

Impacts of air pollution on environment and climate

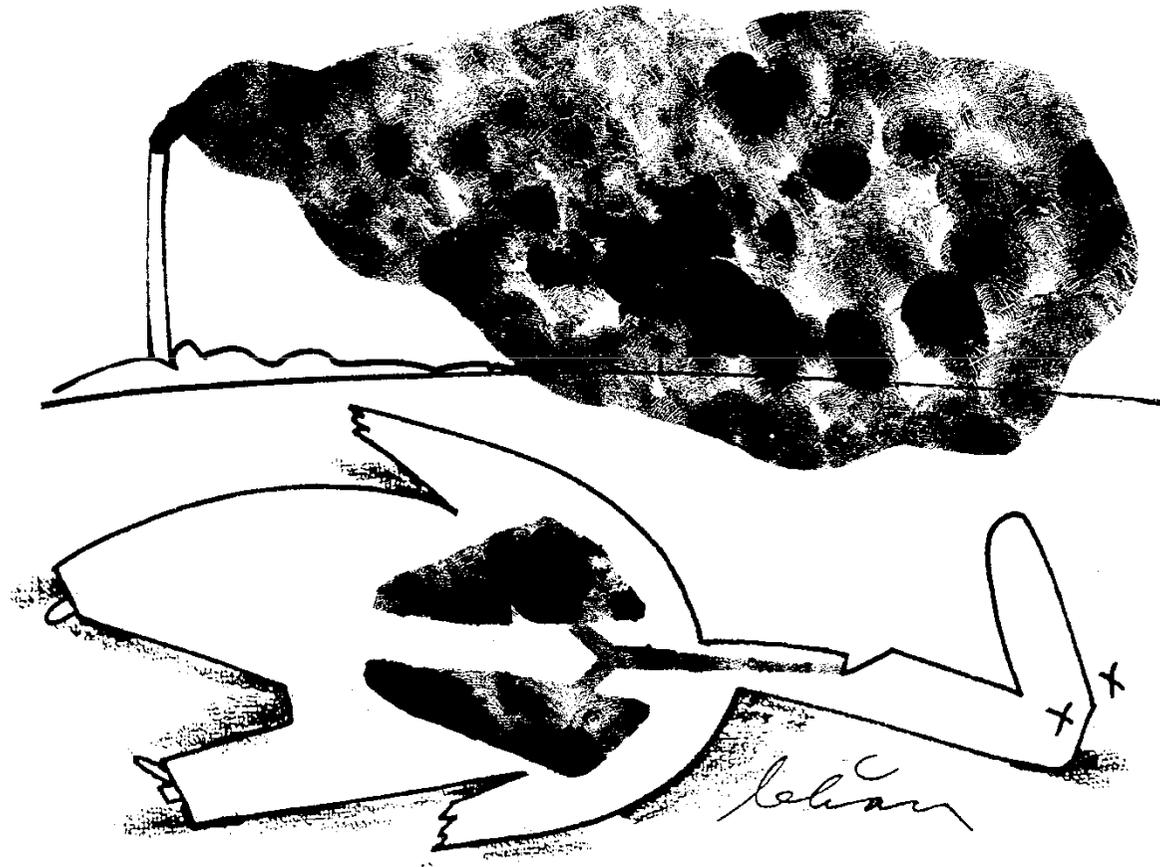
Christer Ågren
Air Pollution & Climate Secretariat



www.airclim.org



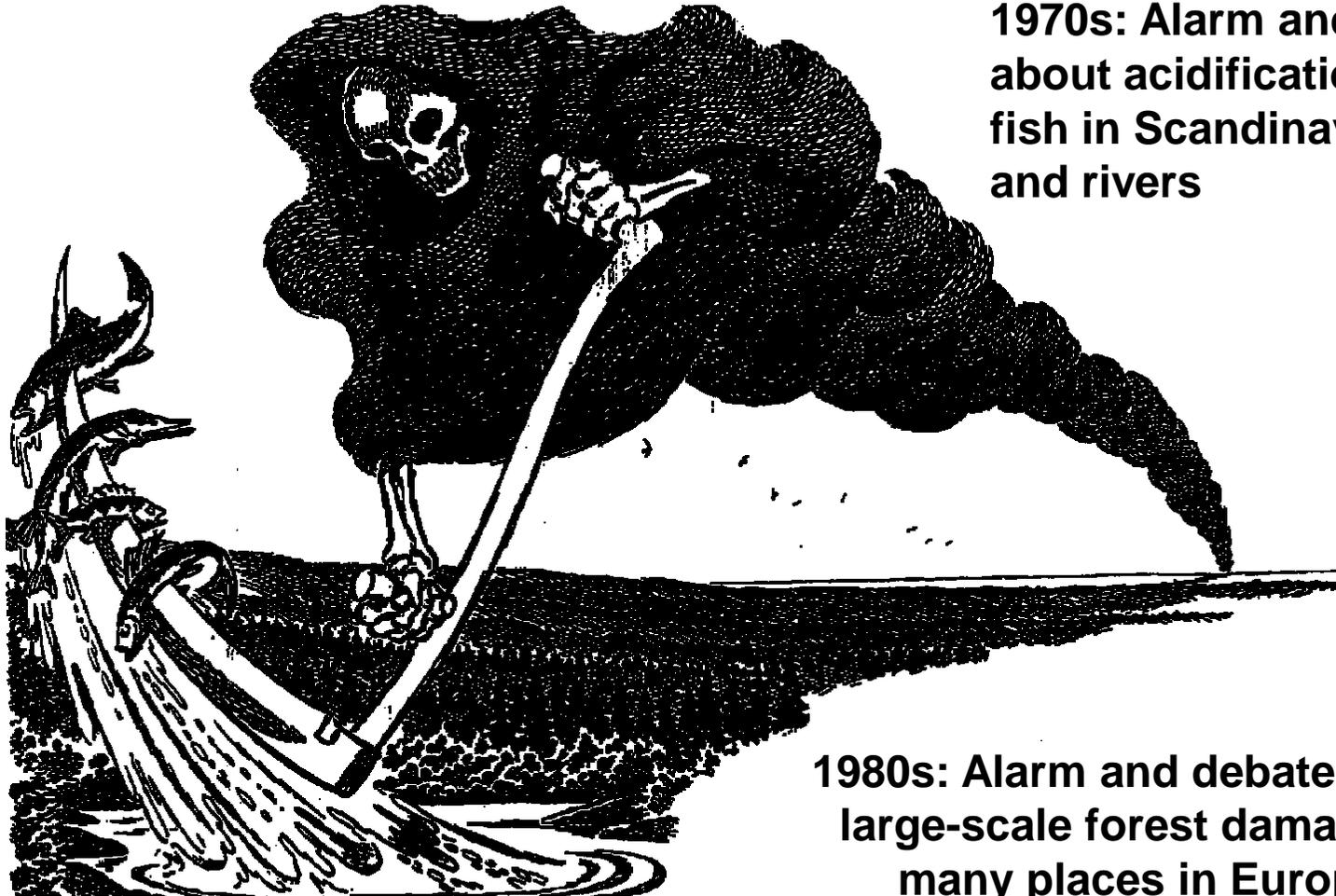
Local air pollution damage well-known for hundreds of years



Initially "resolved" by moving pollution source and/or building taller chimneys...

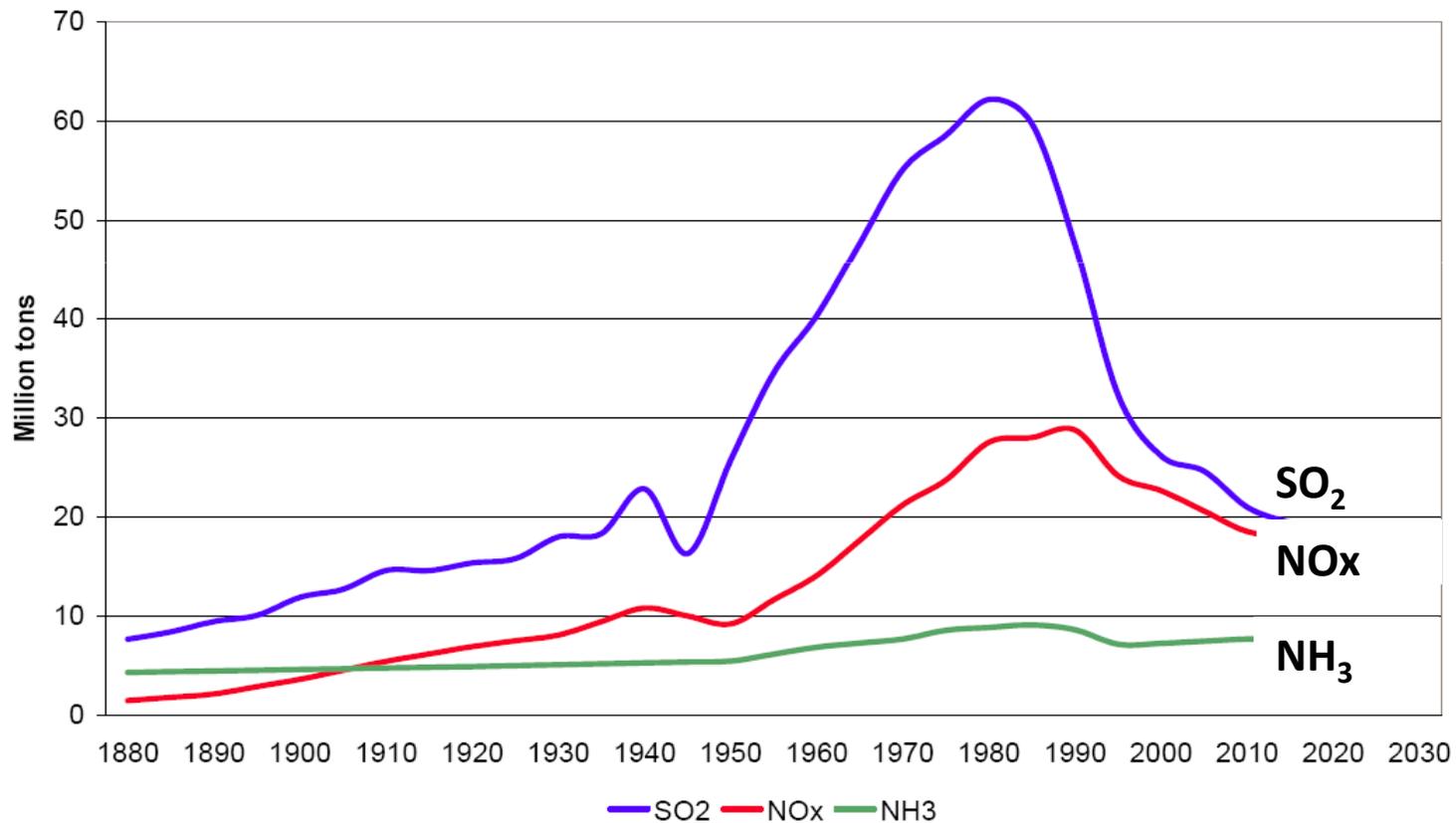
1970s and 1980s: Transboundary air pollution damaging freshwaters and forests

1970s: Alarm and debate about acidification killing fish in Scandinavian lakes and rivers



1980s: Alarm and debate about large-scale forest damage in many places in Europe

Emissions 1880-2005 in Europe

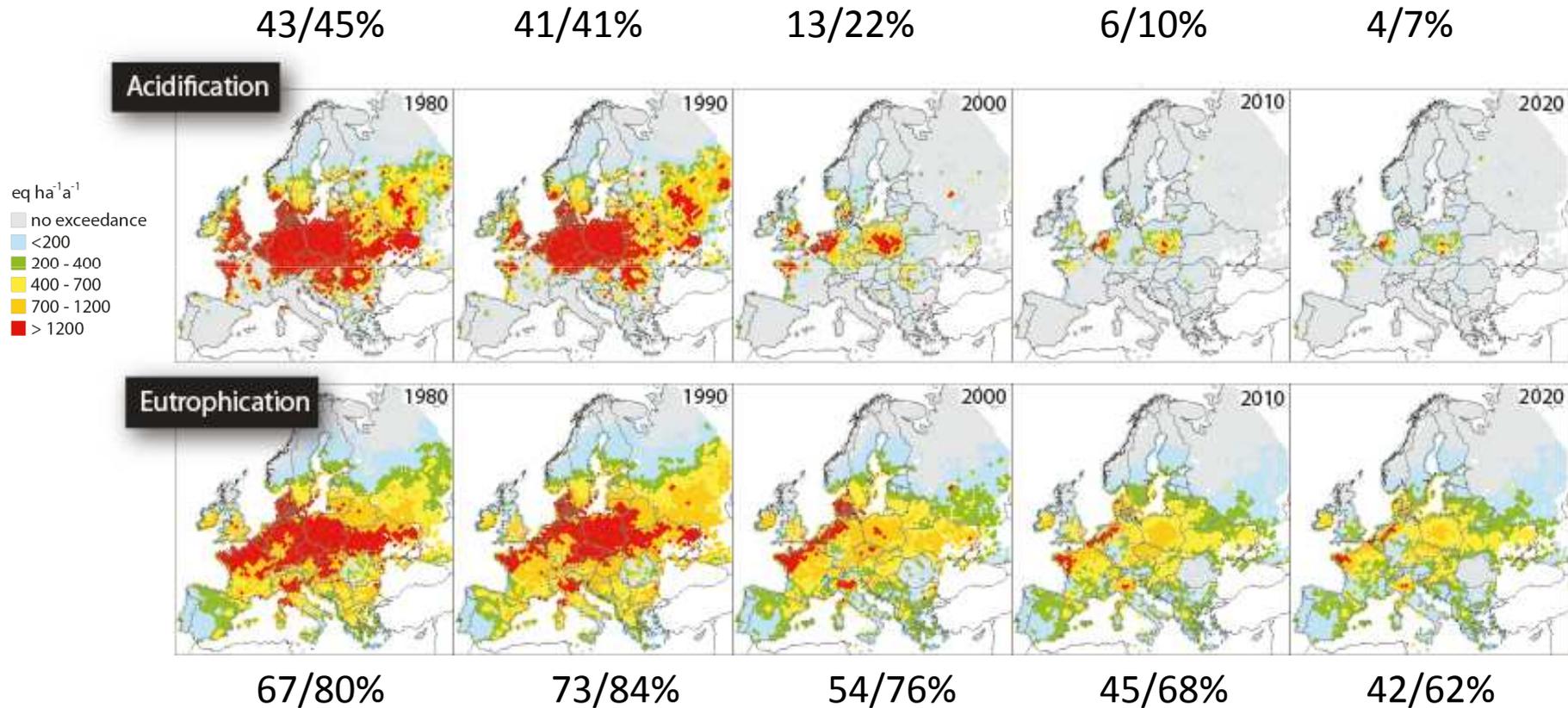


Source: IIASA (2007)



Excess pollutant deposition 1980-2020

Acidification and eutrophication in Europe/EU

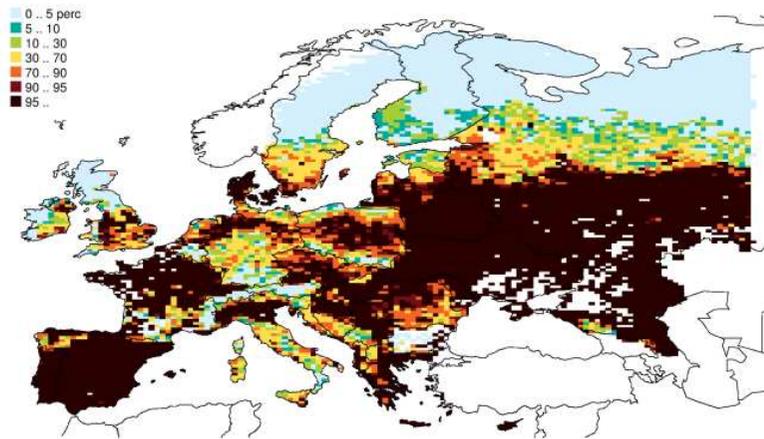
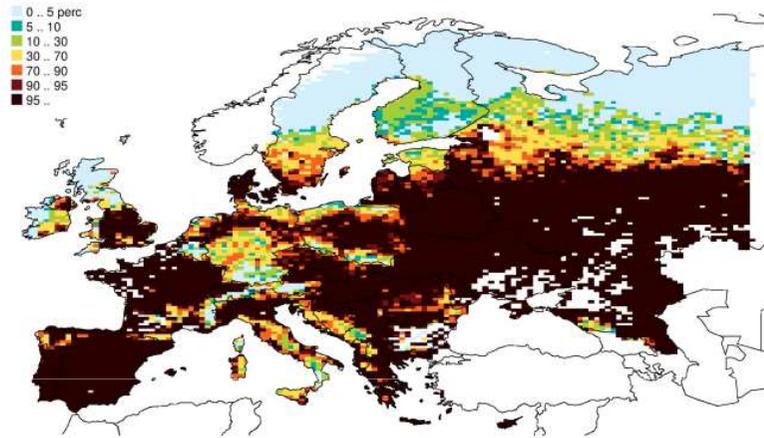


Ecosystem area where pollutant deposition exceed critical loads

Source: CCE (2013)

Eutrophication

2010: 62% (1,000,000 km²)

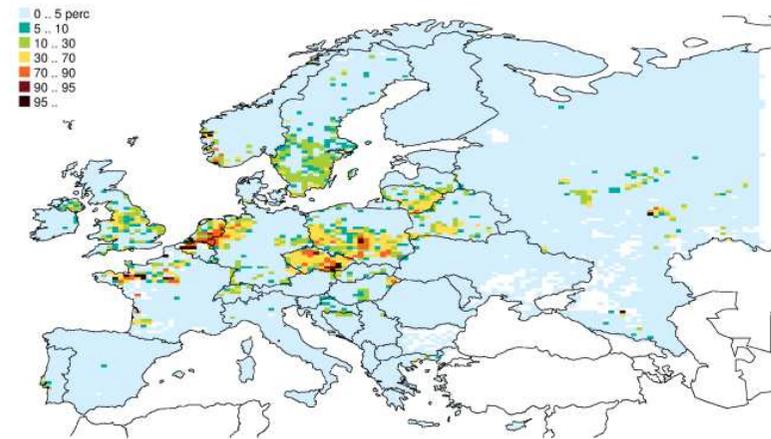
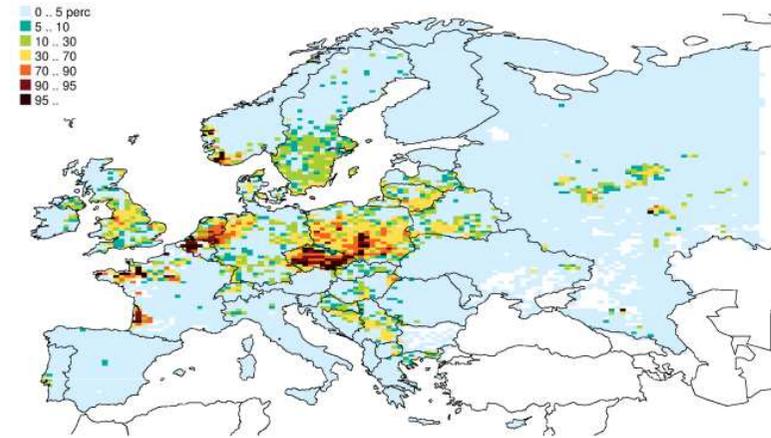


2030 Baseline: 54% (890,000 km²)

Source: IIASA (Nov 2012)

Acidification

2010: 7.5% (96,000 km²)

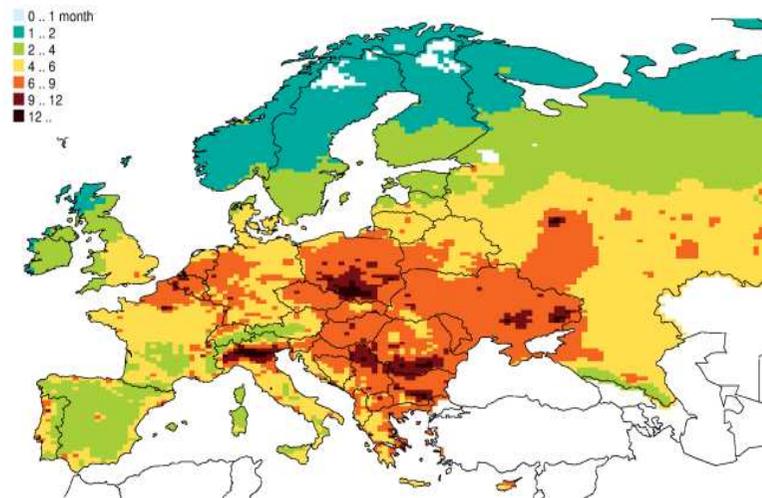


2030 Baseline: 3.7% (47,000 km²)

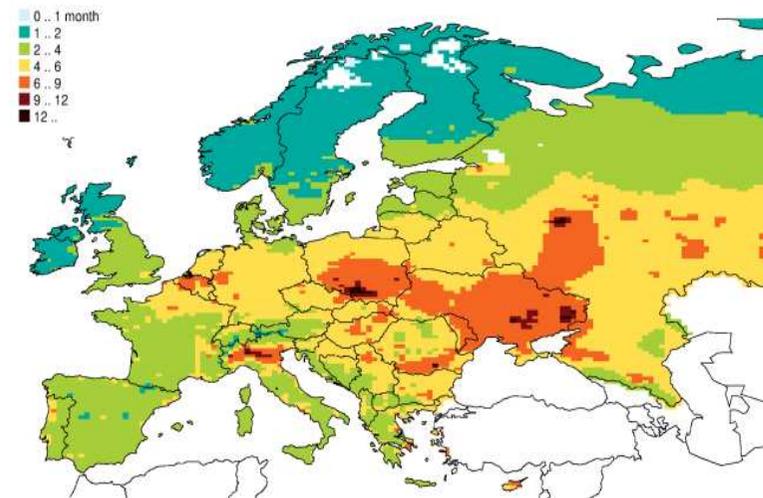
Air Quality & Health

- In 2005, excessive levels of PM were estimated to cause 455,000 premature deaths/year in EU27.
- Under a baseline scenario, by 2030 PM pollution would still cause more than 300,000 premature deaths/year.

2010



2030 Baseline



Maps: Average loss of statistical life expectancy from PM exposure (months)

Sources: IIASA (Nov 2012); EMRC (Nov 2012); EEA (June 2009)

Air pollution damage in the EU in 2010

- **Health**: Air pollution caused more than 400 000 premature deaths. Plus illnesses, hospital care, medication and lost working days.
- **Acidification**: Nearly 200 000 km² (10%) of sensitive ecosystems exposed to excess deposition of acidifying pollutants.
- **Eutrophication**: Some 1,1 million km² (68%) of sensitive terrestrial ecosystems exposed to excess deposition of eutrophying nitrogen pollutants.
- **Ozone**: Approximately 800 000 km² av EU's forest area were (in 2000) exposed to excess ozone levels.
- Plus impacts on **agricultural crops** and **materials**, including our **cultural heritage**.

Ship emissions are a major cause of eutrophication and acidification

Examples of countries with a high proportion of air pollutant fallout from ship emissions:

<u>NO_x-N</u>		<u>SO₂-S</u>	
Ireland	29%	Ireland	27%
Norway	27%	Portugal	26%
Denmark	26%	Denmark	24%
Sweden	26%	<u>Netherl.</u>	<u>23%</u>
Portugal	25%	Norway	19%
<u>Netherl.</u>	<u>21%</u>	France	17%
UK	21%	UK	18%
Finland	19%	Sweden	16%
France	17%	Spain	16%
Italy	17%	Italy	15%
Belgium	14%	Belgium	11%

Source: EMEP (2013)

Causing 50,000 deaths a year

Air pollutant emissions from international shipping is estimated to cause some 50,000 premature deaths/year in Europe.

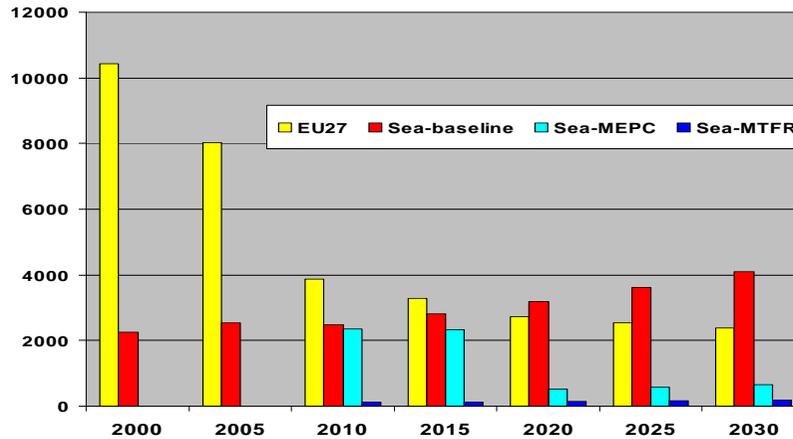
Tiny airborne particles (PM) cause premature death through lung and heart disease.



Source: J. Brandt et al, CEEH, Denmark (March 2011).

Land-based emissions are going down while those from ships are increasing

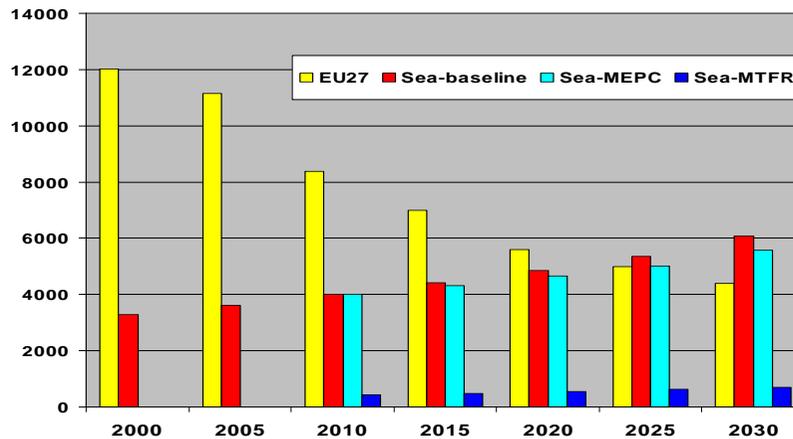
SO₂



EU27 land-based SO₂ emissions down by 88% 1980-2010.

IMO-standards and EU Sulphur Directive will cut ship SO₂ emissions from 2015 and 2010.

NO_x

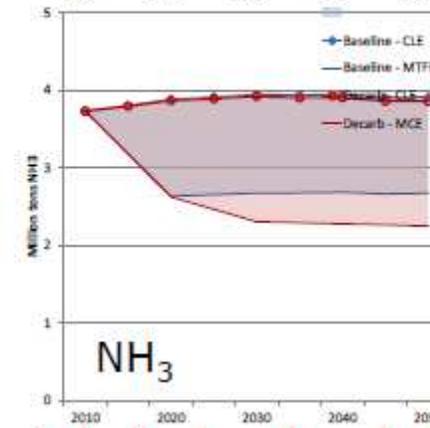
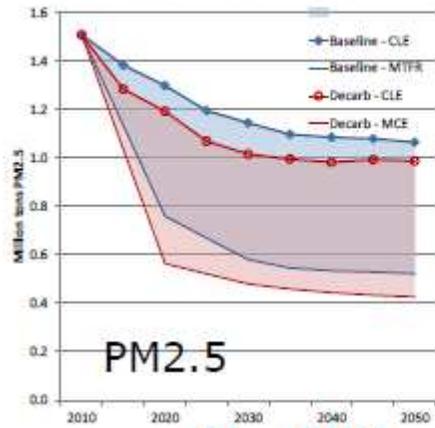
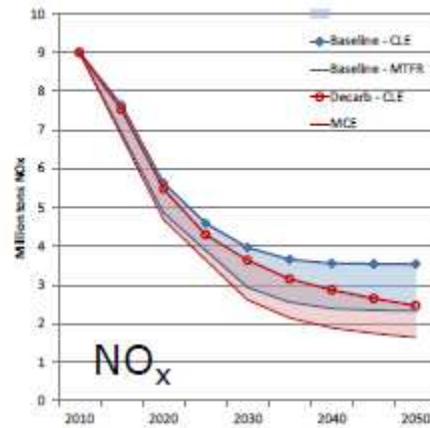
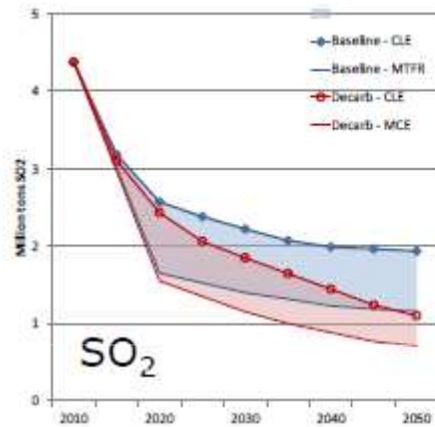


EU27 land-based NO_x emissions down by 48% 1980-2010.

Current NO_x standards will **NOT** cut overall ship NO_x emissions in near future.

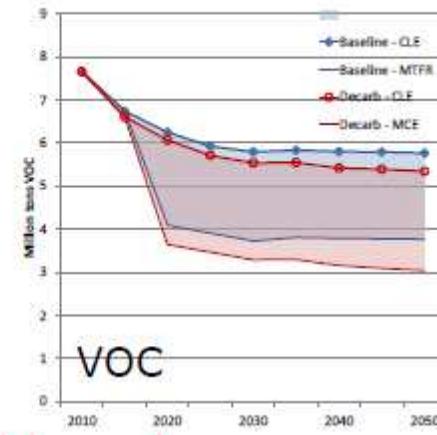
Sources: IIASAs GAINS-model (2010) and EMEP (2012)

Potential for EU land-based emission reductions 2010-2050



Further emission reductions from:

- Decarbonisation (mainly SO₂ & NO_x)
- Air pollution control measures (could further halve emissions)



Source: IIASA (2013)

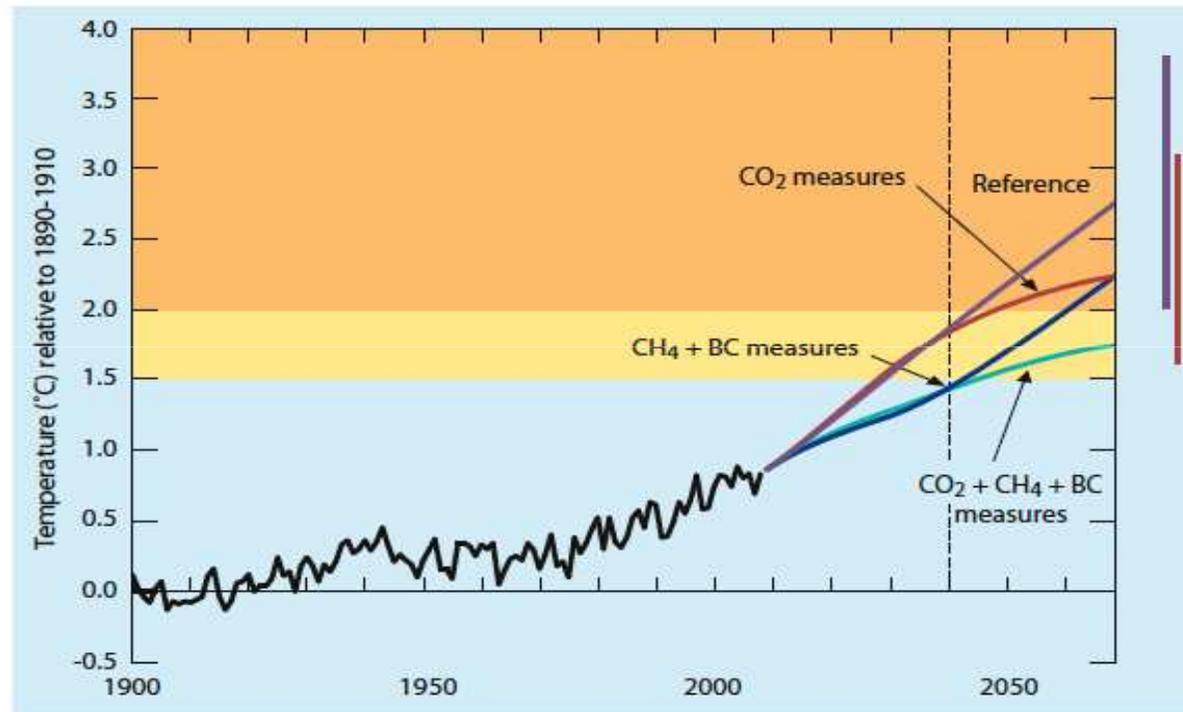
Climate benefits from air pollution abatement

Short-lived climate pollutants (SLCP) act both as "traditional" air pollutants and as greenhouse gases (GHG).

- Methane
- Ground-level ozone
- Black carbon (a fraction of PM)

Precursors to ground-level ozone include:
NO_x, non-methane VOCs, methane and CO.

Action on short-lived climate pollutants (SLCPs) is important – but action on CO₂ is imperative



If fully implemented by 2030, the selected 16 SLCP measures are estimated to reduce global warming between 2010 and 2050 by about 0.4 to 0.5° C.

Source: UNEP/WMO (2011)

Co-control: example of measures

- **Energy efficiency/conservation**
(generation, distribution, use)
- **Structural change – fuel shift**
(fuel switch, e.g. coal/oil to gas; fossil to renewable)
- **Behavioural change**
(less energy/transport demand; modal shift; less meat; etc.)
- **NOx reduction**
(SCR on stationary & mobile sources, incl. ships)
- **PM/BC reduction**
(cleaner fuels; domestic stoves/boilers wood -> pellets;
PM traps existing diesel engines; limit straw burning)

Health benefits of GHG-cuts

Less burning of fossil fuels = less air pollution

Air quality health benefits of the EU's 20% GHG target estimated at €13-52 billion/yr

Additional health benefits from moving to a 30% "domestic" target estimated at €10-30 billion/yr

Total health benefits:
€23-82 billion/yr

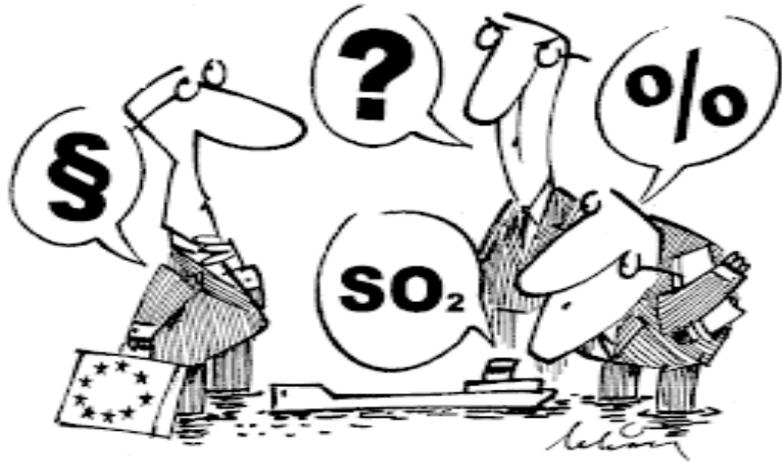
Source: HEAL (2010)



What's needed?

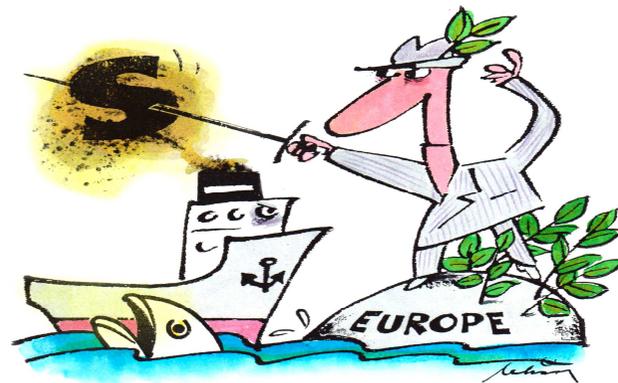
- **Support** – not least from member states – **for a high level of ambition** in EU's air pollution policy:
 - **National Emission Ceilings (NECs) for 2020/25/30 that achieve EU's environmental objectives;**
 - **Air quality standards in line with WHO's recommendations;**
 - **New/strengthened sector legislation to support the NECs;**
 - **Measures to ensure compliance and enforcement.**
- **Action on ships:** EU and member states must take domestic action and push action in the IMO to cut ship emissions.
- **Action on greenhouse gases:** Domestic and international action (in the FCCC) for binding commitments that safeguard a maximum temperature increase of 1.5 degrees.

Measures to cut ship emissions



- Designate all European seas as Emission Control Areas
- Lowered speeds
- Emission standards for PM

- Emission charges or standards to cut NO_x from existing ships
- Improved emissions monitoring and compliance control
- Develop and adopt an EU marine fuels quality directive



Conclusions

- Air pollutant emissions and damage are still much too high.
- Further emission reductions bring **significant benefits** to society.
- The revised EU air pollution policy and NEC directive should aim to achieve **EU's environmental objectives**.
- Ensuring a high level of ambition in the revised NEC directive requires **new and strengthened sectoral measures**, especially for:
 - Agriculture (NH₃, PM/BC, CH₄)
 - International shipping (SO₂, NO_x, PM/BC)
 - Domestic solid-fuel combustion (PM/BC, VOCs)
 - Road and non-road vehicles (NO_x, PM/BC)
 - Medium (1-50 MW) industrial combustion plants (SO₂, NO_x)
 - Solvents in products (VOCs)
- **Climate policy** has great impact on air pollutant (SO₂ and NO_x) emissions. EU must establish and implement faster and more far-reaching **domestic GHG emission reductions**.

More information?

www.airclim.org

Subscribe to
Acid News!

