted to remain throughout the modelled time period until 2050. This would necessitate adequate measures in forest management and a change of main tree species might need to be considered.

12. Effects of critical load exceedance on forest condition in terms of defoliation were evaluated on 148 to 303 ICP Forests level II plots depending on the parameters under observation. Only for common beech was there a significant relation between the exceedance of critical loads for nutrient N, calculated with N throughfall, and defoliation. In general, the deposition parameters were strongly intercorrelated. For beech, there were as well significant relations between NO_3 bulk and throughfall deposition and defoliation. For Norway spruce, N throughfall and bulk depositions were significantly related to defoliation. Scots pine defoliation showed a significant relation to NO_3 throughfall deposition, but not to the other deposition parameters. For all tree species, stand age was more strongly related to defoliation than to deposition or critical load exceedance.

13. For the first time, 16 countries submitted data to ICP Vegetation on the total N concentration in mosses from almost 3,000 sites for 2005/2006. The highest N concentrations were found in Central and Eastern Europe and the lowest values in Northern Finland and Northern United Kingdom. Although the modelled total N deposition from the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) for 2004 showed a similar spatial distribution (apart from Eastern Europe, where N deposition was relatively lower), the relationship between mean N concentrations in mosses and N deposition rates in an EMEP grid cell showed a lot of scatter, with saturation in mosses occurring at deposition rates above 10 kg ha^{-1} $year^{-1}$. However, in selected European countries (e.g. Switzerland), a strong linear relationship was found between the N concentrations in mosses and measured site-specific N deposition rates.

14. The use of biomass energy has become an important mitigation strategy to combat climate change. The modelling study of ICP Integrated Monitoring predicted that increased use of forest harvest residues via whole-tree harvesting for biofuel production would have a significant negative influence on the nutrient (base cation) budgets at the catchments studied. Sustainable forestry management policies would need to consider the combined impact of air pollution and harvesting practices. Further emission reductions would mitigate the negative impacts of increasing use of harvest residues, if such a policy was increasingly implemented. Increased fertilizer use, such as wood ash applications, might be required to maintain soil nutrient status and lake-water quality in the forested ecosystems.

15. ICP Modelling and Mapping and CCE noted various findings on the strong impact of nitrogen deposition on biodiversity loss, which confirmed the use of critical load exceedance as a risk indicator. Dynamic models applied at Swedish and Swiss sites demonstrated systemic co-effects of N deposition, climate change and management.

16. ICP Modelling and Mapping received updates on calculated and empirical critical loads on nutrient N, from 19 and 12 national focal centres (NFCs) respectively, through the 2007/2008 call for data. These data were extended with the CCE background database to cover all Europe. Its Task Force meeting recommended using these data in the work on the revision of the Gothenburg Protocol.

III. OZONE

17. Passive ozone (O_3) sampler data collected from 91 ICP Forests level II sites were used to compare mean summer concentrations for the years 2000–2004. Highest mean concentrations were observed in the exceptionally hot year 2003. AOT40 values (accumulated O_3 concentration over the threshold of 40 parts per billion (ppb) during daylight hours) were modelled for 46 to 71 plots depending on data availability in the different years. In all years, the critical level of 5 ppm h (parts per million times hours) was exceeded on more than 75% of the plots. Occurrence of visible O_3 injury was evaluated for plots in Italy, Spain and Switzerland. Positive relationships were found between the proportion of plant species with O_3 symptoms and modelled AOT40. O_3 flux was modelled for five sites with sufficient monitoring data. Results showed that stomatal conductance of O_3 might substantially differ from measured O_3 concentrations. Thus, flux modelling allowed for a more precise O_3 risk assessment.

18. In 2007, only a few sites across Europe have been participating in the clover biomonitoring experiments of ICP Vegetation. New sites in Hungary and Ukraine showed large O_3 effects (leaf damage and biomass reduction) on clover, particularly in August and September. ICP Vegetation has recently been scaling down the annual clover biomonitoring experiments. More participants were now contributing to O_3 risks assessments via field surveys and O_3 exposure experiments to improve the development of O_3 stomatal flux models, in particular for (semi-)natural vegetation.

19. ICP Vegetation has published the report, “Evidence of widespread ozone damage to vegetation in Europe (1990–2006)”. Evidence from field surveys, biomonitoring activities and experiments comparing exposure to ambient and O_3-filtered air showed that:

(a) O_3 damage to vegetation varied greatly between years and regions in Europe, reflecting the spatial and temporal variations in ambient O_3;

(b) AOT40-based maps underestimated the risk of O_3 damage across Europe. In many areas, effects have been detected below the critical level for biomass or yield reduction;

(c) Generic O_3 flux maps for crops were better at predicting the widespread occurrence of O_3 damage than AOT40 maps, with increasing stomatal flux being associated with increasing incidences and severity of O_3 injury and biomass reductions. A tentative generic flux threshold for effects of 12 mmol m^{-2} was established.

20. ICP Vegetation has developed, in collaboration with ICP Forests and EMEP Meteorological Synthesizing Centre-West (MSC-West), forest tree flux-based O_3 risk assessment methods using localized parameterizations for representative species and species ecotypes for four different European climatic regions (Northern Europe, Atlantic Continental Europe, Continental Central Europe and the Mediterranean). These parameterizations have improved seasonal and diurnal stomatal flux estimates according to local conditions. Further work is required to include suitable soil water modelling methods to assess the influence of soil water status on stomatal O_3 flux.

21. ICP Vegetation established a framework for modelling stomatal O_3 flux to (semi-) natural vegetation and a generic "grassland" flux-based risk assessment may be possible in the next two years. Although some new data sets are becoming available for the development of canopy flux models for specific vegetation types (e.g. Dehesa grasslands), canopy-based flux-effect modelling remains hampered by the shortage of suitable experimental data. The effects of modifying factors such as canopy height and influence of competing species are being incorporated into the Ellenberg modelling method for the identification of O_3-sensitive communities.

22. The analysis prepared by the Task Force on Health indicated that O_3 pollution affects health of most of the populations of Europe, leading to a wide range of health problems. It was estimated that approximately 21,000 premature annual deaths were associated with O_3 exceeding 70 µg m^{-3} measured as a daily maximum 8-hour mean in the 25 EU Member States. The slight decline in ground-level O_3, which is expected to result from current legislation on air pollutant emission reductions and current policies addressing climate change, was estimated to reduce premature mortality by only approximately 600 cases per year between 2000 and 2020. Markedly larger reductions of about 40% could be achieved with implementation of the maximum technically feasible reductions scenario.

IV. PARTICULATE MATTER

23. The Task Force on Health reviewed progress achieved in research on health effects of particulate matter (PM). It noted new evidence confirming the linearity of the association between long-term exposure to PM and mortality. New evidence was also found regarding: (a) effects on mortality of long-term exposure to traffic-related air pollution, demonstrated by recent European cohort study; (b) impacts of air pollution on development of cardiovascular diseases; (c) development of respiratory disease in children; and (d) beneficial effects of exposure reduction on lung function in adults.

V. HEAVY METALS

24. Results from the 20-year report of ICP Waters on heavy metals were based on its own monitoring and assessment of other data sources. They showed that heavy metals were found in sediments and waters in remote areas of Europe at levels that were related to the long-range transport of air pollutants.

25. Twenty-eight countries submitted data to ICP Vegetation on the concentrations of 12 metals (including cadmium (Cd), lead (Pb) and mercury (Hg)) in mosses from approximately 6,000 sites for 2005/2006. This survey showed that the spatial trends were similar as reported for previous surveys, i.e. in general an east-west decline in the metal concentrations in mosses (with also high concentrations being found in Belgium) and the lowest concentrations being observed in northern Scandinavia and northern United Kingdom. Since 2000/2001, the average median metal concentration in mosses did either not change or showed a further decline, in particular for Pb and vanadium with a decline of 30%. For the other metals the decline was up to 14% (for Cd), and 7% (for Hg). However, changes were country-specific and increases were also found. Peak concentrations of heavy metals in mosses had generally declined since 2000/2001 (except for nickel), indicating a decrease in emissions.

26. A workshop on critical loads for heavy metals was held on 21 and 22 November 2007 in Windermere, United Kingdom. It considered that a systematic evaluation was needed to examine the influence of a changing environment on metal fluxes, biouptake and toxicity. It recommended, inter alia, to apply, in addition to critical load exceedance, dynamic models and current exceedance of critical limits for further policy evaluation, and that simple dynamic models be used for mapping at national and European scales.

27. ICP Modelling and Mapping contributed to the workshop on the promotion of the ratification of the 1998 Protocol on Heavy Metals across the entire UNECE region, held from 14 to 16 May 2008 in Yerevan. CCE had presented tentative maps of critical loads of heavy metals in countries of Eastern Europe, Caucasus and Central Asia (EECCA). Currently, work was underway to estimate exceedance in collaboration with EMEP/MSC-East.

28. The Task Force on Health published the final report on health risks of heavy metals, including risk assessment of Cd, Pb and Hg. The assessment concluded that the margin of safety for Cd was narrow and that efforts should be made to achieve further reductions in the emissions and direct input of Cd to soil. Exposures to Pb had decreased in many areas of Europe over the last few decades. However, there were indications that Pb may be harmful even at very low exposure levels. Therefore, any rising lead levels in soils over the long term due to direct long-range transported deposition of lead were a matter of concern and should be avoided. Methylmercury, a potent neurotoxin, was another concern. As human exposure occurs mainly through fish consumption, and considering that fish consumption is beneficial to health, reducing the methylmercury levels in fish was a high priority. Reducing Hg emissions to atmosphere would contribute to this goal.

VI. PERSISTENT ORGANIC POLLUTANTS

29. Results from the 20-year report of ICP Waters on persistent organic pollutants (POPs) were based on data collected from various sources in the international literature. POPs were found in fish, sediments and waters in remote areas in Europe and North America and a relation to the long-range transport of air pollutants had been shown.

VII. CROSS-CUTTING ISSUES

30. ICP Forests carried out a tree crown condition survey on a large-scale transnational 16 km × 16 km grid in 2007, comprising 4,834 plots in 27 countries and 104,399 trees. Of all trees, 21.9% assessed had a needle or leaf loss of more than 25% and were thus classified as either damaged or dead. Compared to 2006, mean defoliation remained rather unchanged. This indicated continued recuperation after increased defoliation that followed the extremely hot and dry summer in 2003. International cross calibration courses for defoliation assessment had been conducted in Estonia and Greece in 2007. The course in Estonia took place on sites that had been assessed at a similar course in earlier years. This provided the basis for evaluating the temporal consistency of the assessments. In most of the assessed stands, good agreement between observers was reached.

31. The 2007 biological intercalibration of invertebrate fauna of ICP Waters included invertebrates from five countries. Altogether, 14 countries participate on a regular basis. The results were considered to be good.

32. The 2007 chemical intercomparison of ICP Waters included determination of major ions and heavy metals. Seventy-two laboratories in 28 countries participated, including five from Asia. The overall results were considered acceptable.

33. ICP Materials developed a new model for calculating zinc (Zn) runoff from surfaces on buildings and constructions. It employed direct laboratory and field runoff measurements and a runoff calculated from an empirical mass balance equation from the programme sites. The rate is affected by dry periods between precipitation events (the first-flush effect), depending on the sulphur dioxide (SO_2) concentration, and by precipitation amount and pH. The potential capability of the model was demonstrated by runoff maps over Europe for the years 1980, 1990 and 2000 and the most recent year where data were available (resolution 50 km × 50 km) based on modelled EMEP data. The maps showed increased runoff values in Europe where SO_2 was elevated and in areas with high precipitation.

34. The inventory of stock of cultural heritage at risk was carried out for Madrid by ICP Materials. It resulted in a database containing 260 entries of immovable, as declared of cultural interest by the regional cultural heritage department, and 1,618 entries of movable, as included in the council movable cultural heritage 2004 list. The potential of this database was demonstrated by overlaying corrosion maps and maps of geographical distribution of cultural heritage for

Madrid, which enabled the identification of areas with major impact of air pollution on cultural heritage.

35. Carbon steel, Zn and limestone are used as indicator materials for corrosion and have been exposed in the ICP Materials test site network during the period 1987–2006. During the period 1987–1997, the decreasing trend in the concentrations of acidifying air pollutants resulted in a decreasing trend in corrosion of all indicator materials. During the period 1997–2003, corrosion of Zn and limestone ceased to decrease, while corrosion of carbon steel continued to decrease. When comparing the latest two exposures in 2002–2003 and 2005–2006, the corrosion of carbon steel was on average similar.

36. ICP Materials combined and mapped effects of climate and pollution for carbon steel and Zn. These were also combined in a multiple difference risk map valid for most metals. They showed that the corrosion to metals was expected to increase in coastal areas due to the combined effect of temperature and chloride deposition. The corrosion to metals in areas affected by constant SO_2 pollution was also expected to increase in northern part of Europe and decrease in southern part of Europe as a result of climate change.

37. Prognostic dynamic models on combined climate change, management and nitrogen deposition effects on terrestrial ecosystems were applied to Swedish and Swiss sites. ICP Modelling and Mapping noted that the results showed strong effects on biodiversity, but only after long lag times, up to centuries.

38. The Extended Bureau of the Working Group on Effects had decided in February 2008 to prepare draft guidelines on the reporting on the monitoring and modelling of air pollution effects. It had requested CCE to coordinate the work. ICP Modelling and Mapping noted that such a document would strengthen effects-oriented activities under the Convention at the international and national levels. Many NFCs stated that it would raise awareness and facilitate support from national authorities. Workplan items common to all ICPs would help promote implementation and use of the guidelines. To this end, the selected key parameters (see table 2) showing the sufficiency and effectiveness of air pollution policies should be carefully discussed and remain amendable.

39. The Joint Expert Group on Dynamic Modelling identified significant progress made in the development of model chains capable of linking the emission of atmospheric pollutants to terrestrial biodiversity targets. Specifically, the species niche models have been completed in the United Kingdom for a significant fraction of the plant flora incorporating abiotic and climate variables and their interaction. Critical thresholds for soil pH, NO_3, C/N, etc. have been identified for several species and vegetation types in the Netherlands. Response functions for acidity, nitrogen, moisture and temperature have been derived for 43 plant species groups in Sweden and 73 in Switzerland, and critical loads based on ecological impact can be assessed against confounding influences of climate change and land management. Guidelines for critical

load calculations for nutrient N for terrestrial ecosystems, using vegetation community composition as the biological indicator, have been developed in Sweden.

40. The Joint Expert Group on Dynamic Modelling agreed that the process for developing biodiversity-relevant indicators and damage thresholds for terrestrial ecosystems was in place. Progress made was good and national discussions with conservation agencies have commenced; this would enable targets for nutrient N to be defined. Prototype models were available for testing.

41. The Joint Expert Group on Dynamic Modelling concluded that climate change would almost certainly drive ecosystem changes which will occur regardless of future atmospheric deposition. This also means that the pre-industrial (reference condition) status of ecosystems is almost certainly not achievable in all locations due to climate change. Dynamic models were available to determine the long-term effects of air pollution that were superimposed on climate and land management driven changes.

42. The following sections cover the workplan items common to all programmes. In these sections, those bodies not running monitoring networks report on the data they employ in their work.

A. Updated review of the robustness of monitored and modelled air pollution impacts

43. ICP Forests would report on the robustness at a later stage.

44. There were no new developments of robustness by ICP Waters.

45. ICP Materials reported on the robustness of monitored and modelled air pollution corrosion impacts reported in 2007. Using the same methodology as for corrosion, the statistical uncertainty for soiling measurements (Haze) was determined to be 10%. Dose-response functions for soiling including uncertainty would be reported in 2009.

46. An inter-laboratory calibration exercise conducted during the 2005/2006 European moss survey by ICP Vegetation showed that the coefficient of variation in heavy metal concentrations in moss reference material using a range of analytical techniques varied from about 8% for antimony and Zn to about 14% for Al. For nitrogen, the uncertainty was about 7%. Previous research showed that for the metals Al and chromium/iron the applied method of sample dissolution in the moss survey represents approximately 60% and 85%, respectively, of the total metal concentration in moss reference material.

47. ICP Integrated Monitoring reviewed available information of long-term chemical and biological responses in soils and surface waters at background sites. The effects of the observed pollutant loading decrease could be detected as large regional trends in surface waters, while NO_3 did not show consistent trends.

48. ICP Modelling and Mapping continued to address the robustness of critical loads and dynamic modelling. It developed a methodology “ensemble assessment of impacts” (EAI) to identify the likeliness of exceedance of critical loads of nutrient nitrogen in European ecosystems. EAI used both empirical and computed critical loads of nutrient N. An application of EAI on deposition patterns, assuming the current legislation scenario in 2020, revealed that ecosystems which are “very likely” or “virtually certain” to be at risk were dominant in Western and Central Europe, including the Czech Republic, Denmark, France, Germany, Ireland, the Netherlands, Poland and Ukraine. Areas where exceedance was “likely” included Austria, Italy, Romania and the United Kingdom. Exceedance was “as likely as not” in Greece, the Russian Federation and Spain. Assuming maximum technically feasible reductions scenario in 2020, the areas “virtually certainly” at risk of nutrient N were limited to regions in western France, the border area of Germany and the Netherlands, and northern Italy. Similar conclusions emerged for nutrient N when the analysis was limited to Natura 2000 areas.

49. Uncertainty related to the potential impact of O_3 on life expectancy was a major limitation of the risk assessment by the Task Force on Health, affecting cost-benefit analysis of actions to reduce O_3 exposures. Better knowledge of the magnitude of the risk and of the O_3 levels at which long-term exposure might affect mortality and life expectancy would be necessary to reduce this uncertainty. A wide range of non-lethal health effects were attributed to O_3. However, the relevant database was not consolidated and the health burden estimates were mostly based on mortality, possibly missing substantial parts of the burden, especially in subpopulations with lower risk of mortality, such as children. The impact estimates depended on the exposure indicator selected and in particular on the cutoff above which the effects are calculated. Better understanding of the shape of the concentration-response function at the low levels of exposure and improvement of ability of the models to estimate low concentrations might affect the currently used cutoff point (35 ppb).

50. There were no new developments of robustness by the Joint Expert Group on Dynamic Modelling.

B. Updated compilation of observed parameters, monitoring methodologies and intensities of effects-oriented activities

51. Most of the effects-oriented programmes had set up monitoring networks, which varied in the observed parameters, mainly according to the target ecosystems of the programme, and also in their spatial and temporal coverage. Some bodies relied on modelled data or analyses of other studies. The table on these items was presented in 2007 and it was decided that it should be updated in 2008. Table 1 presents an overview of the environmental compartments observed or employed by effects-oriented bodies on at least half of their plots.

52. The only means to address the sufficiency and effectiveness of emission reduction policies is the assessment of air pollution effects. Selected potential key parameters are displayed in table 2 as indicators for impacts on ecosystems, materials and human health, divided by major

pollutants and receptors. All parameters are currently monitored and modelled by the ICPs. The modelling of air concentrations and depositions is carried out in collaboration with EMEP centres. Note that some activities do not have a monitoring network (ICP Modelling and Mapping, the Task Force on Health and the Joint Expert Group on Dynamic Modelling).

Table 1. Environmental compartments that are observed or employed by effects-oriented bodies. Abbreviations: x=monitored, –=not monitored, I=level I sites, II=level II sites, TF=throughfall, NO_2=nitrogen dioxide, HNO_3=nitric acid, HM=heavy metals, CL=critical load, DM=dynamic modelling, JEG=Joint Expert Group.

Number of sites and countries	ICP Forests (mainly on level II data)	ICP Waters	ICP Materials	ICP Vegetation	ICP Integrated Monitoring	ICP Modelling and Mapping	Task Force on Health	JEG on DM
Sites (countries)	I: 6,093; II: 671; modelling : 186	202 (15); CL: 92 (14); DM: only with other projects	25 (16)	O_3: 39 (20); modelling stomatal flux 13 (11); mosses: 6,000 (28) (HM), 2,928 (16) (N)	45 (17)	Data from NFCs: >1,000,000 (calculated CL: 20 (acidity) and 19 (nutrient N); empirical CL: 12, DM: 12); other countries: CCE background database	Population in the whole of Europe	12 regions across Europe (8)
Meteoro-logical data	217	–	25	22 (12)	–	Modelled and interpolated from measurements	–	–
Air concen-tration	110	–	SO_2, NO_2, O_3 and HNO_3: 25	22 (12)	39 (14)	Modelled	Modelled	Modelled
Atmos-pheric deposition	216 bulk and 249 TF (SO_4, NO_3, NH_4 measured at all sites)	–	PM: 25	Modelled	44 (17)	1860–2020 (modelled)	–	Modelled
Waters	–	202 (15)	–	–	36 (including soil/ground–water) (16)	x	–	x
Soils	I: 4,000; II: none	–	–	4 (soil water potential)	Soil chemistry: 33 (13); soil water: 29 (14)	x	–	x
Vegetation	235	–	–	19 (12)	30 with vegetation plots and surveys (11)	x	–	–
Trees	I: 6093; II: 671	–	–	–	Forest health: 31 (10)	–	–	–
Fauna	–	14	–	–	Only a couple of sites have reported data	–	–	–
Materials	–	–	25 (16)	–	–	–	–	–
Health	–	–	–	–	–	–	All European countries	–

Table 2. Selected key parameters to indicate the development of air pollution effects on ecosystems, materials and human health divided by major pollutants and receptors. Abbreviations: –=not monitored or modelled, P=phosphorous, K=potassium, Mg=magnesium, PCB=polychlorinated biphenyls, PCDD=polychlorinated dibenzodioxins.

Effects	**Receptors**	**Suggested key parameters for reporting**	
		Monitored	**Modelled**
Acidification	Aquatic eco-systems	Acid neutralizing capacity (ANC), pH, alkalinity, inorganic Al concentration, total organic carbon (TOC), other selected critical threshold criteria	Calculated critical loads and exceedance
	Terrestrial ecosystems	Soil base saturation, ANC leaching, pH, SO_4, NO_3 and total Al concentrations, ratio of base cations to Al (BC/Al), other selected critical threshold criteria	Calculated critical loads and exceedance
Eutrophication	Terrestrial ecosystems	Total nitrogen content in mosses and soil, NO_3 leaching, C/N, nutrient ratios in foliage for dominant and key species (N/P, N/K, N/Mg), empirical critical loads with selected endpoints, other selected critical threshold criteria	Calculated critical loads and exceedance
Ground-level O_3	Vegetation	Growth and yield reduction and foliage damage, climatic factors, exceedance of selected AOT values	Exceedance of selected AOT values, accumulated stomatal flux and exceedance
	Materials	Degree of soiling, acceptable and/or tolerable levels of soiling	–
	Health [1]	Concentration of ozone in urban areas; risk for mortality and morbidity estimated by epidemiological studies	SOMO35 (sum of mean 8-hour ozone concentrations above 35 ppb)
Particulate matter	Materials	Degree of soiling, acceptable and/or tolerable levels of soiling (based on coarse PM (PM_{10}))	–
	Health [1]	Concentration of PM_{10} and $PM_{2.5}$ in urban areas; risk for mortality and morbidity estimated by epidemiological studies	Population exposure with modelled annual average fine PM ($PM_{2.5}$)
Heavy metals	Aquatic ecosystems	Concentrations of heavy metals in water and lake sediments, other selected threshold criteria	Critical loads and exceedance (Hg)
	Terrestrial ecosystems	Concentrations of heavy metals in mosses and soils, other selected threshold criteria	Critical loads and exceedance
	Health	Threshold criteria to be proposed	Critical loads and exceedance
Persistent organic pollutants	Aquatic ecosystems	Concentration levels in vital organs (e.g. in fish), concentration levels in lake sediments	–
	Health [1]	Biomarkers of human exposure (e.g. PCBs/PCDDs in breast milk)	–
Multiple pollutants (SO_2, HNO_3, O_3 , PM)	Materials	Corrosion of materials (carbon steel, Zn and limestone)	Acceptable and/or tolerable levels of corrosion
Concentrations and depositions of air pollutants	Ecosystems, materials and health	Bulk, throughfall and total S and N deposition (oxidised and reduced N separately), O_3 concentration, AOT values	Total S and N deposition (oxidised and reduced N separately), O_3 concentration, AOT values, stomatal O_3 fluxes

[1] Provisional.

C. Updated summary of effects-oriented activities in countries of Eastern Europe, Caucasus and Central Asia

53. The Working Group on Effects has encouraged EECCA countries to participate in its sessions and activities. Table 3 presents an overview of the participation of these countries in the annual meetings of the effects-oriented bodies and on the submissions of data for the programme centres.

Table 3. Official participation of EECCA countries in the annual meetings (column ‘mtg’) of effects-oriented bodies and submitted data concerning the noted year (column ‘data’) during the past three years or at any earlier time. For abbreviations, see table 1.

	ICP Forests (for level II)		ICP Waters		ICP Materials		ICP Vegetation		ICP Integrated Monitoring		ICP Modelling and Mapping		Task Force on Health	JEG on DM
	mtg	data	mtg	data	mtg	data	mtg	data	mtg	data	mtg	data	mtg	mtg
Armenia													2007 2008	
Belarus		2005 2006 2007	2006	2006				2005, 2007 (HM)	2005 2006 2007	2005 2006	2005 2007 2008	2005 2008[1]	2006 2007 2008	
Azerbaijan													2007 2008	
Georgia											2007		2005 2006 2007 2008	
Kazakhstan													2007	
Kyrgyzstan													2006 2007 2008	
Moldova		2005 2006 2007									2008	1998	2006 2007 2008	
Russian Federation	2005 2006 2007	2002 §, 1996 (soil)	2006 2007	2006 2007		1987– 2003	2005 2006 2007 2008	2007¤ (HM)	2005 2006 2007 2008	2005 2006	2005 2006 2007 2008	2005 2006 2007 2008	2005 2006 2008	
Tajikistan*														
Turkmenistan*														
Ukraine	2005	2005 2006 2007						2007 (O_3) 2007 (HM)			2005 2006 2007 2008	2005 2006 2007 2008	2005 2008	
Uzbekistan*														

* Not Party to the Convention.
§ Data for defoliation on level I plots.
[1] Preliminary data requiring further collaboration.

VIII. REVIEW OF RECENT EFFECTS-ORIENTED ACTIVITIES

54. Information on the general activities carried out by ICPs and the Task Force since the twenty-fifth session of the Working Group on Effects and the most important recent publications of their results are summarized in annexes I to VII of this report. Please note that the references have been reproduced as received by the secretariat.

Annex I

International Cooperative Programme on Assessment and Monitoring of Air Pollution Effects on Forests (ICP Forests)

1. The twenty-fourth Task Force meeting took place from 24 to 28 May 2008 in Larnaca, Cyprus, and was attended by 61 experts and national representatives from 28 countries. It addressed the following main topics:

(a) Implementation of the strategy of ICP Forests;
(b) Project proposals under the EU LIFE+ financing mechanism;
(c) Collaboration with other international organizations;
(d) Deposition measurements;
(e) Integrated evaluation of existing level I and level II data and use of existing data bases for evaluations in the field of climate change and biodiversity.

2. The Task Force adopted the technical and executive reports on forest condition in Europe and agreed on data submission formats for monitoring data of the year 2008.

3. The programme coordinating group convened on 8 October 2007 in Hamburg, Germany. It discussed possible future contributions to forest monitoring under the LIFE+ regulation. To this end, the group was extended to include additional experts and country representatives. A first joint ICP Forests – ENFIN (European National Forest Inventory Network) workshop was organized on 9 October 2007 in Hamburg, Germany. A close cooperation between ICP Forests and ENFIN was considered essential for the set up of an integrated future forest monitoring system in Europe.

4. The ICP Forests Programme Coordinating Centre as well as experts and national representatives participated in the strategic workshop of the European Cooperation in the field of Scientific and Technical Research (Cost) for identifying future monitoring and research needs in Istanbul, Turkey. More integration and cooperation between research, monitoring and modelling was considered necessary by the participating experts.

5. Monitoring of 4,800 level I plots and 800 level II (intensive monitoring) plots continued. Results were published in the 2008 technical report (Lorenz et al. 2008) and in the 2008 executive report (Fischer et al. 2008). The monitoring data were evaluated as follows:

(a) Mean deposition of ammonium, nitrate and sulphate on level II plots, as well as the temporal development of deposition for the years 2000–2005;
(b) Evaluation of relations between exceedance of critical loads for acidity and nutrient nitrogen and defoliation on level II plots;
(c) Evaluation of mean ozone concentrations for the years 2000–2004 on 90 plots;

(d) Temporal and spatial trends of large-scale forest condition (defoliation) on 4,800 level I plots;

(e) Pilot study for the application of the BERN model to assess composition of vegetation on three level II plots in relation to changing deposition scenarios.

6. The programme centre of ICP Forests continues to contribute to database management of level I and level II data in collaboration with the European Commission and private consultants. Routine data submission and validation are ongoing. Technical data submission reports have been compiled. The centre has direct access to the validated raw data and data sets. Plot-specific results of previous evaluations are maintained in the programme centre's database. The centre closely cooperates with the European Commission in the BioSoil project, which includes a repetition of a previous soil survey of 4,000 level I plots and at the implementation of a number of surveys in the field of biological diversity on the same plots.

7. A number of coordination activities are routinely carried out by the programme centre, including:

(a) Participation in expert panel meetings;

(b) Representation of the programme at policy meetings and scientific conferences;

(c) Maintenance of the programme's website (www.icp-forests.org);

(d) Data provision to third parties upon request;

(e) Update of the manual for harmonized sampling and monitoring, in close collaboration with involved national experts.

Literature

Fischer R, Lorenz M, Köhl M, Becher G, Granke O (2008) The condition of forests in Europe; Executive report 2008.

Lorenz M, Fischer R, Becher G, Granke O, Seidling W, Ferretti M, Schaub M, Calatayud V, Bacaro G, Gerosa G, Rocchini D, Sanz M (2008) Forest condition in Europe; Technical report 2007. Institute for World Forestry, Hamburg, 92 pp.+annexes.

Fischer R, Mues V, Ulrich E, Becher G, Lorenz M (2007) Monitoring of atmospheric deposition in European forests and an overview on its implication on forest condition. *Applied Geochemistry* 22, 1129–1139.

Lorenz M, Nagel H-D, Granke O, Kraft P (2008) Critical loads and their exceedances at intensive monitoring sites in Europe. *Environmental Pollution* doi:10.1016/j.envpol.2008.02.002.

Lorenz M, Mues V (2007) Forest health status in Europe. *The Scientific World Journal* 7(S1), doi:10.1100/tsw.2007.17, 22-27.

Lorenz M, Fischer R, Becher G, Mues V (2007) Twenty years of ICP Forests: Results and Perspective. *Works* 10, 145-155.

Lorenz M, Kriebitzsch W-U, Reuter M, Köhl M (2008) Wirkungen des Klimawandels auf Bäume und Wälder. In: Lozán JL, Graßl H, Jendritzky G, Karbe L, Reise K (editors) Warnsignal-Klima. ISBN 978-39809668-4-9. Hamburg. 383 pp.

Seidling W, Fischer R (2008) Deviances from expected Ellenberg indicator values for nitrogen are related to N throughfall deposition in forests. *Ecological Indicators* 8, 639 – 646.

Annex II

International Cooperative Programme on Assessment and Monitoring of Acidification of Rivers and Lakes (ICP Waters)

1. The twenty-third Task Force meeting was held from 8 to 10 October 2007 in Nancy, France. It was attended by 35 experts from 19 Parties to the Convention. At present, 19 countries participate in the activities of ICP Waters.

2. The Task Force considered the progress reports from the programme centre on

(a) Chemical intercomparison;
(b) Biological intercalibration;
(c) Progress on the 20-year report.

3. The results from these reports are included in this document.

4. Results from the project on trends in dissolved organic carbon (DOC) trends in formerly glaciated areas in Europe and North America showed that the regional increasing trends in DOC were shown to be related to decrease in atmospheric deposition of sulphate and seasalts.

5. Results from the report on review of the Gothenburg Protocol showed that the decrease in sulphur deposition has resulted in chemical recovery and biological recovery, but not yet in satisfying health of the ecosystems. More emission reductions than according to the Gothenburg Protocol would be needed to have a good water quality in Europe.

6. The Task Force discussed the process for an update of the programme manual. It was recommended that manual should be broader than the present manual and include methods for monitoring of acidification, nitrogen, heavy metals and POPs in water and biota. It was also recommended that the manual, when possible, should harmonize, where possible, methods from the EU Water Framework Directive (WFD).

7. The importance of the WFD was discussed. National monitoring programmes might be reorganized under the WFD, with potential effects on the present monitoring network for acidification. The long-range transboundary pollutants were not taken very well into account in the WFD, because the aim behind it was to solve pollution within the river basin. ICP Waters sites might be used as reference sites under the WFD, because most WFD sites were affected by agriculture.

8. The Task Force also considered national reports with results on trends in water chemistry, biological response, heavy metals and dynamic modelling. The presentations are published in ICP Waters report 92.

9. Representatives of the ICP Waters programme centre actively participated in the meetings of the Task Forces on ICP Integrated Monitoring, and ICP Modelling and Mapping, as well as the Joint Expert Group on Dynamic Modelling and the "Saltsjöbaden 3" workshop.

Literature

Wright RF, Posch M, Cosby BJ, Forsius M, Skjelkvåle BL (2007) Review of the Gothenburg Protocol: Chemical and biological responses in surface waters and soils. NIVA-report SNO 5475-2007. ICP Waters report 89/2007.

Hovind H (2007) Intercomparison 0721: pH, Cond, HCO3, NO3-N, Cl, SO4, Ca, Mg, Na, K, Fe, Mn, Cd, Pb, Cu, Ni, and Zn. NIVA-report SNO 5486-2007. ICP Waters report 90/2007.

Monteith DT, Stoddard JL, Evans CD, de Wit HA, Forsius M, Hogasen T, Wilander A, Skjelkvåle BL, Jeffries DS, Vuorenmaa J, Keller B, Kopacek J, Vesely J (2007) Dissolved organic carbon trends resulting from changes in atmospheric deposition chemistry. *Nature* 450, 537-540.

Fjellheim A, Raddum GG (2008) Biological intercalibration: Invertebrates 1107. NIVA-report SNO 5551-2008. ICP Waters report 91/2008.

Annex III

International Cooperative Programme on Effects of Air Pollution on Materials, Including Historic and Cultural Monuments (ICP Materials)

1. The twenty-fourth meeting of the Task Force was held from 2 to 4 April 2008 in Tallinn.

2. ICP Materials provided input to the first meeting of the Task Force of Reactive Nitrogen from 21 to 23 May 2008 in Wageningen, Netherlands.

3. ICP Materials planned the next exposure of indicator materials for 2008–2009. It will include exposure of carbon steel, Zn, limestone for monitoring of corrosion and modern glass for monitoring of soiling.

4. ICP Materials produced a progress report on corrosion and air pollutant trends in the period 1987–2006 (Report 56).

5. ICP materials produced a report on a case-study on stock at risk in Madrid (Report 57).

6. ICP Materials completed and reported all specific and common workplan items for the 2008 workplan.

Literature

Report 56. Trends in pollution and corrosion of carbon steel, zinc and limestone 1987–2006.

Report 57. Case study on assessment of stock at risk and mapping areas of increased corrosion risk in Madrid, Spain.

Annex IV

International Cooperative Programme on Effects of Air Pollution on Natural Vegetation and Crops (ICP Vegetation)

1. The twenty-first meeting of the Task Force was held from 26 to 29 February 2008 in Oulu, Finland. It was attended by 52 experts from 19 countries, as well as by a representative of ICP Modelling and Mapping, the Chair of the Working Group on Effects and the Convention secretariat. At present, 35 countries participate in the activities of ICP Vegetation. Minutes and further details of the meeting are available from the ICP Vegetation website: http://icpvegetation.ceh.ac.uk.

2. A preliminary exercise was conducted to develop a likelihood-based approach to assess nitrogen critical load exceedance for ecosystems across Europe which takes account of the uncertainties in both empirical critical load values and deposition rates. The methodology developed was applied to “Heathland, scrub and tundra habitats” (European Nature Information System (EUNIS) class F) and “Grasslands and tall forbs habitats” (EUNIS class E) using the Convention’s harmonized land-cover map and modelled depositions of EMEP for 2005 and those projected for 2010 according to the Gothenburg Protocol targets. The results highlighted that a high proportion of “likely” or “very likely” exceedance of the critical load occurring in a small number of sensitive habitats for which the empirical critical load range extended below 10 kg ha^{-1} yr^{-1}. Even if the emission targets for 2010 were met, substantial exceedance was likely to remain for sensitive habitats if the minimum value of the critical load range was applied. Although little exceedance might remain for 2010 if the mean empirical critical load range was applied, substantial exceedance had been reported by countries applying the mean empirical critical load range but using mean national nitrogen deposition rates and national land-cover maps.

3. A first-stage meta-database was developed with the aim of describing regional, countrywide and European-wide field surveys on nitrogen impacts on vegetation. Currently, the meta-database contains 28 data sets, showing that nitrogen impacts such as changes in species composition or loss of sensitive species were often difficult to separate from other confounding factors. However, some studies have shown changes in species composition, such as an increase in species with higher Ellenberg nitrogen values (nitrophilous species) or a reduction in species richness. Some surveys showing changes in species composition have not been linked with measured or modelled nitrogen deposition. These links should be made in the future to enhance the strength of evidence of impacts of nitrogen deposition on different habitats. There was a need to identify other surveys to increase the size of the meta-database, in particular for habitats and regions of Europe (e.g. Mediterranean countries) for which there was no information to date.

4. The OZOVEG (OZOne impacts on VEGetation) database on biomass responses of (semi-)natural vegetation to ozone includes dose-response relationships for 89 plant species. For 23 species, dose-response relationships were added for plants grown in a competitive environment using information from ozone exposure experiments in Europe that had been conducted on whole plant communities. Five out of the 23 species (i.e. 22%) showed a significant difference in ozone response between plants grown in competition and those grown individually. The effects of competition on ozone responses were complex.

5. A workshop on quantification of ozone impacts on crops and (semi-)natural vegetation is tentatively planned for the autumn of 2009 in Ispra, Italy.

Literature

Harmens H, Mills G, Cooper J, Kubin E, Piispanen J, Poikolainen J, Kotingas-Venäläinen S, Kemppainen S (2008) Programme and abstracts of the 21st Task Force Meeting of the ICP Vegetation, 26–29 February 2008, Oulu, Finland. http://icpvegetation.ceh.ac.uk.

Harmens H, Norris D and the participants of the moss survey (2008) Spatial and temporal trends in heavy metal accumulation in mosses in Europe (1990-2005). ICP Vegetation Programme Coordination Centre, CEH Bangor, United Kingdom. ISBN 978-1-85531-239-5. http://icpvegetation.ceh.ac.uk.

Harmens H, Norris D, Cooper D, Hall J and the participants of the moss survey (2008) Spatial trends in nitrogen concentrations in mosses across Europe in 2005/2006. Defra contract AQ0810. ICP Vegetation Programme Coordination Centre, CEH Bangor, United Kingdom. http://icpvegetation.ceh.ac.uk

Harmens H, Norris DA, Koerber GR, Buse A, Steinnes E, Rühling Å (2008) Temporal trends (1990–2000) in the concentration of cadmium, lead and mercury in mosses across Europe. *Environmental Pollution* 151: 368-376.

Harmens H, Norris DA, Koerber GR, Buse A, Steinnes E, Rühling Å (2007). Temporal trends in the concentration of arsenic, chromium, copper, iron, nickel, vanadium and zinc in mosses across Europe between 1990 and 2000. *Atmospheric Environment* 41, 6673-6687.

Hayes F, Mills G, Harmens H, Norris D (2007) Evidence of widespread ozone damage to vegetation in Europe (1990–2006). ICP Vegetation Programme Coordination Centre, CEH Bangor, United Kingdom. ISBN 978-0-9557672-1-0. http://icpvegetation.ceh.ac.uk.

Hicks K, Harmens H, Ashmore M, Hall J, Cinderby S, Frey S, Cooper D, Rowe E, Emmett B (2008) Impacts of nitrogen on vegetation. Final report work package 5, UNECE International

Cooperative Programme on Vegetation, Defra contract AQ810, SEI York and CEH Bangor, United Kingdom. http://icpvegetation.ceh.ac.uk.

Mills G, Harmens H, Hayes F, Norris D, Jones L and the participants of ICP Vegetation (2008) Air pollution and vegetation. ICP Vegetation annual report 2007/2008. http://icpvegetation.ceh.ac.uk.

Schröder W, Pesch R, Englert C, Harmens H, Suchara I, Zechmeister HG, Thöni L, Maňkovská B, Jeran Z, Grodzinska K, Alber R (2008) Metal accumulation in mosses across national boundaries: uncovering and ranking causes of spatial variation. *Environmental Pollution* 151, 377–388.

Vandermeiren K, Harmens H, Mills G, De Temmerman L (submitted October 2007) Impact of ground-level ozone on crop production in a changing climate. Book chapter in: Singh SN (editor) Climate Change and Crops.

Annex V

International Cooperative Programme on Integrated Monitoring of Air Pollution Effects on Ecosystems (ICP Integrated Monitoring)

1. The sixteenth meeting of the Task Force was held from 14 to 16 May 2008 in Pamplona, Spain. The programme included a one-day workshop on the assessment of ICP Integrated Monitoring data.

2. ICP Integrated Monitoring was represented at the Task Force meetings of ICP Forests, ICP Waters and ICP Modelling and Mapping.

3. Data from ICP Integrated Monitoring sites were used in the following EU projects:

(a) EURO-LIMPACS (an integrated project to evaluate impacts of global change on European freshwater ecosystems, www.eurolimpacs.ucl.ac.uk);
(b) ALTER-Net (a long-term biodiversity, ecosystem and awareness research network, www.alter-net.info).

4. Scientific work on priority topics continued:

(a) Calculation of pools and fluxes of heavy metals and relations to critical limits and risk assessment. A scientific paper will be finalized in 2008;
(b) Dynamic modelling. This work had strong links to EU projects. Priority was given to site-specific modelling. A progress review on modelling the effect of climate change on recovery of acidified freshwaters was included in the programme’s 2008 annual report. The annual report also included a summary of research work on the development of a model framework for assessing links between climate change and air pollution effects using site-specific data;
(c) Biodiversity issues. An overview of the available ICP Integrated Monitoring biodiversity data, policy-relevant questions regarding biodiversity, and the potential contribution of ICP Integrated Monitoring data to planned European biodiversity projects was included in the programme’s 2008 annual report;
(d) Assessment of long-term chemical and biological responses in soils and surface waters. An assessment report was prepared together with the ICP Waters (Wright et al. 2007).

5. The Programme Centre and representatives from several national focal points of the programme participated also in the development of the European LTER network (Long-Term Ecological Research network, http://www.lter-europe.ceh.ac.uk/) and the related EU infrastructure project LIFE Watch (http://www.lifewatch.eu/).

Literature

Kleemola S, Forsius M (editors) (2007) 16th Annual Report 2007. ICP Integrated Monitoring The Finnish Environment 26/2007. Helsinki, Finnish Environment Institute. 100 pp. ISBN 978-952-11-2758-8 (pbk.), 978-952-11-2759-5 (pdf); URN:ISBN:978-9521127595, ISSN 1238-7312; 1796-1637. http://www.ymparisto.fi/default.asp?contentid=243825&lan=en.

Monteith DT, Stoddard JL, Evans CD, Wit HA de, Forsius M, Høgåsen T, Wilander A, Skjelkvåle B-L, Jeffries DS, Vuorenmaa J, Keller B, Kopácek J, Vesely J (2007) Dissolved organic carbon trends resulting from changes in atmospheric deposition chemistry. *Nature* 450(7169), 537–540. ISSN 0028-0836. http://dx.doi.org/10.1038/nature06316.

Posch M, Aherne J, Forsius M, Fronzek S, Veijalainen N (2008) Modelling the impacts of European emission and climate change scenarios on acid-sensitive catchments in Finland. *Hydrology and Earth System Sciences* 12, 449–463.

Wright RF, Posch M, Cosby B, Forsius M, Skjelkvåle BL (2007) Review of the Gothenburg protocol: chemical and biological responses in surface waters and soils. Report prepared by the Programme Centres of ICP IM and ICP Waters. Report 89/2007 Oslo, Norwegian Institute for Water Research. 41 pp. ISBN 978-82-577-5210-1.

Annex VI

International Cooperative Programme on Modelling and Mapping of Critical Loads and Levels and Air Pollution Effects, Risks and Trends (ICP Modelling and Mapping)

1. The twenty-third meeting of the Task Force was held on 24 and 25 April 2008 in Berne, after the eighteenth Coordination Centre for Effects workshop held from 21 to 23 April. The Task Force meeting was attended by experts from 21 countries, as well as representatives of other ICPs and organizations outside the Convention. The network of active national focal centres (NFCs) was extended to Moldova and Romania, and there is very good cooperation with the United States and China.

2. The effects of nitrogen inputs on biodiversity, especially in terrestrial ecosystems, have been the focus in the past years, and critical loads and dynamic modelling methods have been and will be further developed and applied. For instance, ongoing work on critical loads of Mediterranean ecosystems will much improve the quality of critical loads in this area. The potential of combining empirical critical loads with dose-response functions to assess risks to biodiversity will be tested. Finally, ICP Modelling and Mapping will further explore policy relevant assessments using dynamic modelling of nitrogen effects, including biodiversity, and feedbacks to climate change, carbon biogeochemistry and management.

3. The exceedance of critical loads of nitrogen is used as headline indicator of risk to biodiversity by the project "Streamlining European Biodiversity Indicators for 2010" (SEBI 2010) and also by Eurostat. Cooperation at the national and European levels has explored improved relationships between critical load exceedance, nitrogen impacts and objectives set according to the EU Habitats Directive and comparable national legislation. This applies to all areas, including the Natura 2000 areas in EU Member States. The cooperation with nature conservancy agencies should be extended, especially at the national level.

4. The Task Force has participated in the development of nitrogen assessment for multiple media and effects for some years. It noted with appreciation the establishment of the Task Force on Reactive Nitrogen. It offered to provide effects-based methods and data and to further develop methodologies (including on dynamic modelling and indicators for multimedia, multiscale nitrogen management) relevant to the Task Force. It noted that various effects were connected to the nitrogen cascade at the national and international levels.

Literature

Aherne J, Posch M, Forsius M, Vuorenmaa J, Tamminen P, Holmberg M, Johansson M (2008) Modelling the hydro-geochemistry of acid-sensitive catchments in Finland under atmospheric deposition and biomass harvesting scenarios. *Biogeochemistry* 88(3), 233–256.

Posch M, Aherne J, Forsius M, Fronzek S, Veijalainen N (2008) Modelling the impacts of European emission and climate change scenarios in acid-sensitive catchments in Finland. *Hydrology and Earth System Sciences* 12, 449–463.

Reinds GJ, Posch M, De Vries W, Slootweg J, Hettelingh J-P (2008) Critical loads of sulphur and nitrogen for terrestrial ecosystems in Europe and Northern Asia influenced by different soil chemical criteria. *Water, Air and Soil Pollution* (online) http://dx.doi.org/10.1007/s11270-008-9688-x .

Slootweg J, Posch M, Hettelingh J-P (editors) (2007) Critical loads of nitrogen and dynamic modelling: CCE Progress Report 2007. Coordination Centre for Effects, MNP Report 500090001, Bilthoven, Netherlands, 201 pp. www.mnp.nl/cce.

Spranger T, Hettelingh J-P, Slootweg J, Posch M (2008) Reactive nitrogen effects: An overview of LRTAP convention activities. *Environmental Pollution* (online) http://dx.doi.org/10.1016/j.envpol.2007.10.035.

Wright RF, Posch M, Cosby BJ, Forsius M, Skjelkvåle BL (2007) Review of the Gothenburg Protocol: Chemical and biological responses in surface waters and soils. ICP-Waters Report 89/2007, Norwegian Institute for Water Research, Oslo, Norway, 40 pp.

Annex VII

Joint Task Force on the Health Aspects of Air Pollution

1. The eleventh meeting of the joint Task Force on the Health Aspects of Air Pollution was held on 17 and 18 March 2008 in Bonn, Germany. Thirty experts from 19 Parties to the Convention attended the meeting. The World Health Organization's European Centre for Environment and Health (WHO/ECEH) had invited participants from all EECCA countries. Representatives of Armenia, Azerbaijan, Belarus, Georgia, Kyrgyzstan, Moldova, the Russian Federation and Ukraine attended the meeting with financial support from WHO, based on funds received from Germany.

2. The meeting focused on the update and final review of the WHO report, "Health risks of ozone from long-range transboundary air pollution", and formulated its main conclusions. The Task Force will publish the report in 2008.

3. The Task Force reviewed the activities of the countries in EECCA and South-Eastern Europe (SEE) assessing health impacts of air pollution. Representatives of EECCA and SEE countries presented concise reports on national activities.

4. The Task Force updated the evidence on health impacts of particulate matter (PM). The Task Force's discussion on the health hazards of PM from biomass combustion concluded with an agreement to initiate a preliminarily assessment of the current health impacts due to PM from biomass combustion. It noted, however, that a full risk assessment was not yet possible. The Task Force agreed on the scope of this assessment.

5. Details on the above issues are presented in the document ECE/EB.AIR/WG.1/2008/12.

6. The Task Force agreed to include the development of the guidelines on monitoring and modelling of health effects of air pollution in its medium-term work plan. The draft guidelines will be discussed at the twelfth Task Force meeting.

Literature

WHO (2007a) Health risks of heavy metals from long-range transboundary air pollution. World Health Organization, 130 pp. http://www.euro.who.int/document/E91044.pdf.

WHO (2007b) Health relevance of particulate matter from various sources. Report on WHO workshop, Bonn, Germany, 26-27 March 2007, 26 pp. http://www.euro.who.int/Document/E90672.pdf.
