LRTAP
Long-range Transboundary Air Pollution

Impacts of air pollution on human health, ecosystems and cultural heritage

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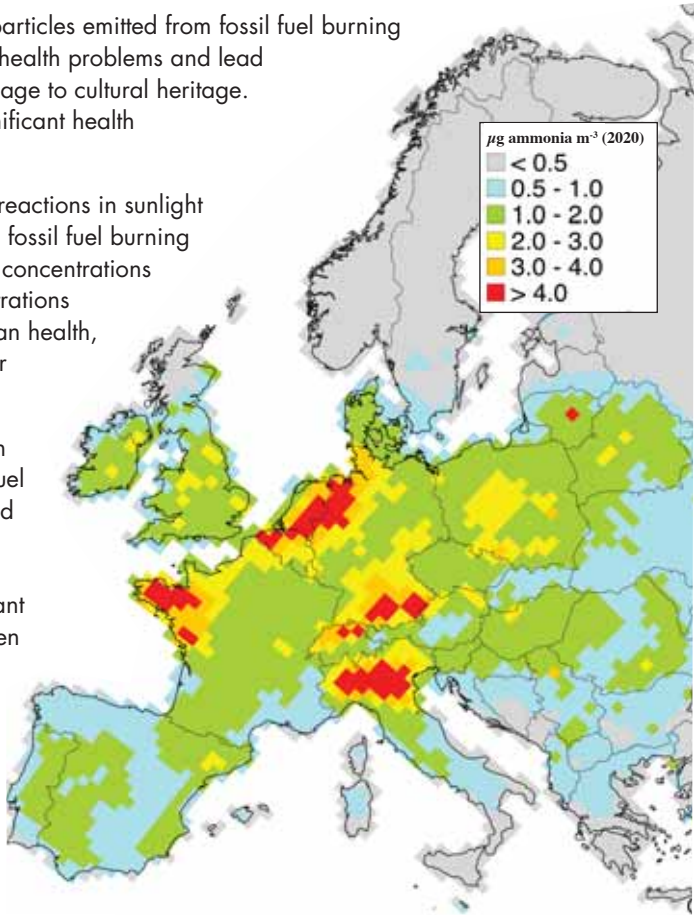
Working Group on Effects
of the
Convention on Long-range Transboundary Air Pollution

Air pollution causes damage to human health, crops, ecosystems and cultural heritage

The scientific data presented in this brochure have been collated by the Working Group on Effects to support the revision of the 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone. This Protocol is one of the eight multilateral environmental agreements under the UNECE Convention on Long-range Transboundary Air Pollution (LRTAP). Since its ratification in 1979, this Convention has contributed to lower transboundary air pollution through policy measures based on scientific studies and collaborations.

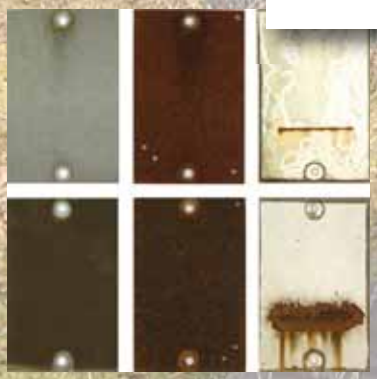
These agreements on emission reductions cover the following air pollutants:

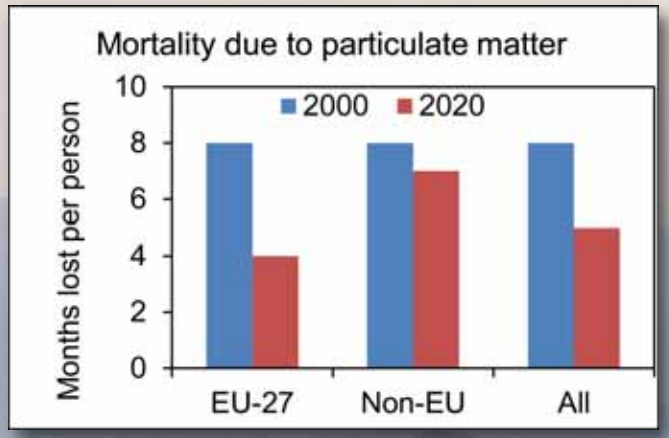
- **Sulphur dioxide** – emitted from fossil fuel burning (industry, households, transport), sulphur dioxide causes acidification of soils, streams and lakes and leads to erosion of building materials, including cultural heritage.
- **Particulate matter** – small particles emitted from fossil fuel burning and natural fires cause human health problems and lead to soiling of materials and damage to cultural heritage. Fine particulate matter is a significant health problem in urban areas.
- **Ozone** – formed by chemical reactions in sunlight from air pollutants emitted from fossil fuel burning and industry. Both peak ozone concentrations and rising background concentrations have negative impacts on human health, crop production, tree and other vegetation growth.
- **Reactive nitrogen** – nitrogen oxides are emitted from fossil fuel burning and ammonia is emitted from agricultural activities. Nitrogen is a nutrient and its increased deposition affects plant biodiversity. In addition, nitrogen contributes to acidification of soils and waters.

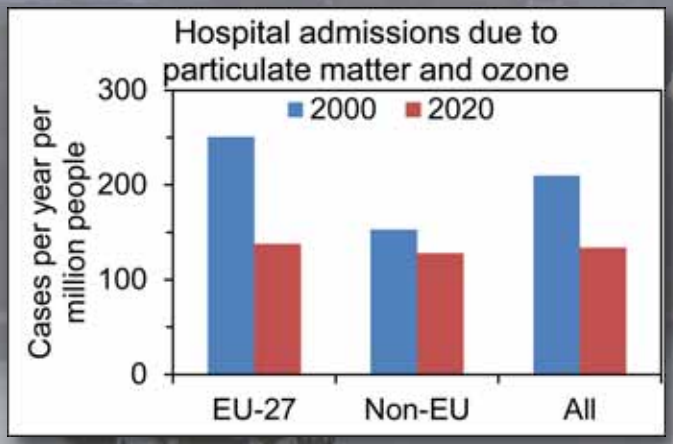


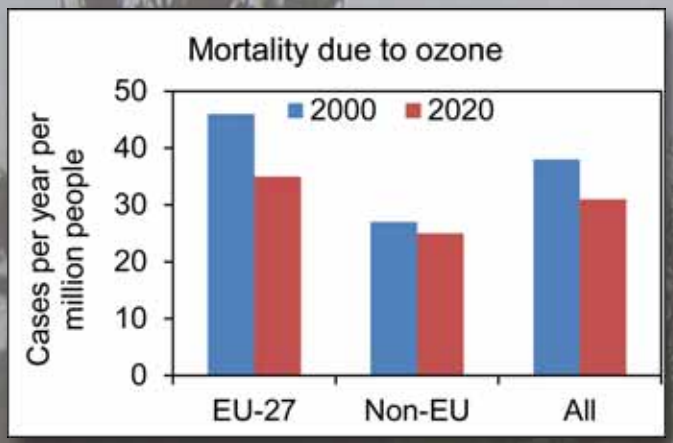
Sulphur dioxide deposition has killed fish in lakes and streams, caused forest dieback and corrosion of cultural heritage

Although sulphur dioxide deposition has been reduced over the last 30 years, recovery of the brown trout population in Lake Saudlandsvatn (Norway) has only started in the last decade
(dashed line: critical level for acidification)









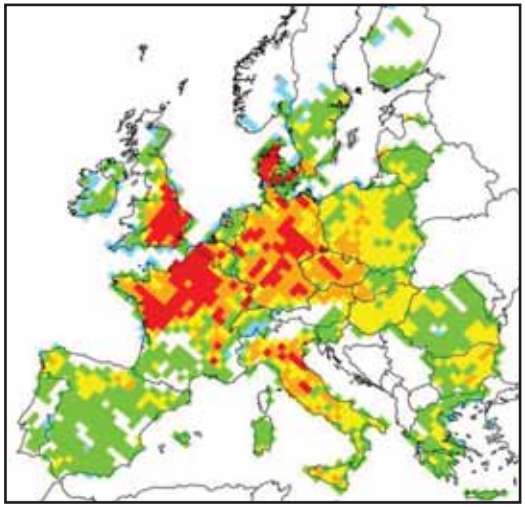
Fine particulate matter reduces life expectancy and increases hospital admissions

So does ozone .....

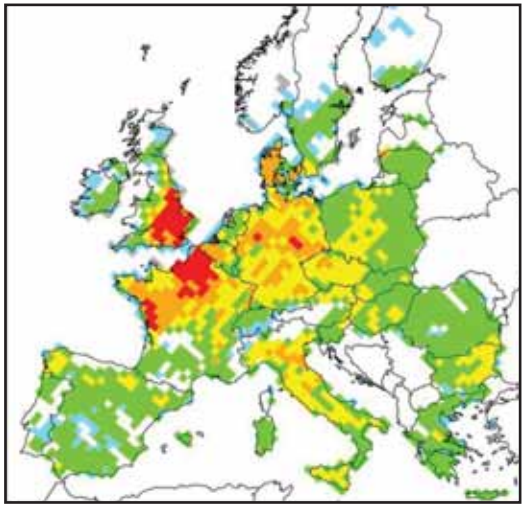
Ozone reduces crop yield and forest growth, and damages the appearance of leaf crops

Ozone-caused losses in wheat value in Europe[1]

Map 1: Economic losses in 2000
(3.2 billion Euro in EU27+CH+NO)



Map 2: Economic losses in 2020
(2.0 billion Euro in EU27+CH+NO)



Losses are in million Euro per 50 x 50 km grid square:

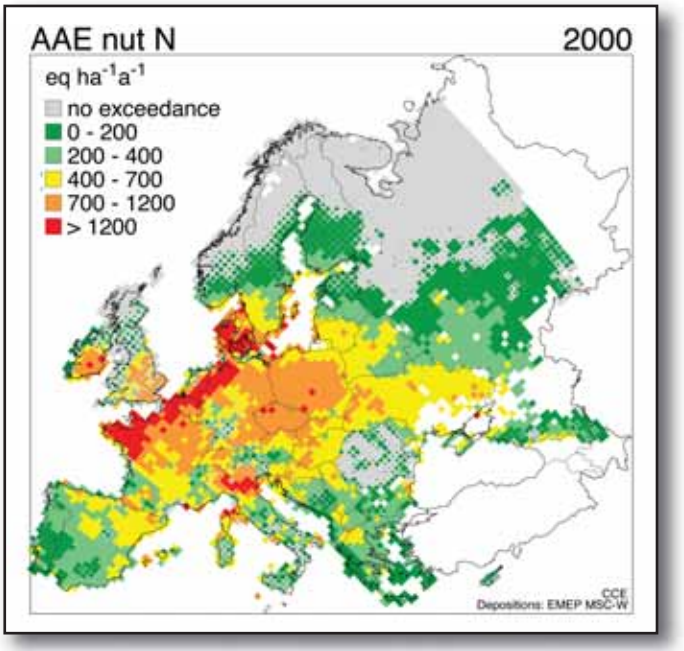
- < 0.01
- 0.01 - 0.1
- 0.1 - 1.0
- 1.0 - 2.5
- 2.5 - 5.0
- > 5

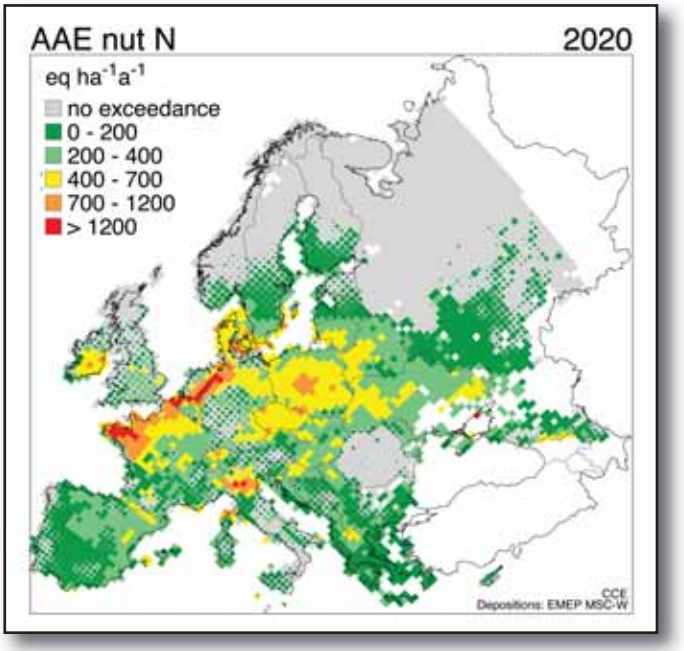
[1] Calculated using the ozone flux method, the mean economic value in 2000 and assuming irrigation is used when needed

Although vegetation growth is increased by nitrogen deposition, it leads to loss of plant biodiversity

Before nitrogen deposition

After nitrogen deposition





The level of exceedance of the nitrogen critical load provides an indication of the level of risk of adverse effects of nitrogen on ecosystems

Air pollution will remain a problem in the future

- Air pollution continues to cause cardiovascular and respiratory illnesses.
- Air pollution reduces the economic value of crops and leads to expensive cleaning of cultural heritage.
- Air pollution reduces plant biodiversity and affects other ecosystem services, such as clean water, recreational activities and carbon storage.
- Air pollution contributes to climate change, hence air pollution abatement policies have co-benefits for climate change abatement policies.

Although air pollution abatement policies have been successful for sulphur dioxide, further abatement measures are required for reactive nitrogen, ozone precursors and particulate matter.

This brochure was produced by the Working Group on Effects of the United Nations Economic Commission for Europe Convention on Long-range Transboundary Air Pollution to support the revision of the 1999 Gothenburg Protocol.

The following International Cooperative Programmes (ICPs) or Task Force have contributed to this brochure:

- **ICP Forests**: http://icp-forests.net/
- **ICP Integrated Monitoring**: www.environment.fi/syke/im
- **ICP Materials**: http://www.corr-institute.se/ICP-Materials/web/page.aspx
- **ICP Modelling and Mapping**: http://www.rivm.nl/en/themasites/icpmm/index.html
- **ICP Vegetation**: http://icpvegetation.ceh.ac.uk
- **ICP Waters**: http://www.icp-waters.no/
- **Task Force on Health**: http://www.euro.who.int/en/what-we-do/health-topics/environment-and-health/air-quality/activities/health-aspects-of-long-range-transboundary-air-pollution

For a more detailed assessment, see the full report entitled "**Impacts of air pollution on ecosystems, human health and materials under different Gothenburg Protocol scenarios**", available at http://www.unece.org/env/lrtap/workinggroups/wge/welcome.html

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