Report of WGE to EB 27

Effects of Air Pollutants on Human Health and the Environment

Summary of progress reports to the Working Group on Effects 28 (23 - 25 September 2009, Geneva)

Tor Johannessen, Chairman WGE

What does the WGE do?

Monitoring and modelling (key parameters and indicators) ➔ effects & trends ➔ dose-response ➔ ex-post / testing scenarios

- **ICPs/TFH/JEG study the effects of air pollution (S, N, O3, PM, HM &POPs) on materials, health and ecosystem receptors (chemistry & biology)**
- **Critical loads, levels and dynamic modelling**
- **Large number of scientists involved (>200 in ICP V alone)**
- **Long-term collection of deposition, exposure, soil, plant, water and materials effects have allowed the analysis of ecosystems and buildings interaction with atmospheric pollutants**
- **Effect data needed for effectiveness and sufficiency, for the review and revisions of protocols**

Acidification

- **Acidification still remains a problem in parts of Europe**
- **Chemical recovery in progress, but biological recovery slow and not widespread**
- **Critical loads exceeded**
- **There still is a room for further emission cuts of acidifying air pollutants. Dynamic models are capable to provide arguments to continue efforts to reduce emissions.**

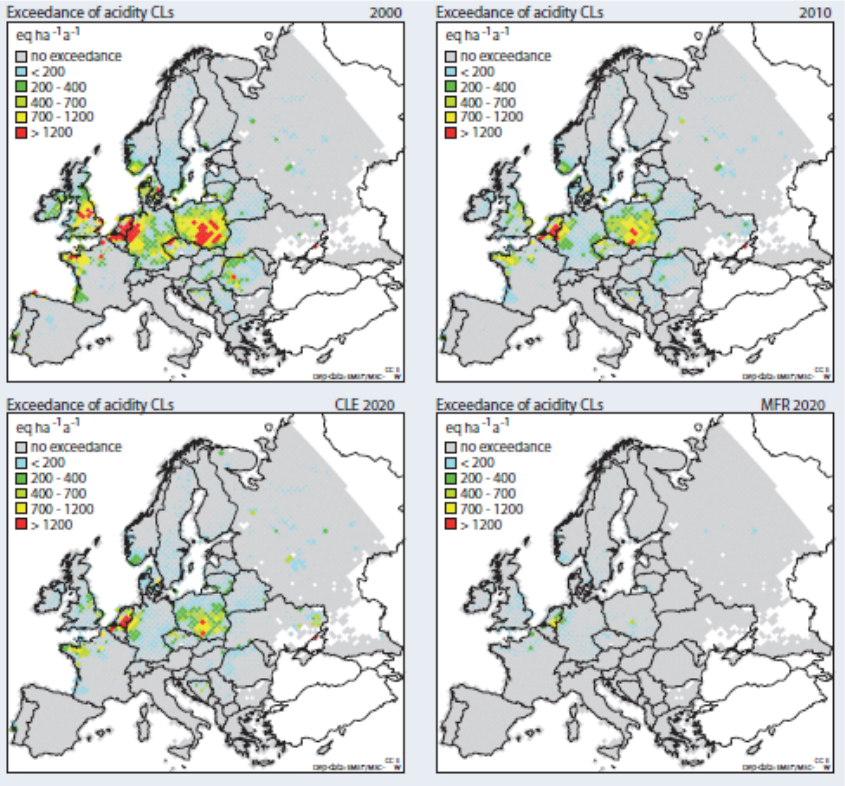


Figure 1-4 Exceedance of critical loads for acidification by depositions in 2000 (top left), 2010 (top right), and 2020 (bottom left) under Current Legislation to reduce national emissions, and in 2020 (bottom right) under Maximum Feasible Reductions.

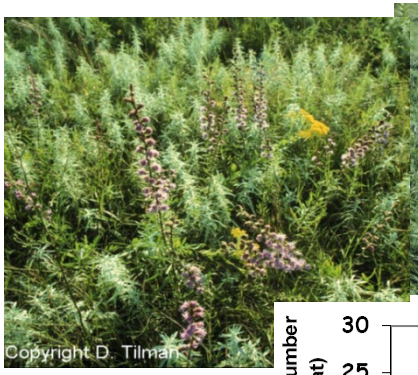
LRTAP
Long-range Transboundary Air Pollution

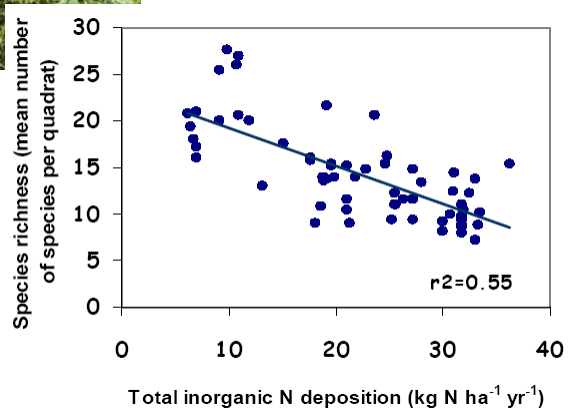
wge
Working Group on Effects
of the
Convention on Long-range Transboundary Air Pollution

Effects of Airborne Nitrogen

Nitrogen remains a problem;
acidification, eutrophication, formation of tropospheric ozone, particles

- **Contributes to acidification of lakes, growth of nuisance plants in freshwaters, algal blooms in marine waters**
- **Changes in species composition /abundance/ loss of species diversity in terrestrial ecosystems**
- **Increased susceptibility to other stresses (diseases, pests, frost, drought, wind)**
- **Effects soils and soil microbiological processes**
- **Adverse effects on human health and materials**

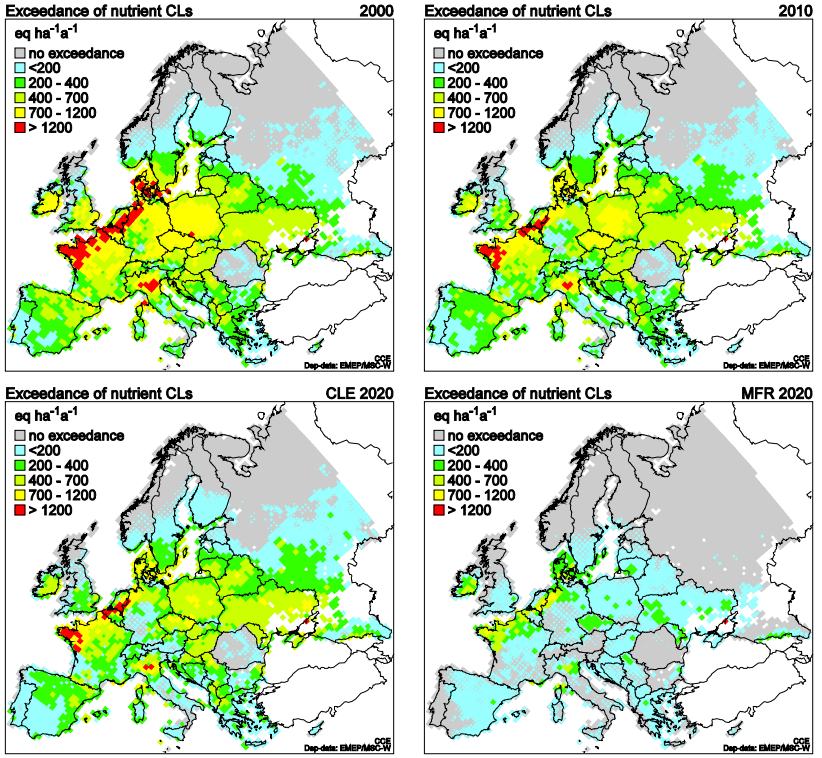




Decline species richness in acid grassland UK (Stevens et al., 2004)

Effects of Airborne Nitrogen - Eutrophication

- **Reduction of exceedance of critical loads will not necessarily mean ecosystem recovery**
- **The historical status of ecosystems would not be a feasible target**
- **Ex-post analyses should be made with all available models and data to increase certainty in assessmentes**
- **In spite of current legislation, current N emissions and deposition continue causing adverse effects on the environment and human health. In the work to revise the Gothenburg Protocol, further N abatement measures are required, in particular measures reducing NH_3 emissions**



Source CCE

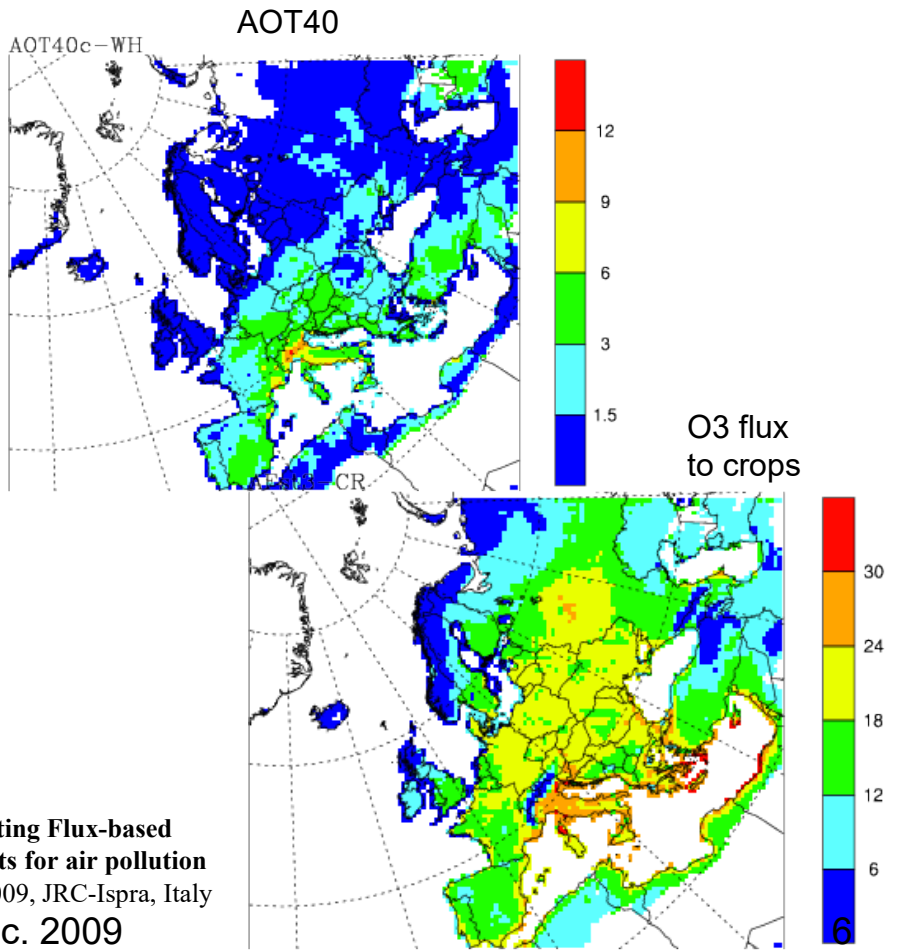
Ozone & vegetation

Production of ozone from NO_x and NMVOCs results in:

- **Reduction in crop yield/quality, decline in plant/tree growth, changes in species composition, and decline C-sequestration**

Flux-based approach recommended for use in IAM:

- **Generic and crop species (7); yield and quality**
- **forest trees (2); flux-effect relationship on biomass**
- **(semi-)natural vegetation**
- **<u>Co-benefits</u>: Protection against effects on carbon sequestration and food security**



ICP V Expert Panel Meeting Flux-based assessment of ozone effects for air pollution policy 9-12 November, 2009, JRC-Ispra, Italy

Health impacts of PM – an update

Fine particulate air pollution and life expectancy in the United States (*Pope AC et al, NEJM 2009):*

- **A decrease of 10 µg/m3 of PM2.5 associated with increase of life**
- **Reduction in air pollution accounts for 15% of overall increase in life expectancy**

Effects of biomass combustion

- **Emissions** PM2.5, VOCs (➔O3), CO

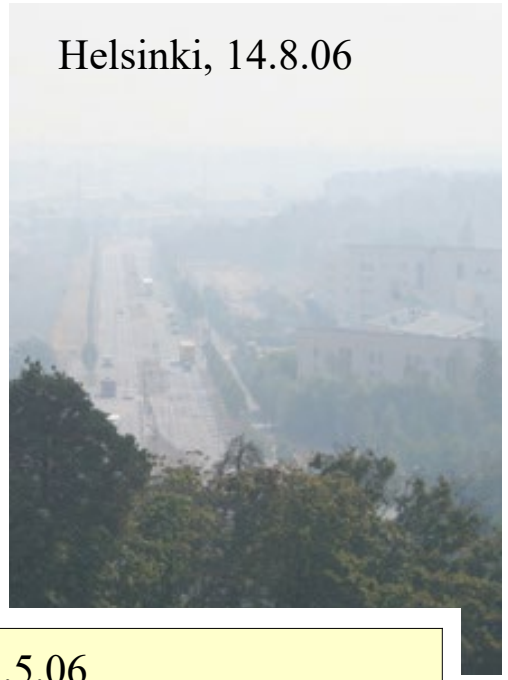
Smoke from forest fires and agricultural burning:

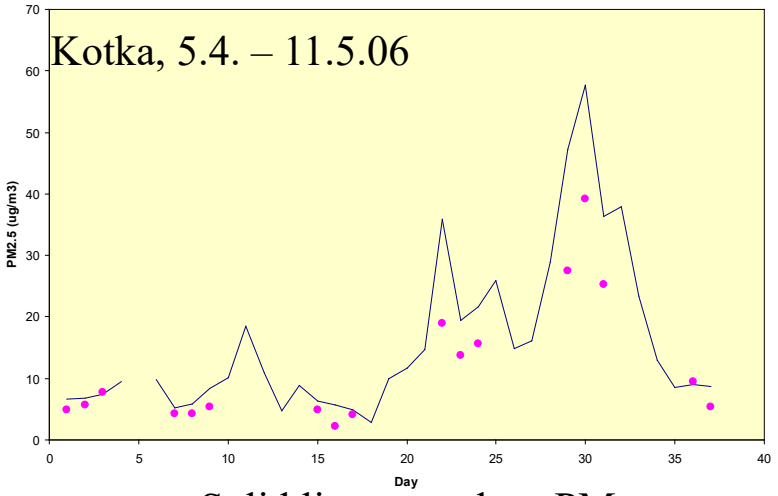
- increased respiratory hospital admissions & emergency room visits
- some evidence on increased incidence of respiratory symptoms and medication use
- subjects with asthma most susceptible

Residential wood combustion:

- exacerbation of respiratory and CV disease
- acute respiratory infections in children and COPD in women (especially due to indoor exposures)

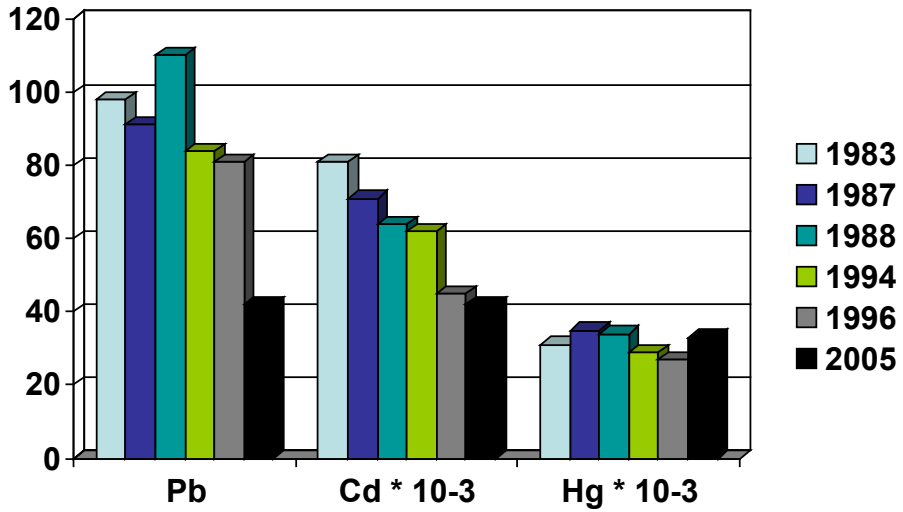
Long-range transported $PM_{2.5}$ from forest fires



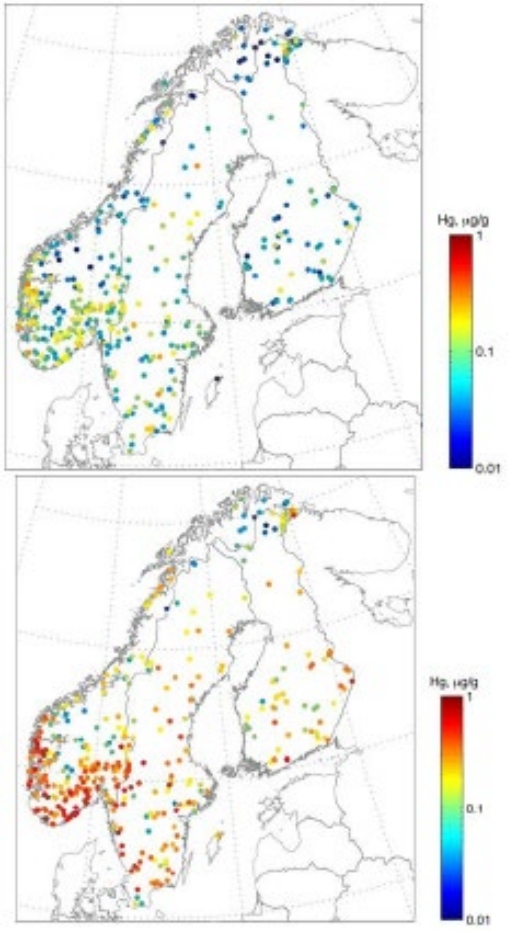


Solid line = outdoor $PM_{2.5}$
Dot = median $PM_{2.5}$ exposure

Heavy metals (Hg)



HM in humus layer, µg/g - 23 years
(ICP IM)

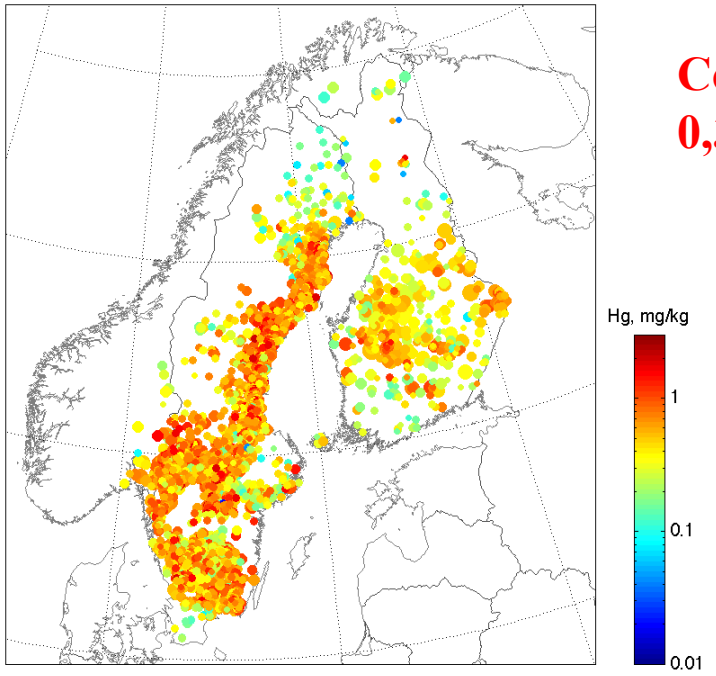


Hg in lake sediments is higher today ➔ than in preindustrial times. (ICP W)

Hg in reference and top sediments in Scandinavian lakes (*from Munthe et al 2007*)

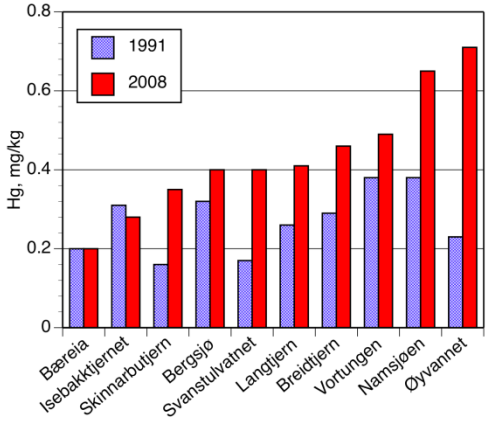
EB Dec. 2009

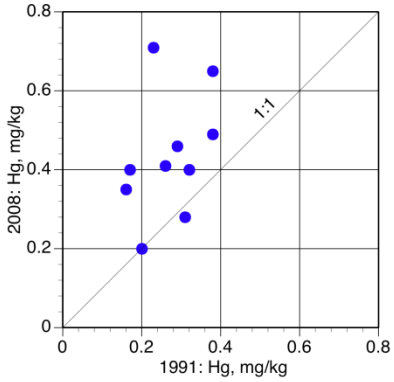
Heavy metals (Hg)



Mercury in pike in Northern Europe
(from Munthe et al 2007)

Consumption guidlines
0,3 - 0,5 mg Hg/kg





Recent results from Norway shows that Hg in fish has increased with about 60% over the last 20 years

Strategy

Long-term strategy (Approved by WGE in 2005: ECE/EB.AIR/WG.1/2005/15/Rev.1) (ECE/EB.AIR/2009/17)

- Describes aims, methods of work, long-term priorities, organization of work

Revision 2009:

- Has taken into account 2008 draft outline of a future strategy for the Convention and 2009 draft revised strategy for EMEP
- Has considered new aspects:
  air pollution effecst on biodiversity, climate change as confounding factor on air pollution effects

Cooperation with EMEP SB

- Implementation of new / revised strategies – division of work & responsibilities
- Adoption by EB 2009 ?

Monitoring and modelling reporting guidelines (ECE/EB.AIR/WG.1/2009/16)

All programmes presented their proposals for

- key parameters
- prorities for target-setting
- policy-relevant indicators

Revision of Gothenburg Protocol

- **Annex I updates, to WGSR April 2010:**
  definitions; ozone critical levels – health, PM critical levels – health, ozone flux – vegetation , activities in North America (Canada)
- **Ex-post analyses?**

WGE request for guidance from EB

ECE/EB.AIR/2009/1 (Progress in core activities); cf. § 36 (f) and (g) - WGE requests guidance on:

- **(f) criteriea of acceptable vegetation change / definition desirable state of ecosystems ….**
- **(g) displaying policy relevant and meaningful information on time-dependent environmental targets ….**

Aspirational targets

Clean air ➔ living ecosystems ➔ healthy people

- **Protect ecosystem structure and function**
- **No loss of biodiversity**
- **Full recovery from previous atmospheric inputs – forests**
- **Healthy fish populations in all acid sensitve lakes**
- **Avoid all detecable O3 damage**
- **Critical loads and levels are not exceeded**
- **WHO Air Quality Guidelines**
- **No damage to materials**

➔