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Topic 4 - Clean Air – Ecosystem and Climate

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Background

While Sulphur deposition has been very successfully controlled, reductions in nitrogen deposition have been smaller, and excess nitrogen loading remains a major threat to biodiversity and ecosystem functioning, especially in regions where exceedance is driven by ammonia emissions. Biodiversity concerns have been increasing the latest decades, and national and international policies (like the CBD and the EU Nature Directives) put in place to counteract the decline. As a consequence, an increasing part of natural ecosystems have been protected and more adequate management or nature restauration measures put in place for many areas. The relative importance of nitrogen as a pressure on biodiversity is therefore increasing.

The session was focused on ecosystem effects and further developments of monitoring and research to support effect based policies to control air pollution effects on ecosystems and biodiversity. In addition, links to ozone effects, forest productivity and carbon sequestration were discussed in the session.

Due to time limitations other impacts of air pollution were not discussed at the workshop, but it is recognized that (e.g.) both acidification and N deposition is still a problem in some aquatic environments, and that pollution with mercury and POP's will require attention in the future.

Each topic was presented by an invited speaker as introduction to the debate:

"Ozone impacts in Mediterranean areas" by Dr. Rocío Alonso, Research Center for Energy, Environment and Technology- CIEMAT (Spain)

"Links to forest production and forestry/climate interests" by Professor Per Gundersen, University of Copenhagen (Denmark)

"Biodiversity effects and the link to the CBD and EU Directives" by Dr. Jesper Bak, University of Aarhus (Denmark)

"The future of effect monitoring, including reporting under EU NEC Directive"by Dr. Anke Lūkewille, European Environment Agency

There were 30 participants (annex 1), where several contributed short presentations, and on the basis of the talks given and the ensuing discussions, the following main conclusions and recommendations were agreed:

Ozone Effects

AOT40 and ozone dose are metrics that provide an indication of ozone risk to vegetation. Ozone dose flux (Phytotoxic O_3 dose) provides a more biologically meaningful metric for the assessment of ozone risk as it takes into account the varying effect of climate conditions, soil moisture and phenology on the amount of ozone absorbed by vegetation. ozone impacts vary depending not only on where atmospheric ozone concentrations are high but also where ozone uptake is high (and where the vegetation in question grows). Currently it is possible to generate flux based ozone risk maps for different crops, including wheat, forests and different types of natural vegetation. It is possible to assess and map ozone risk for biodiversity but only for some grasslands based on flower/seed output as proxy. More information on interactions between ozone and nitrogen/climate change/soil moisture are required to improve risk assessment as well as on ecological dynamic processes.

Recommendations

- To perform ozone risk assessment for different biogeographical regions and vegetation types based on flux uptake together with AOT40 (ICP Veg, ICP Forest, EMEP)
- To explore interactions between ozone and nitrogen/climate change/ competition and ecological dynamics, and to better evaluate risks and impact due to ozone taking into account flux exposure, nitrogen and climate (ICPs, EMEP)
- To extend ozone target values and long term values to different types of vegetation (crops, forest and seminatural vegetation) in legislation
- To use ozone flux modelling for ozone risk assessment on crop production, taking into account not only crop quantity but also crop quality (ICP-Veg, TFIAM)
- To improve the modelling of the influences of soil moisture on ozone fluxes and physiology and to use the flux based approach for climate change scenarios since it considers changes in the meteorological parameters and the profiles of ozone exposure (ICP-Veg, ICP Forest, EMEP)
- To support epidemiological studies on ozone impacts on forest trees and semi-natural vegetation (ICP Veg, ICP Forest)

- To improve air pollution monitoring networks with better dry deposition data and inclusion of mountain areas not present in current networks (EMEP, Air Quality networks)
- Explore other possible response parameters more related to ecosystem services (Research)

Links to forest production and forestry/climate interests

Atmospheric N pollution impacts forest production and thus forest carbon (C) sinks and processes. Furthermore, there is an increasing interest to use forest biomass for bioenergy production, as a measure to mitigate climate change. The increasing use of bioenergy from forest is debated since there are still some uncertainties regarding the actual climate benefits, as well as documented negative impacts on biodiversity, nutrient balances and increased acidification of forest soils. In contrast to some earlier published very high C sequestration rates with extra N, there is now growing evidence that the rate for aboveground biomass is around 10-20 kg C per kg N added, depending on other limiting nutrients (P, base cations, etc.). The availability of water would affect the relationships in arid areas, which might have increasing importance in the future because of climate change. Increased C sequestration caused by N addition will in many cases not be sustained because growth can be reduced when the areas become nitrogen saturated. There is evidence that the effect on C sequestration cease at deposition above 15 kg N per ha per yr.

For unmanaged forest, which are important for biodiversity, there is in contrast an increased risk of N saturation because of the low N removal, and critical loads for unmanaged forests should thus be lower than for managed forests.

Recommendations

- Need to consider biomass production vs. nature protection efforts (e.g. deadwood needed for maintaining biodiversity). Ash recycling needed for high production in sensitive areas (countries)
- Important to harmonize air quality and climate policies to avoid negative effects of intensified forestry for biomass production on ecosystems (UNECE Air Convention, EU, countries).
- Decreasing acid deposition has decreased soil acidification and it should be ensured that intensified forestry does not reverse this trend (UNECE Air Convention, EU, countries)
- Need to better consider land-use management in CL calculations for N using mass-balance CL for N (National Focal Points)

- Better data needed particularly on N impacts on soil C sequestration in forested ecosystems (Research community)
- Better data needed on base cation deposition and mineral weathering rates (Research community).
- Data needed for other ecosystems than forests (Research community)

Biodiversity effects and the link to the CBD and EU Directives

Critical loads for N are still exceeded over large regions in Europe, and impacts on ecosystems have been documented in numerous publications. These impacts are important both for the UNECE Air Convention, and for e.g. the CBD and the EU (e.g. Habitats Directive). Air pollution effects remain in widespread areas of Europe one of the most important threats to the conservation status for habitats and species and the protection of biodiversity. Achievement of the goals of EU and national nature policies will in many cases only be possible with – or very costly without - substantial reductions in nitrogen load. Ecosystem effects and effect-based policies will therefore also be important in the future.

Recommendation

- To improve the mitigation of threats to biodiversity and ecosystems, there should be a strong linkage between air pollution, nature and agriculture policies (EU)
- Arrange a scientific workshop to enhance/verify methodologies for assessing impacts of N on biodiversity (e.g. habitat suitability index) (WGE, ICPs)
- Continue long-term harmonized vegetation monitoring to assess ecosystem and biodiversity effects by air pollution and climate change (WGE, countries)
- Increase number of habitat types and sensitive species in N impacts assessment (WGE, ICPs, countries)
- Assess the critical level for NO_2 regarding impacts on sensitive species (e.g. lichens) (ICPs, research)
- Assess ozone critical levels for biodiversity (ICPs, research)

The future of effect monitoring, including reporting under EU NEC Directive

Emphasis on biodiversity effects will require adjustments of the monitoring and research activities to ensure sufficient coverage, both geographically, of ecosystem types, as well as parameters to monitor and model effects. The EU directive on national emissions ceilings (NECD) requires mandatory monitoring on ecosystem impacts (Annex 5). This monitoring is to a large extent expected to be based on the existing monitoring programmes of the ICPs of the UNECE Air Convention /WGE, as well as EMEP monitoring and modelling activities (particularly for ozone). Synergies with new ecosystem research infrastructures

(RI) under the European RI framework (ESFRI) are also foreseen, since there could be joint funding/saving opportunities, and co-location of sites.

Recommendation

- Constitute a European working group for implementation of ecosystem monitoring under Article 9 (NEC Directive) in cooperation with the member states and the scientific support from the WGE. This WG should be managed by the Commission (EU)
- Harmonize efforts of the WGE and the Commission regarding impact assessment, as well as between the different directives (WGE, EU)
- Share the monitoring data reported to EEA also to ICPs and enhance ICP participation (countries)
- The WGE shall develop and present a common ecosystem monitoring platform to evaluate effects of air pollution in a coordinated manner (WGE)
- Establish cooperation with ESFRI Research Infrastructure (e.g. to enhance monitoring infrastructures and get experimental data) (WGE, ICPs, countries)