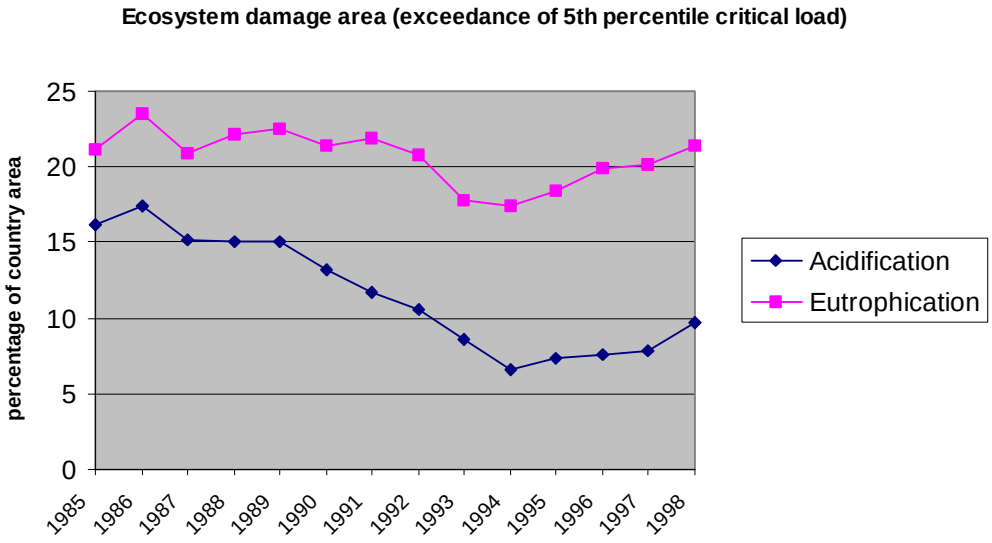
YIR99AP6 Areas exposed to acidification and eutrophication



Title: Ecosystem area potentially damaged by air pollution, EE18

Note: Area with exceedance of 5th percentile critical loads; the percentages of country area are smaller than presented in Environmental Signals 2000 because of a change in methodology, which takes the joint effect of sulphur and nitrogen deposition into account.

Source: EMEP

😐	Increases in the percentage of ecosystems exposed to nitrogen deposition in excess of critical loads since 1990 in several countries have reversed the decreasing trend in the area exposed to acidification and increased the area exposed to eutrophication.

Results and assessment

Relevance of the indicator for describing developments in the environment

Deposition of sulphur and nitrogen compounds contribute to acidification of soils and surface waters and result in leaching of plant nutrition elements and damage to vegetation and water fauna.

Deposition of nitrogen compounds (from nitrogen oxide and ammonia emissions) can lead to eutrophication, resulting in disturbance of natural ecosystems and disappearance of plant species, excessive algal blooms in coastal waters and increased concentrations of nitrate in ground water.

Critical loads have been defined under the CLRTAP as "a quantitative estimate of an exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge." Exceedance of critical loads is a complex function of deposition of various pollutants and soil properties. The area of exceedance of critical loads provides an indication of the ecosystem area in which damage could occur.

The size of ecosystem area exposed to exceedance of critical loads is determined by the sum of all ecosystem areas in grid cells where exceedances occur. Exceedance of critical loads for acidification are calculated by considering both sulphur and nitrogen deposition, while exceedances of the critical load of nutrient nitrogen are independent of sulphur deposition levels.

Policy relevance and policy references

Exceedances of critical loads for the deposition of acidifying substances and ambient air concentration thresholds have been used in the negotiations of the emission reduction protocols for sulphur (1994) and the new multi-pollutant multi-effect protocol on acidification, eutrophication and ground level ozone that was signed in autumn 1999. Exceedances of critical loads is also covered by the Acidification Strategy of the Commission (see AP18).

Assessment

The total EEA area of exceedance of critical loads for acidification has decreased considerably since1985, mainly as a result of reductions in sulphur deposition, which is expected to be reduced further as a result of the second sulphur protocol, the proposed EC National Emission Ceilings Directive and measures required by national legislation.

There has been much less reduction in nitrogen deposition and no reduction in the area of exceedance of critical loads, which has even increased in several countries. In 40 % of the area in EEA countries the percentage of ecosystems exposed to damaging eutrophication effects has increased since 1990. The percentage of ecosystem area exposed to eutrophication in the Netherlands, the United Kingdom, France, Ireland, Italy, Portugal, Spain and Greece increased between 1990 and 1998 (EMEP, 2000). The largest increase, 30 %, was in Greece.

Much of the deposited nitrogen remains immobilised in the soil or taken up by vegetation but with continued deposition this will be mobilised and in the long run contribute further to the processes of acidification and eutrophication.

Data

See AQ_acid_eutr_2000.xls

Meta data

Technical information

1. *Data source*

Data on deposition of sulphur and nitrogen compounds provided by the Meteorological Synthesising Centre West of EMEP (EMEP Report 1/00). Data on accumulated exceedances to critical loads made available by the Co-ordination Centre for Effects (Max Posch, pers. comm., 2000, CCE) of the CLRTAP.

The data is documented in EMEP Report 1/2000 (Tarrason and Schaug (eds.)

2. *Description of data:* original name of data file: TRNEEA_2000.XLS
Original measure units: %.
Original purpose of the data: Exceedances reported to UN-ECE/EMEP (for CLRTAP) EMEP Report 1/2000, Norwegian Meteorological Institute, Oslo, Norway.

3. *Geographical coverage*

EEA18

4. *Temporal coverage*

Annual depositions and calculations of accumulated exceedances to critical loads of acidification and eutrophication 1985 to 1998.

5. *Methodology and frequency of data collection*

Critical loads are calculated by the countries of the CLRTAP, and collected and mapped over Europe by the Co-ordination Centre for Effects. (Posch et al, 1999).

Every year emission data is reported by 31st December by national authorities to UNECE/EMEP. The emission data includes both new estimates of emissions two years in arrears and updated information of emissions from previous years. The emission data is stored and verified at EMEP/MSC-W and the present status is documented in Vestreng and Storen, EMEP/MSC-W Note 1/00. On the basis of these emissions, EMEP/MSC-W carries out new calculations of atmospheric transport of sulphur and nitrogen pollutants, according to actual meteorological conditions. Updated deposition calculations are used as a basis for the calculation of exceedances of critical loads at CCE. Results are presented in the yearly update of the EMEP report on "Transboundary acidification and Eutrophication in Europe" (Tarrason and Schaug (eds) EMEP Report 1/00).

6. *Methodology of data manipulation and evaluation*

The concept of 'accumulated exceedances' has recently been introduced into the EMEP calculations. This is an improvement over last year's calculations for which 'conditional critical loads' were used for reference. In this way, the effect of nitrogen and sulphur deposition together is now considered in the calculations. In the grid cells where exceedances occur, the total area of sensitive ecosystems is registered as a percentage of the total grid cell area. The total area of sensitive ecosystems exposed to exceedances is added for all grid cells in a country and expressed as a percentage of the total country area.

Quality information

7. *Strength and weakness (at data level)*

Strength: officially reported data following comparable procedures. This applies both to critical load data compiled by the CCE and to the emission data compiled by UNECE-EMEP/MSC-W.

Weakness: the approach followed for EU Acidification Strategy, based on the protected ecosystem area, has a major disadvantage when it concerns areas where only few critical load functions are defined. In that case, the ecosystem area protection is difficult to calculate and gives rise to discontinuities that affect the reliability of the approach.

8. *Reliability, accuracy, robustness, uncertainty (at data level)*

The values of the exceedances of critical loads are very dependent on the size of the grid cell used for the calculations. In particular, the area of ecosystem protected can vary considerably depending on the spatial resolution of the grid system. This affects the robustness of the calculations, even though these are of documented accuracy (see references under 1).

9. *Further work required (for data level and indicator level)*

To avoid the discontinuities related to the ecosystem area calculation, the accumulated exceedance concept has been introduced in new political negotiations for the acidification, eutrophication and ground-level ozone protocol. Within a grid cell, exceedances are now multiplied by the respective ecosystem area and summed for all ecosystems in the grid cell. This means that the accuracy of the method depends on the grid size (currently 50x50 km for the deposition). More research is needed to increase the robustness of the calculations.