

## Expert Seminar: Air protection in urban environment

*(Riga, 28 April 2016)*

# Air Protection Threats & Challenges

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MINISTRY  
OF THE ENVIRONMENT

## Air pollutants come from:

- n natural sources (volcanic eruptions, forest fires, and sand stores),
- n anthropogenic sources (industry, transport, agriculture, waste management and households) which are under legislation.



*Photos: Wanda Kacprzyk*



## European air pollution sources:

- n fuel combustion (from road transport, households to energy use and production) is a key contributor to air pollution,
- n some 60 % of sulphur oxides come from energy production and distribution,
- n more than 40 % of emissions of nitrogen oxides and almost 40 % of primary particulate matter (PM<sub>2.5</sub>) come from road transport,
- n businesses, public buildings and households contribute to around half of the PM<sub>2.5</sub> and carbon monoxide emissions
- n agriculture, landfills, coal mining and long-distance gas transmission are sources of methane,
- n around 90 % of ammonia emissions and 80 % of methane emissions come from agricultural activities.

Air pollution is defined as the existence of certain pollutants in the atmosphere at levels that adversely affect:

- n human health, especially children and the elderly,
- n the environment,
- n cultural heritage.



*Photos: Wanda Kacprzyk*



Air pollutants can have a serious impact on human health:

- n Headache and anxiety ( $\text{SO}_2$ ),
- n Impacts on the central nervous system (PM),
- n Irritation of eyes, nose and throat as well breathing problems ( $\text{O}_3$ , PM,  $\text{NO}_2$ ,  $\text{SO}_2$ , BaP),
- n Impacts on the respiratory system (irritation, infections), asthma and reduced lung function, chronic obstructive pulmonary disease (PM),
- n Lung cancer (PM, BaP),
- n Cardiovascular diseases ( $\text{O}_3$ , PM,  $\text{SO}_2$ ),
- n Impacts on liver, spleen and blood ( $\text{NO}_2$ ),
- n Impacts on the reproductive system (PM).

**Heavy metals** (including lead, cadmium, mercury) are persistent in the environment and have documented potential for serious health consequences for: central nervous, cardiovascular and gastrointestinal systems, lungs, kidneys, liver, endocrine glands and bones.

**Persistent Organic Pollutants** are toxic chemicals that adversely affect human health and the environment around the World. POPs can disrupt endocrine, reproductive and immune systems.

## Impact on health in Europe

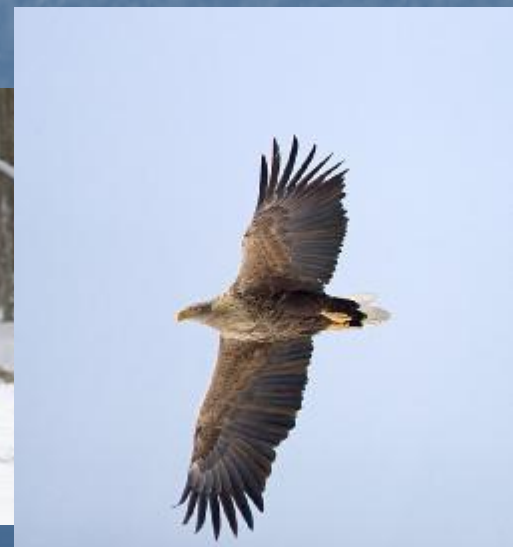
(data from the Aphekom project co-funded by the EC):

- n air pollution leads to a reduction in life expectancy of around **8.6 months per person**,
- n reducing annual average levels of PM<sub>2.5</sub> to **10 µg/m<sup>3</sup> (WHO guideline level)** would result in serious gains in life expectancy (from 22 months on average per person in Bucharest to less than half a month in Dublin).



Different air pollutants have different impacts on a wide range of ecosystems, for example:

- n acidification rivers and lakes,
- n risk of eutrophication,
- n alter the balance between species,
- n biodiversity loss in the affected area,
- n most vegetation and agricultural crops are exposed to ozone levels exceeding the EU long term objective intended to protect vegetation.



Photos: Grzegorz Rąkowski



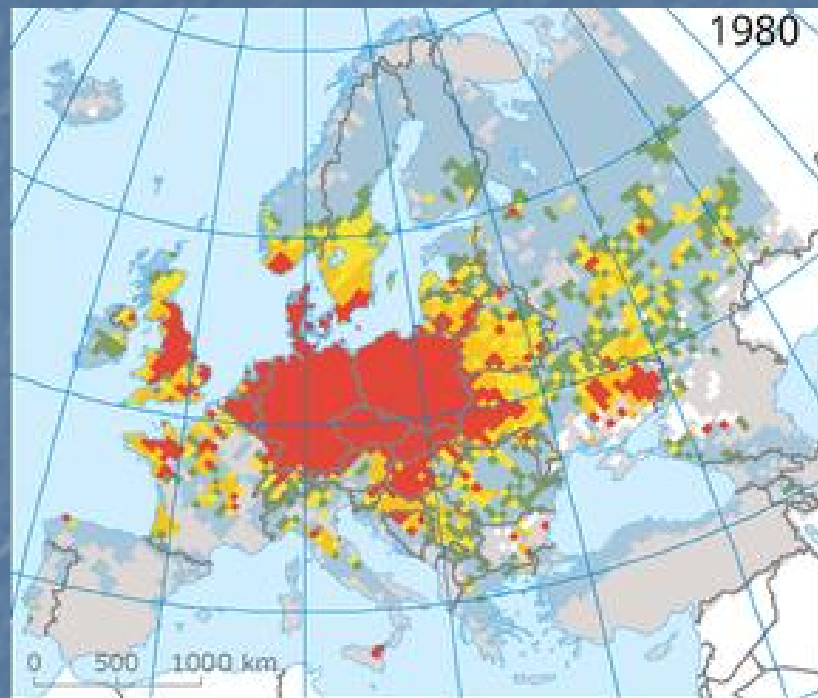
## Pollutions without borders

- n a part of the air pollutants and their precursors found in Europe are emitted in Asia and North America and vice versa,
- n this rule is also true on a smaller scale (between urban and rural areas).



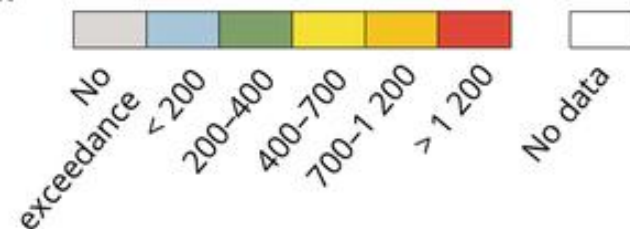
Photos: Grzegorz Rąkowski, Ewa Lisowska-Mieszkowska, Wanda Kacprzyk

Emissions of many air pollutants have decreased substantially over the past decades, resulting in improved air quality across the European region.



#### Exposure of ecosystems to acidification

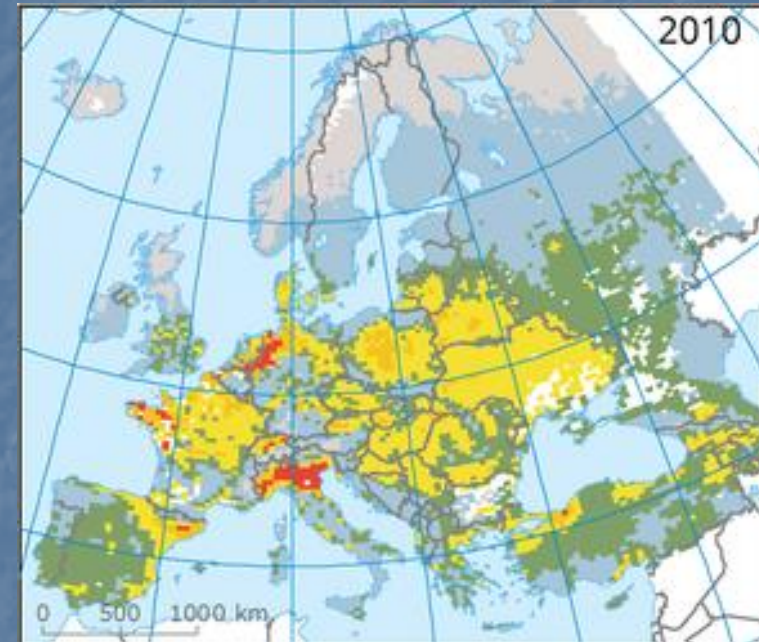
Average accumulated exceedance of the critical loads for acidification (in equivalents ( $H^+$  ions) =  $(mol_{charge})$  per hectare and year)



Source: EEA

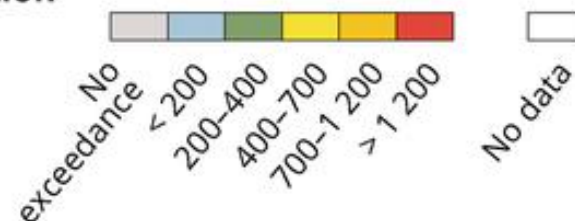


However, air pollutant concentrations are still too high, and air quality problems persist, especially cities, where exceedances of air quality standards occur.



### Exposure of ecosystems to eutrophication

Average accumulated exceedance of the critical loads for eutrophication (in equivalents = (mol nitrogen) per hectare and year)

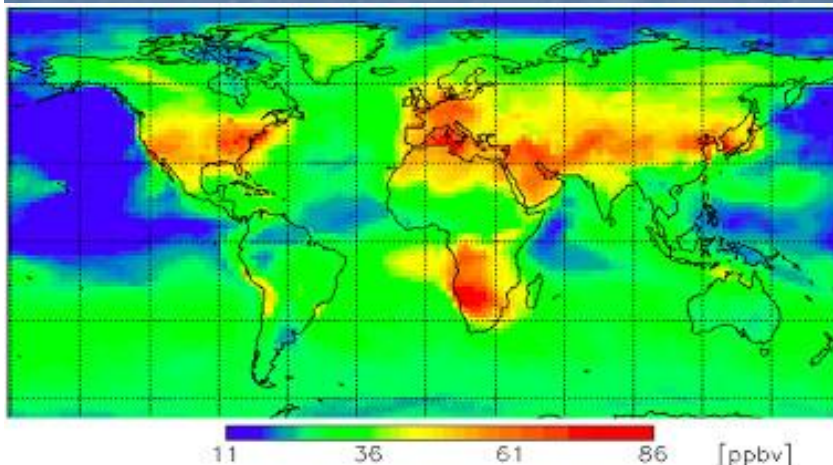


Source: EEA

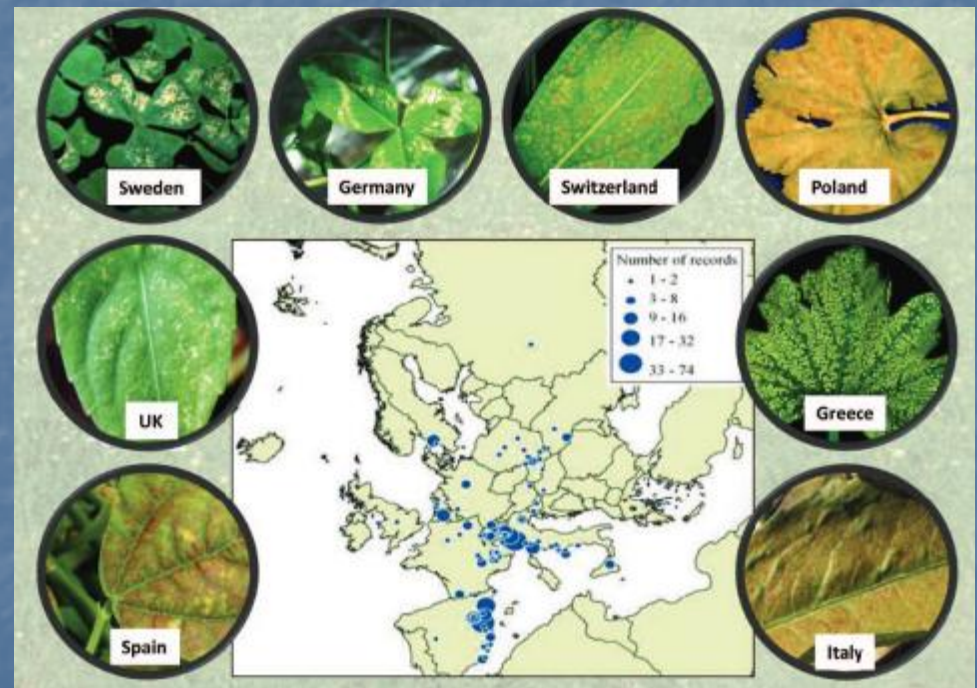


Ozone ( $O_3$ ) at ground level is a pollutant. Ground-level ozone is not emitted directly but formed through complex series of photochemical reactions that occur in presence of nitrogen oxides (emission from incomplete combustion, generally from mobile sources), volatile organic compounds (released by petroleum products), sunlight and high temperatures.

Afternoon ground-level  
ozone concentration in 2011



Source: WMO/GAW



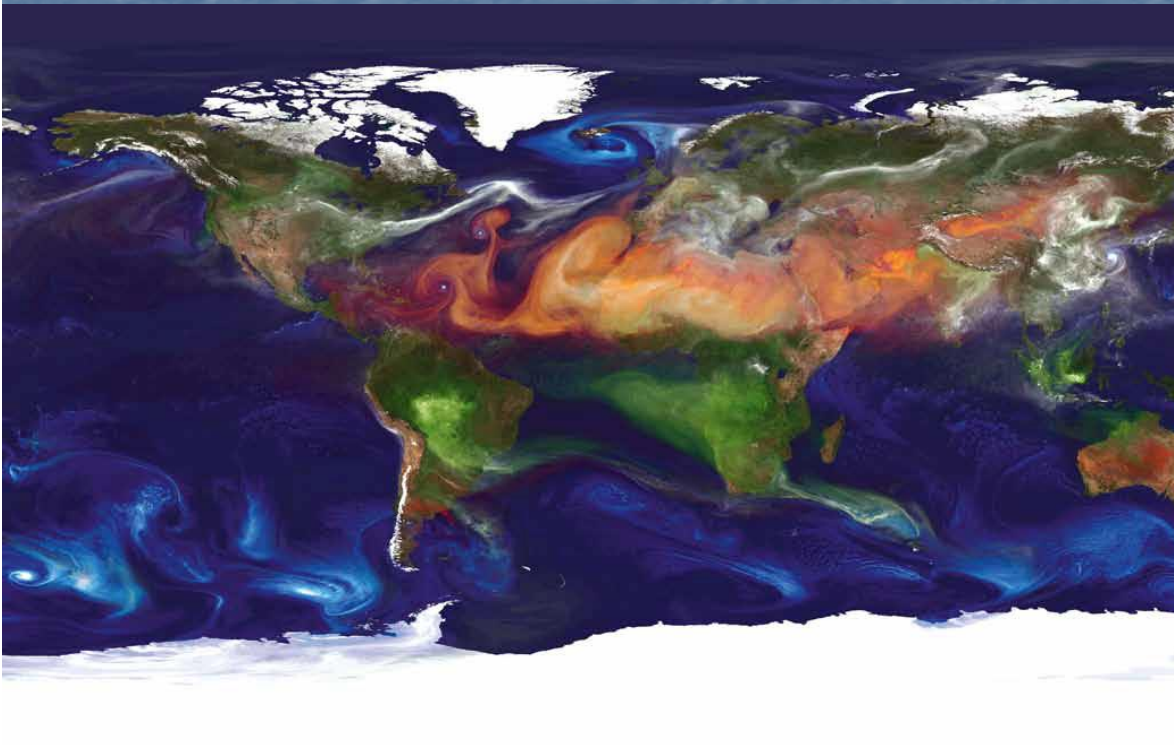
Location of records of visible injury attributed  
to ozone on crops and semi-natural vegetation

Source: ICP Vegetation



PM is a global problem.

An image of global aerosols  
(small particles in the atmosphere)  
delivered by GEOS-5 simulation.



**Dust** is lifted from the surface.

**Sea salt** swirls inside cyclones.

**Smoke** rises from fires.

Sulphate particles  
stream from volcanoes  
and fossil fuel  
emissions.

*Source: William Putman, NASA/Goddard*

Air quality problems could be solved through international cooperation as well on country and local levels

For 37 years the Convention on Long-range Transboundary Air Pollution (**CLRTAP**) has been one of the main means of protecting public health and the environment from the harmful effects of air pollution across of UNECE region.

With 8 protocols, the Convention has developed comprehensive and strong commitments covering all major pollutants. It has extensively improved the air.

However, there are a lot to do, in particular to meet the aims set for the pollutants which flux and affect millions of people living in cities throughout the world.



For example, the **Protocol to Abate Acidification, Eutrophication and Ground-level Ozone** (signed in Göteborg in 1999 and amended in 2012) includes:

- n national emission reduction commitments to be achieved up to 2020, by 2020 and beyond,
- n emission limit values for both key stationary sources and mobile sources,
- n emission reduction commitments for fine particulate matter,
- n reference to short-lived climate pollutant Black Carbon (or soot) as a component of PM.

*Photo: Tomasz Pecka*



## **Air legislation in European Union** (examples)

- n Directive on ambient air quality and cleaner air for Europe (2008/50/EC),
- n Quality of petrol and diesel fuel Directive (98/70/EC),
- n National Emission Ceiling Directive (2001/81/WE),
- n Industrial Emission Directive (2010/75/EU),
- n Medium Combustion Plant Directive (EU/2015/2193),
- n Euro limits on road vehicle emissions (Euro 6 entered into force in 2015),
- n Directive on the sulphur content of marine fuels (2012/33/EU) - ships in the Baltic Sea are using fuels with a sulphur content of no more than 0.10%.



**EU Clean Air Policy Package** (adopted in 2013) includes support measures to help cut air pollution, with a focus on improving air quality in cities, supporting research and innovation, and promoting international cooperation

- n new Clean Air Programme for Europe with measures to ensure that existing targets are met in the short term, and new air quality objectives for the period up to 2030,
- n revised NEC Directive with stricter national emission ceilings for the six main pollutants responsible for acidification, eutrophication, and ground-level ozone pollution (under negotiation).

According to air-quality legislation EU Member States divide their territories into a number of management zones in which air quality is assessed using measurement or modelling approaches. Most big cities are declared to be such zones. If air quality standards are exceeded in the zone, country has to:

- 1) report to the EC and explain the reasons,
- 2) develop local or regional plans describing how they intend to improve the air quality. For example by:

- n establish so-called low-emission zones that restrict access for more polluting vehicles,
- n encourage a shift in transport to less polluting modes including walking, cycling, and public transport,
- n ensure that industrial and commercial combustion sources are fitted with emission-control equipment, according to the latest, best-available technology.



Intergovernmental Panel on Climate Change predicts a decline in air quality in cities in the future due to climate change.

Limit the global mean temperature increase to 2°C above pre-industrial era levels was agreed.

EC aims at reducing the EU's domestic greenhouse gas emissions by 80–95 % compared to their 1990 levels by that date.

It is clear that more efforts are needed to reduce emissions further in order to achieve of both aims. Fast action on pollutants such as black carbon, ground level ozone and methane may help limit near term global temperature rise and significantly increase the chances of keeping temperature rise below 2°C.

Adaptation actions are already taking place across Europe, but more such actions will be needed in future. A wide spectrum of measures can be used to adapt to climate change and receive common advantages:

- n limiting emissions,
- n the transition to a low-carbon economy,
- n reduction in final energy demand,
- n more efficient use of energy,
- n more renewable energy (solar, wind, geothermal, hydro),
- n less use of fossil fuels,
- n planting trees and increasing green spaces (parks) in urban areas alleviates the effects of heat waves, while also improving air quality



*Photo: Jan Borzyszkowski*



Effective implementation of climate& energy and air policies can benefit each other.

A challenge for Europe is to ensure these policies for the next decade promote and invest in 'win-win' scenarios and technologies that are mutually reinforcing.



*Photo: Paweł Woszczyk*



*Photo: Fotoloto*

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