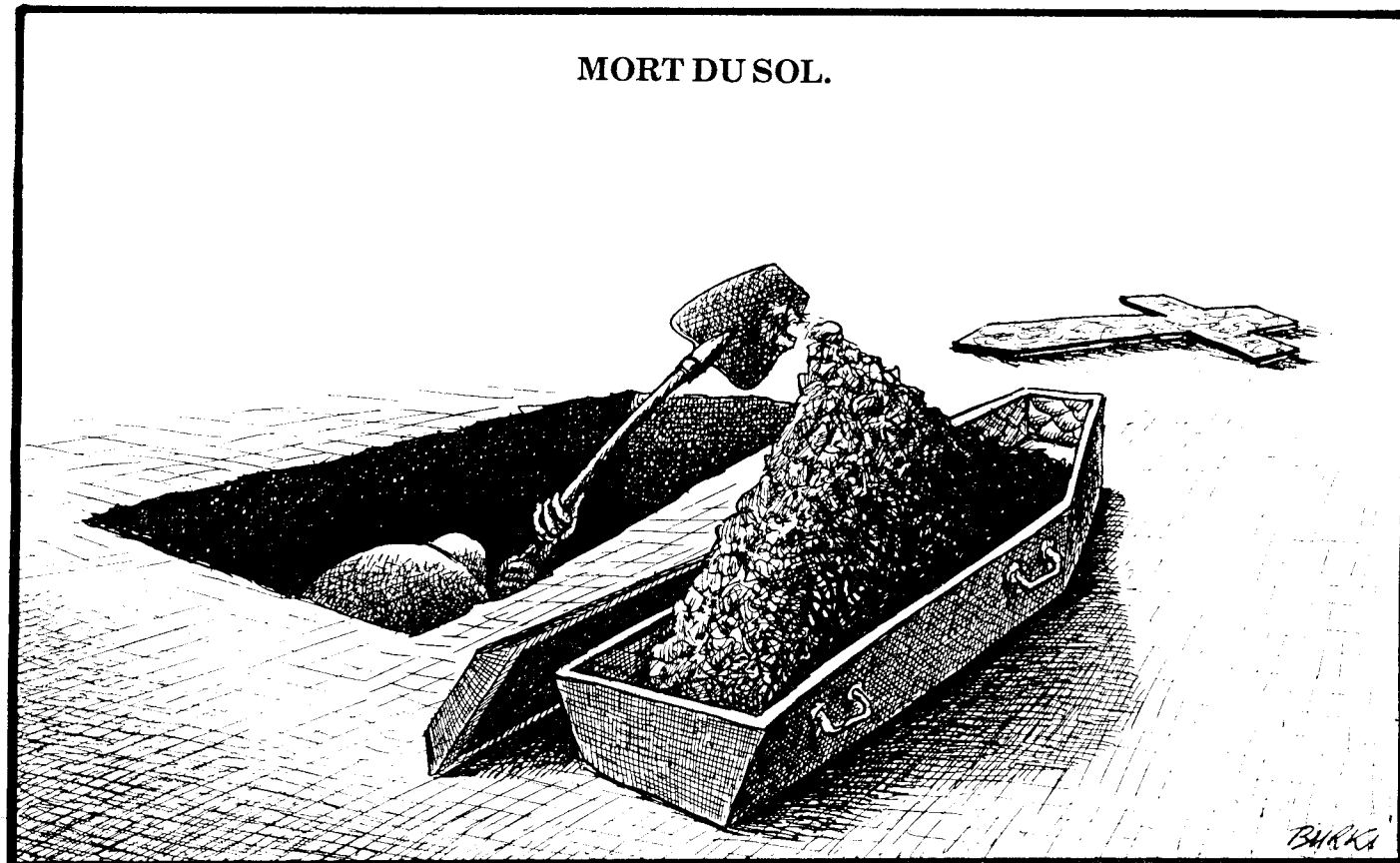


Acid News

NO. 2, MAY 1992

A Newsletter from the Swedish and Norwegian NGO Secretariats on Acid Rain

MORT DU SOL.



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FORESTS

What we stand to lose

ACCORDING TO a recent study,* acidic substances are being deposited in an extent that exceeds the critical load (nature's tolerance) on more than four-fifths of Sweden's total forest area. Failing a marked reduction of the emissions of acidifying airborne pollutants, there will be a great danger of a significant diminishment of forest growth in the parts so affected. The potential loss in harvest value is estimated to run to billions of kronor a year.

For calculating and mapping critical loads, the research team used a method known as "steady state mass balance" (see pp 11-13). A key factor for determining the critical load by this method is the chemical

weathering rate of the soil minerals in any particular location. From a comparison of the critical-load maps with the actual depositions of sulphur and nitrogen compounds in each locality, it can be seen where and to what extent the loads are being exceeded.

Acidification of the soil can affect the trees' growth and vitality in various ways, such as by reducing the availability of nutrients or increasing the concentrations of potentially toxic metals in the soil water. When the supply of base cations in the form of calcium, magnesium, and potassium diminishes, while that of hydrogen ions and aluminium ions increases, the ability of the trees to

take up nutrients becomes lowered.

Through a study of other research reports, a relationship could be seen between the concentrations in the soil water of calcium, magnesium, and potassium on the one hand, and aluminium on the other—that is, the ratio of $\text{Ca}+\text{Mg}+\text{K}/\text{Al}$. There is thought to be no danger of a decline in tree growth as long as the ratio remains greater than 1. Acidification of the soil will however in time reduce the ratio, thus bringing on a risk.

The study also estimated the economic consequences of a decline in forest growth in the light of scenarios assuming various future levels

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Acid News

A newsletter from the Swedish and Norwegian Secretariats on acid rain.

ACID NEWS is a joint publication of the two secretariats, whose aim is to provide information on the subjects of acid rain and the acidification of the environment.

Anyone interested in these problems is invited to contact the secretariats at either of the addresses below. All requests for information or material will be dealt with to the best of our ability.

In order to fulfill the purpose of Acid News, we need information from everywhere – so if you have read or heard about something that might be of general interest, please write or send a copy to:

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THE SECRETARIATS

The Swedish NGO Secretariat on Acid Rain is supported by the following environmental organizations:

- The Environmental Federation (Miljöförbundet)
 - The Swedish Anglers' National Association (Sportfiskarna)
 - The Swedish Society for Nature Conservation (Naturskyddsföreningen)
 - The Swedish Youth Association for Environmental Studies and Conservation (Fältbiologerna)
 - World Wide Fund for Nature Sweden (Världsnaturfonden WWF)
- Address and telephone: see above.

The Norwegian Secretariat, "The Norwegian Clean Air Campaign," is organized by five non-governmental organizations concerned with the environment:

- Nature and Youth (Natur og Ungdom)
- The Norwegian Forestry Society (Det Norske Skogselskap)
- The Norwegian Association of Anglers and Hunters (Norges Jeger- og Fiskeforbund)
- The Norwegian Society for Conservation of Nature (Norges Naturvernforbund)
- The Norwegian Mountain Touring Association (Den Norske Turistforening)

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EDITORIAL

To avoid a misfire

INTERNATIONAL NEGOTIATIONS for reducing emissions of air pollutants proceed from the well-founded assumption that ecosystems can only withstand a certain amount of pollution, beyond which there may be various degrees of adverse effects. In the work that is being carried on under the UN ECE Convention on Long Range Transboundary Air Pollution, this is known as the "critical loads approach," now accepted by all European countries as the principle on which to base agreements for reducing emissions.

Some countries have however lodged reservations in case this principle should prove difficult to carry out in practice, and the first test of its applicability will come up in the course of the next year, when a new agreement for limiting emissions of sulphur dioxide is due to be negotiated. A start will be made at a meeting in Geneva in August, to be followed by two or three more. The aim is to have a draft protocol ready for signing in November 1993.

In the case of sulphur there should be little difficulty in applying the critical loads approach. The connection between emissions and depositions, and between depositions and effects, is well proven. The sensitivity of ecosystems to this form of pollution is relatively easy to determine, and the amounts and sources of emissions have also been accurately documented. There is less certainty, on the other hand, as regards other air pollutants, such as nitrogen compounds, hydrocarbons, and ozone. Failure to apply the critical loads approach in the case of sulphur would mean greatly reduced chances of its being used at all in international agreements for years to come – although it could of course be done by individual countries, as Sweden and the Netherlands have indeed shown.

There are nevertheless a number of difficulties that will have to be surmounted if a sulphur agreement based on the critical loads approach is to be a fact in 1993.

So far only about a third of the signatories to the Convention have produced maps delineating the critical loads for sulphur in their territories. The problem has been tempo-

rarily solved by the ECE mapping centre in the Netherlands making generalized maps of the sensitivity to depositions in those countries that have not developed their own.

A strict interpretation of the critical-loads principle would also mean that deposition – and so emissions of sulphur – would have to be reduced in some areas by more than 90 per cent. In practice however the short-term solution will be to agree on intermediate, so-called target, loads. Consequently the coming protocol will amount to no more than a first step towards the attainment of true critical-load levels.

If emissions are to be reduced in the most cost-effective manner, the greatest reductions ought to be made in central and eastern Europe as well as in Great Britain – that is, in countries that have large emissions and so far have done little by way of abatement. Economic and technical aid will be especially required, in order to expedite the necessary measures, for instance in Poland, Czechoslovakia, and the Baltic States. Finding internationally acceptable instruments for such transfers will however be no easy task.

What is needed is a protocol embodying solid commitments aimed towards the eventual lowering of depositions to critical levels. Also included should be minimum requirements for the use of "best available technologies" in old as well as new installations. There is an evident risk of the new agreement misfiring in the same manner as the NOx protocol of 1988, which more or less entrenched the status quo.

It is therefore highly important for NGOs to keep a close watch on developments, and to try and ensure, by exerting pressure both at the international and national level, that the new sulphur protocol will be a really effective instrument. To this end the Swedish NGO Secretariat on Acid Rain arranged a seminar in Göteborg in the beginning of April, which was attended by the representatives of more than twenty environmentalist organizations both from East and West. There will be a report in our next issue.

CHRISTER ÅGREN



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Continued from front page
for pollutant deposition. The baseline in this case was the net harvest value in 1988 – calculated from the sale of timber to the first purchaser, without any addition for further processing. The final value would be about three times as great.

There are altogether 587,000 sq kilometres of forest in Scandinavia (including Denmark and Norway as well as Sweden and Finland). Of that total 494,000 sq kilometres are classified as productive forest area. In Sweden almost half of the land area is covered by forest, and the country's annual revenue from its exports of forest products alone amounts to something like Skr65 billion.

Even if the depositions of sulphur and nitrogen compounds were to be

stabilized at present (1990) levels, a diminishment of growth might be expected in 80 per cent of Sweden's forest area. The net economic value of the annual harvest that would be at risk, according to this scenario, would be of the order of Skr10 billion, or 1 per cent of the gross national product. For Norway and Finland the corresponding figures would, by way of comparison, be Skr2.3 billion and Skr6 billion respectively, or 0.5 and 1 per cent of the GNP of those countries.

Such losses can only be avoided in the long term through a reduction of the depositions of sulphur compounds by at least 90 per cent from present levels, and those of nitrogen by 50 per cent.

In view of the potentially great losses from acidification, the study

group urges the need to take a risk-assessment approach for forestry in the same way as manufacturing industry does for its process risks. Besides the economic risk, they say, there is also the danger that if we wait too long, acidification may cause irreversible, or almost irreversible, damage – which neither business nor the community at large can afford to let happen.

CHRISTER ÅGREN

***A risk assessment of ecological effects and economic impacts of acidification on forestry in Sweden**, by H. Sverdrup, P. Warfvinge, and B. Nihlgård. Copies of the report can be obtained from H. Sverdrup, Dept. of Chemical Engineering, Lunds Institute of Technology, Box 124, S-221 00 Lund, Sweden. Phone +46-46-108274.

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For sustainable mobility

THE ISSUE OF A GREEN PAPER by the European Commission on February 19 marked the first serious attempt to integrate environmental protection into EC transport policy. Aimed at "sustainable mobility," it is notable for proposals to arrest the seemingly inexorable growth of road traffic.

The intention is to stimulate public debate on how the socio-economic role of transport can be maintained at the same time as its damaging effects on the environment are held in check. The influence of this debate should be seen in a forthcoming White Paper which will set the tone of EC transport policy for some years ahead.

As the Transport Commissioner Karel van Miert noted when launching the Green Paper, a "completely unmanageable" situation will face the Community if present trends in the transport sector are allowed to continue. Transport is now one of the main causes of environmental damage within the Community, the predominant factor being road traffic.

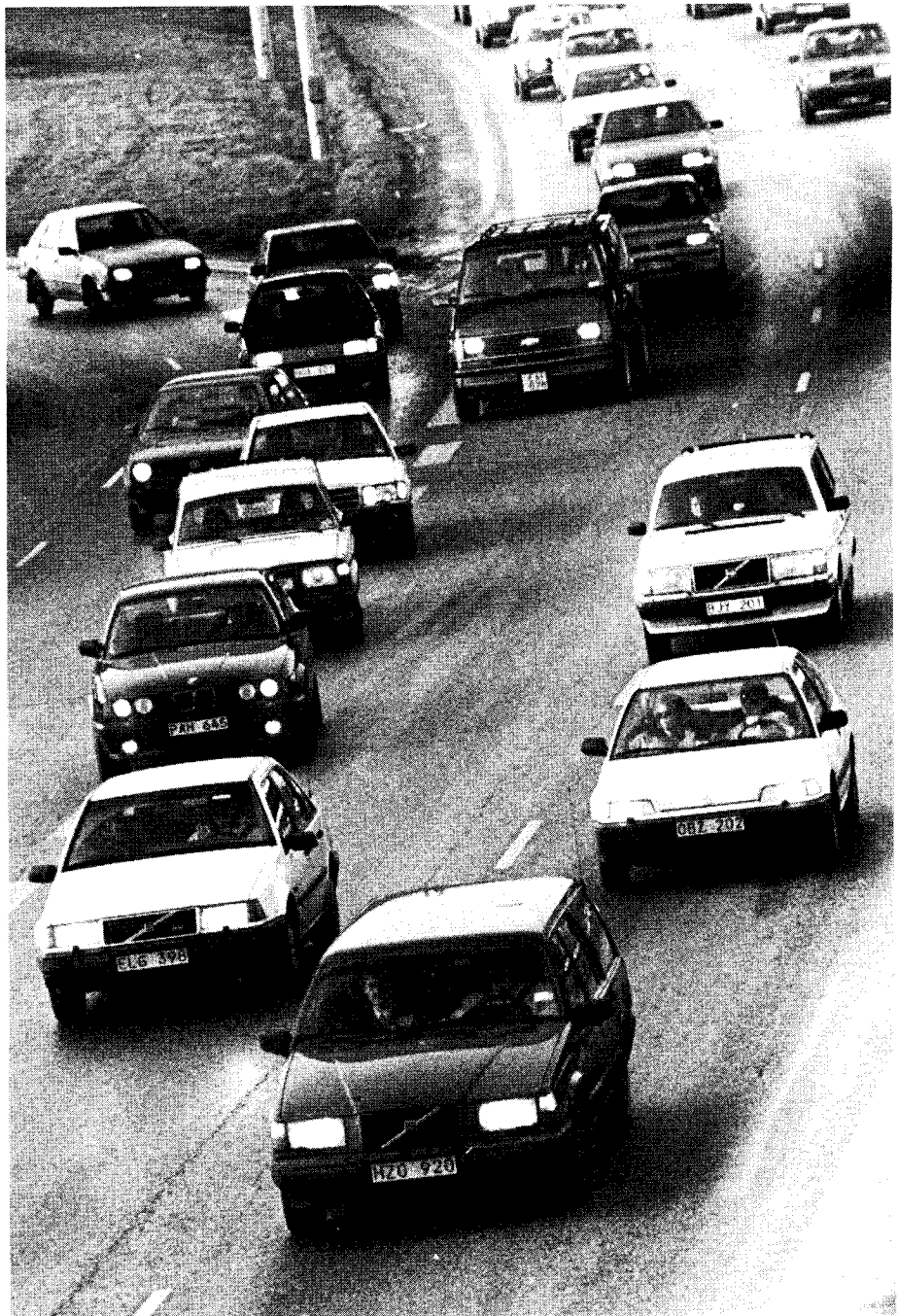
The present situation is outlined in the Green Paper as follows.

ENERGY. The transport sector accounts for almost 30 per cent of the final energy consumption in the Community. Of that total 84.4 per cent is ascribable to road traffic, 11.1 per cent to aircraft, 2.5 per cent to railways, and 2.0 per cent to inland waterway traffic.

CARBON DIOXIDE. In 1986, 577 million tons of CO₂, 22.5 per cent of the EC total, were emitted from transport vehicles. Road traffic was again the chief offender, accounting for 79.7 per cent of the CO₂ emissions from transportation. Of this sub-total, passenger cars were answerable for 55.4 per cent, trucks for 22.7 per cent, aircraft for 10.9 per cent, and rail traffic for 3.9 per cent.

OTHER EMISSIONS. Road transport is a major source of other air pollutants too – contributing 54 per cent of the EC emissions of nitrogen oxides, 27 per cent of those of volatile organic compounds, and 74 per cent of the carbon monoxide.

Among the effects, which are less



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readily quantifiable, are noise, the pollution of soil and water, landscape degradation, ecological damage, and congestion.

Under a business-as-usual scenario, the effects are, according to the Green Paper, bound to increase. Road carrying, which increased its share of the freight market from 56 per cent in 1970 to 73 per cent in 1988, is expected to have grown by 42 per cent by the year 2010. Between 1987 and 2010 the stock of

passenger cars is projected to increase from 115 to 167 million, and the total car mileage by 25 per cent (as from 1990). And a rise of 74 per cent is predicted for air travel.

If these trends should continue, the damage could not, according to the Green Paper, be averted with existing Community laws. Even if they were supplemented by the "best available technology," as well as by the strictest possible environmental standards for noise and gas-

eous emissions, fuel efficiency, fuel quality and alternative fuels, combined with measures to enforce implementation, any gains achieved could easily be offset, in a business-as-usual scenario, by the ensuing

*Completely unmanageable
situation if present
trends should continue*

growth in traffic and increased congestion.

The EC Commission nevertheless emphasizes that the existing Community program for technical standard-setting must be kept up and expanded. The reduction of pollution will, it says, require "stricter gaseous emission standards for all fuel types, for motor vehicles (cars, commercial vehicles, buses and coaches), motorcycles, aircraft, ships and barges, stricter noise emissions standards for motor vehicles, motorcycles, trains and aircraft, stricter standards for fuel quality and bio-fuels, stricter energy efficiency requirements for motor engines, aircraft engines, motorcycle engines, ship and barge engines, as well as noise design re-

quirements for roads, railways and runways."

While laying down broad principles for future EC transport policy, the paper does not set out in detail how the various elements should fit together, nor does it examine the crucial question as to whether initiatives should be promoted at the Community rather than at the national or local level.

In general, it is presupposed that transport policy should encourage the more environmental-friendly modes – in particular through economic and fiscal instruments to influence consumers choice in favour of cleaner technologies and modes of transportation.

"In order to reinforce these initiatives," the Green Paper concludes, "public and private investment should be guided towards collective transport, whereas urban, industrial and commercial as well as regional development should be geared towards reducing the need for mobility." Prior assessment of the environmental effects of transport policies and plans is said to be another task for the future.

Adapted from *Ends Report 205*, February 1992. The title of the paper is **Green Paper on the impact of transport on the environment: A Community strategy for "sustainable mobility."**

EMISSIONS

Targets to apply to all sources

IN A DRAFT for a fifth EC Environment Action Programme, the European Commission has proposed emission targets for sulphur and nitrogen oxides. These would apply to all emissions sources.

NO_x. A stabilization of emissions at 1990 levels by 1994, followed by a 30 per cent reduction by 2000.

SO₂. A 35 per cent reduction in emissions by 2000, taking the figures for 1985 as the baseline.

It seems likely that the targets will not apply to each Member State, but will be overall Community targets that will be apportioned among the members. Hitherto the targets have only been for existing large combustion plants. According to a

directive adopted in 1988, the emissions of sulphur and nitrogen oxides from such plants were to be reduced by 42 and 30 per cent respectively by 1998, as from 1980. A further reduction of 58 per cent by 2003 was required for sulphur.

The proposed targets for greenhouse gases would be: Stabilization of carbon dioxide emissions at 1990 levels by the year 2000, reducing them by 10 per cent by 2005, and by 20 per cent by 2010. Halon gas is destined to disappear by the year 2000.

Sources: **ENDS Report 205**, February 1992, **Europe Environment**, January 21, 1992

Recent publications

Impact of Fuels on Diesel Exhaust Emissions (1991)

Edited by Roger Westerholm and Karl-Erik Egeback.

Report on an investigation of the emissions from eight types of diesel fuel with differing contents of sulphur and aromatics. The aim was to find a "benign" diesel fuel that would be suitable for use in urban areas. The fuels were subjected both to chemical analysis and biological testing. A quantifiable relationship was confirmed between the composition of the fuel, its emissions and their biological effects.

Report 3968. 158 pp. Can be obtained from the Swedish Environmental Protection Agency, Information Department, S-171 85 Solna, Sweden.

Cities and new technologies (1992)

The rapid development of information technology is likely to have an effect on infrastructures. Less need of transportation may for instance be the result of more work being done at home through the use of computers. This report, published as a part of the OECD urban program, summarizes the proceedings of an international conference on the subject of cities and new technologies. More than thirty experts from the OECD member countries have contributed to the study.

Price US\$80. 290 pp. Available from OECD Publications, 2 rue André Pascal, F-75775 Paris cedex 16, France.

Energy taxation and environmental policy in EFTA countries (1991)

Economic and fiscal instruments are being increasingly used to achieve cost effective implementation of environmental policies. This report summarizes the experiences of energy taxation in the EFTA countries. It also discusses such taxation in respect to international trade and the need for international cooperation.

May be obtained from the Press and Information Service of the EFTA Secretariat, rue de Varembe 9-11, CH 1211 Geneva 20, Switzerland.

Växthusgaserna – utsläpp och åtgärder i ett internationellt perspektiv (1991)

Tables and text setting forth Sweden's present emissions of greenhouse gases and likely future developments, with a more summary treatment of counter-measures and international trends.

Report 4011. 200 pp. Swedish only. Available from the Swedish Environmental Protection Agency, Information Department, S-171 85 Solna, Sweden.

California to have cleaner petrol

A LAW PASSED LAST NOVEMBER in California will lead to petrol that is 30 per cent cleaner and will cost 12-17 cents more per gallon (3-4.5 cents per litre) than the present lead-free types. It will come into force in March, 1996.

Refinery conversion for production of the new fuel is estimated to cost the oil companies between \$2 and \$5bn and take about four years. Two companies, ARCO and Ultramar, were in favour of the new requirements as being the most cost-effective way of combating smog. The former already has a reformed product that meets them and can probably be put on sale towards the end of 1995. It will cost 16 cents more per gallon.

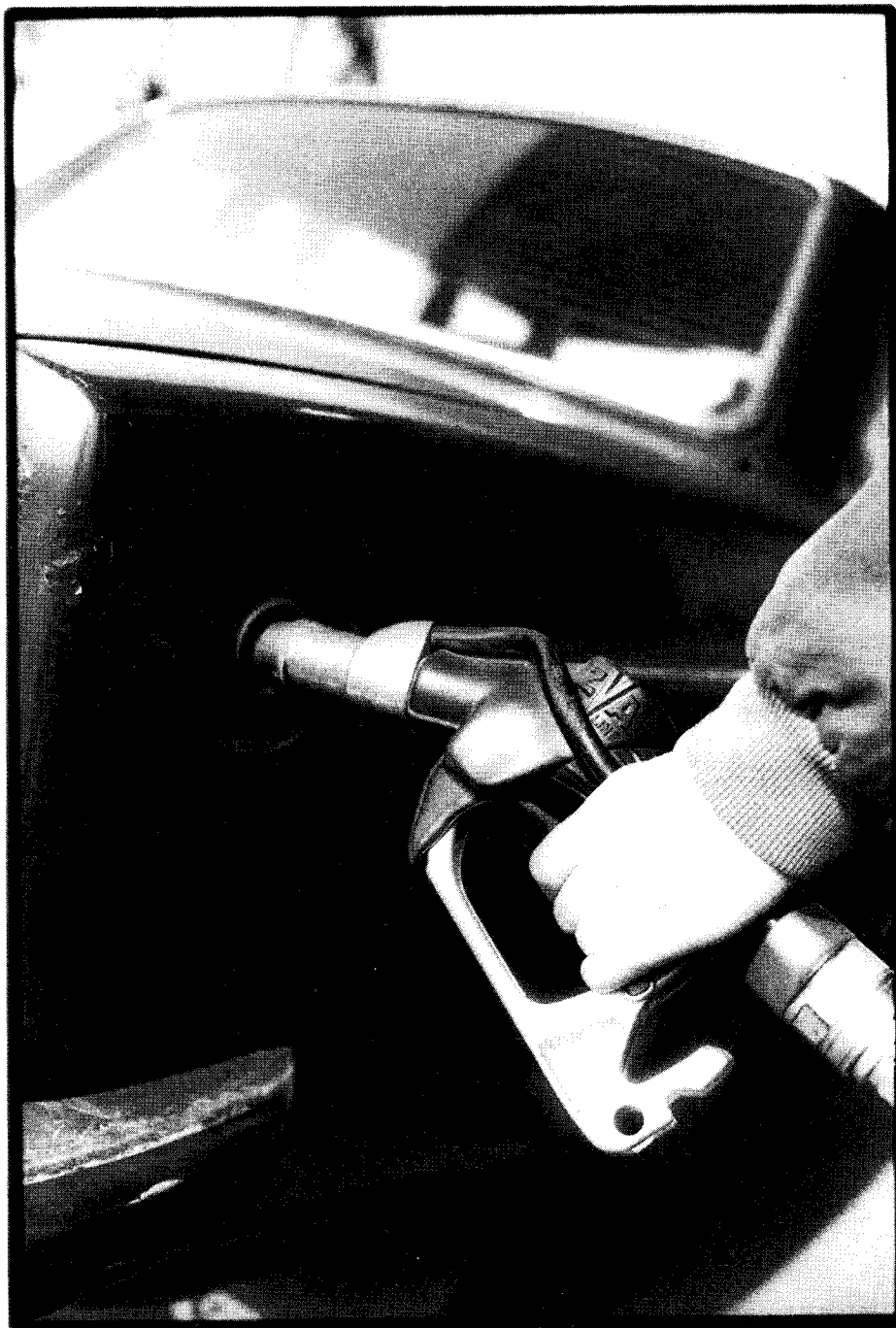
Some of the other big oil companies, such as Unocal and Texaco, would have preferred to achieve cleaner air by buying up and scrapping old cars without catalytic converters, thus forcing the owners either to buy new ones or use public transportation. The scheme would be financed by a tax on petrol of 15 cents per gallon. Smaller companies objected to the new law on the grounds that it would force them into bankruptcy, leaving the field to their bigger competitors.

The new law will require reforming of the fuel so as to reduce the proportion of olefins by 50 per cent, that of aromatic hydrocarbons by 25 per cent, sulphur by 80 per cent and benzene by 50 per cent. The effect is calculated to be a reduction of emissions by 1302 tons per day for California as a whole, with half that figure applying to the Los Angeles area.

The overall result should be a 5-per-cent reduction of air pollutants, which in turn would mean a fall in potential cancer cases of 35 per year from 1996 to 2010.

Half of all the smog-forming substances emitted in California come from vehicle exhausts.

Source: **L.A. Times**, November 23, 1991



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Britain lagging

BREACHES of the European air quality standards for nitrogen dioxide have been revealed in the United Kingdom through a survey carried out by Friends of the Earth for the BBC R4 Today program.

The survey shows that the EC limits for NO₂ were exceeded at four sites in the capital and one in Birmingham. It showed too that sites in Manchester and Cardiff "must be at risk of breaching the (EC) Directive" and that some in Sheffield, Glasgow, Bristol, Farnham, and Bradford "need careful scrutiny." Levels below the EC guideline values were

only recorded at six of the twenty sites that were monitored.

In summing up, Fiona Weir, air pollution campaigner for Friends of the Earth in Britain, stated: "Our survey shows that air quality in parts of Britain is very poor. Official testing stations don't give the public a full and accurate picture of pollution levels in cities because the government's monitoring network is pitifully inadequate."

The results of the survey have been sent to the European Commission in support of a previous complaint by Friends of the Earth. □

Avoiding cold starts

STARTING A CAR FROM COLD usually entails burning a great deal of fuel and emitting a lot of pollutants. It is clearly better for the environment, if it is only a matter of travelling a short distance, either to cycle or to walk. If the car must be taken, it is best to get the engine warm as quickly as possible.

By using a heater, the engine can be brought more quickly to running temperature, with a lower consumption of fuel, less wear on moving parts, and reduced emission of pollutants as a result. Properly used, a heater saves more energy than it consumes.

The temperature is especially important if the car is equipped with a catalytic converter. A warm catalyzer reduces the emissions of carbon monoxide (CO), volatile organic compounds (VOCs), and nitrogen oxides (NO_x) by 90 per cent. If the engine is cold, however, it takes a couple of minutes for the catalyzer to reach proper working temperature, and the same amounts of VOCs and CO are emitted as from a non-catalyzer car. According to Skandia insurance company, 90 per cent of an average catalyzer car's emissions of CO and VOCs come from cold start-

ing, as do 50-70 per cent of the NO_x emissions.

A means of coming to grips with the problem has recently been announced by the Ford motor company. Styled *exhaust gas ignition*, it involves feeding the engine at the moment of starting with an extra-rich fuel mixture, followed by after-burning of the hydrocarbon-rich exhaust gas with an addition of oxygen just before the catalyzer. The latter then gets warmed up in a matter of seconds, thus reducing the emissions of CO and VOCs by 80 per cent during the first few minutes of driving.

For its part the Saab company is developing an accumulator that utilizes heat from the engine. The device contains salt crystals which melt when heated, thus storing a considerable amount of energy. The next time the car is started, the cooling water and engine oil, as well as the interior, are warmed up by means of a heat exchanger. The accumulator is said to retain full effect for three days even when the car is standing still. The method is claimed to result in a reduction of emissions by 50 to 80 per cent during the first few minutes of driving.

PER ELVINGSON

Another car-free city

AMSTERDAM appears set to be the first capital in Europe without private cars in the city centre. In a referendum on March 25, 52.9 per cent voted in favour of excluding cars, as against 45.6 per cent who wanted still to allow them. There was in any case a majority in the Amsterdam city council ready to support the idea of car-free streets, which has been under debate for the last two years.

Several years will however be needed to clear the city centre entirely of cars. There are now some 180,000 car owners in Amsterdam, and a further 130,000 cars come in daily from outside, bringing people to work or shop. The resulting congestion has, in the words of a city

official, been "verging on the intolerable."

The idea is now to revive canal traffic as the basic mode of public transportation, leaving the streets free for pedestrians as well as the numerous cyclists, whose numbers will doubtless increase still further. Motorists will be accommodated by large parking lots in the outskirts.

Opposition has come mainly from shopkeepers, who feared a loss of business if cars were excluded from the city centre. In places where this has already been done, such as Zurich and Bologna, experience has however shown that after an initial setback, trade returns to normal when people have become accustomed to the new ways of getting about. □

Surprising emissions revealed

IN SWEDEN during the last twenty years the number of pleasure craft has about doubled, and engines have become ever more powerful. There are now almost 800,000 powered pleasure boats in the country, which together emit 14,400 tons of VOCs every year – in other words, 90 per cent of the VOC emissions from all types of vessel, large and small, plying in Swedish waters.

The greater part of the emissions of VOCs, carbon monoxide, and particulates comes from petrol-driven two-stroke engines, usually of the outboard type. On account of the low combustion temperature in these engines, they only emit small quantities of nitrogen oxides.

Fishing boats and other utility craft, on the other hand, which are usually diesel-driven, emit relatively large amounts of NO_x – although the greater part of all such emissions from shipping comes from ferries and merchant vessels (ships larger than 300 gross tons).

These facts came to light after a survey had been conducted by the national Shipping Administration in collaboration with the Environmental Protection Agency. The revelation of the size of the of VOC emissions came as a surprise to the Shipping Administration, which is now proposing that there should be emission limits both for pleasure and work boats, similar to those to be introduced in California in 1994. Meeting such requirements will require oxidizing catalyzers, which greatly reduce emissions of VOCs and carbon monoxide. The Administration also points to the need for a general switch to cleaner fuels.

The Scandinavian countries are now aiming to set up common standards for emissions of air pollutants from pleasure craft and other small boats.

PER ELVINGSON

Environmental effects of pleasure craft, fishing boats and other small utility vessels. In Swedish only. The Environmental Protection Agency 1992. Rapport 3993.

Convention in doldrums

NEGOTIATIONS for a Convention on Climate Change are now approaching a final stage. At the latest, the 5th session of the Intergovernmental Negotiating Committee in New York in February, no agreement could be reached because of the unwillingness of the United States to join the other OECD countries in calling for a stabilization of CO₂ emissions by 2000. Mainly on account of US opposition, OECD countries have still not arrived at any collective agreement to commit additional financial aid to developing countries for action on climate change.

At the 4th INC session in December 1991 a first draft of the Climate Convention relating to "commitments" was formally circulated to the negotiators. The draft put forward six "principles": Sustainable Development, Precautionary Principle, Equity and Common but Differentiated Responsibility, Right to Development, Polluter Pays Principle, and Special Circumstances.

The section on "Specific Commitments for Stabilization and Reduction of Emissions" mainly consisted of text in square brackets (meaning that no agreement has been reached on the issue).

During the 5th session in New York a text had been prepared for the OECD containing specific commitments, but the US opposed these too. It only went as far as to announce making US\$50m available for developing countries to study and assess their own national emissions of greenhouse gases.

Because of this slow progress, the INC is to have an extraordinary final and 6th session in New York from April 30 to May 8. This meeting is seen as absolutely the last chance to agree on "specific commitments."

Environmentalist NGOs are closely watching the INC negotiations and are publishing a daily newsletter, *Eco*, during the sessions, which is criticising the negotiations from an NGO perspective.

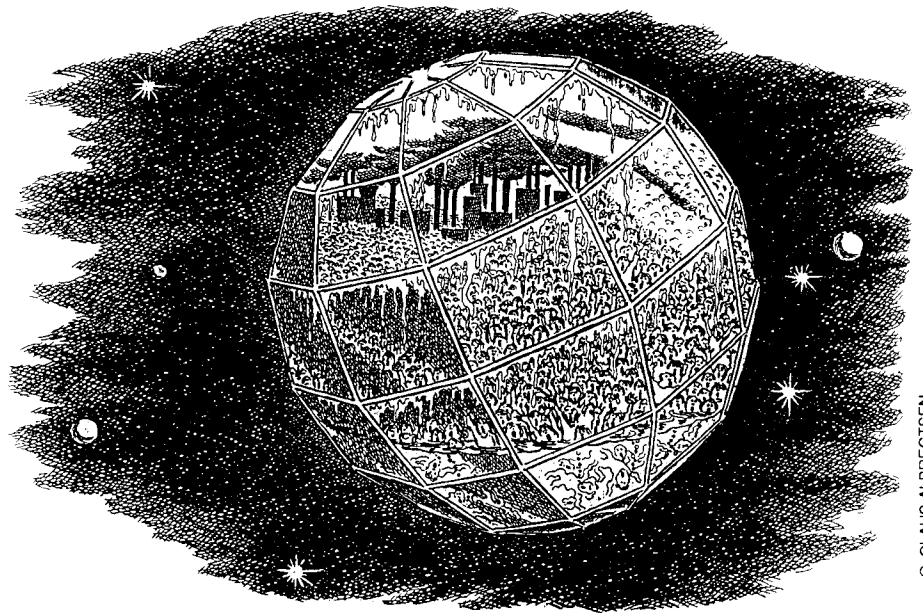
Eco commented: "After two weeks of discussion, the convention text is hardly in better state than at the

start of the session. If the final document contained only the text that is not now in brackets, one wonders whether it would be possible to discern the subject of the convention."

All around the world NGOs have been organizing, by way of a last

effort, protests and actions, as they did on Earth Day, April 22, and will be doing during European Traffic Action Day, May 15, calling on the OECD countries to finally act.

REINHOLD PAPE



New findings confirm scientists' warnings

THE MOST RECENT report of the United Nations Intergovernmental Panel on Climate Change (IPCC) confirms earlier estimates that the Earth's temperature will rise 1.5 to 4.5°C if the concentrations of CO₂ are doubled. The report, which updates the panel's authoritative 1990 Scientific Assessment, was adopted at a meeting last January in Guangzhou, China. Delegates to the climate-treaty negotiations were briefed on the latest results.

Among the new findings were:

□ Global warming observed in the late 1980s has continued into the present decade.

□ Sulphates from fossil-fuel emissions may be masking a significant part of the greenhouse warming in the northern hemisphere. As sulphur dioxide emissions are reduced, an accelerated warming is expected.

□ Ozone depletion in the stratosphere may also have a masking effect. Taking the sulphate and ozone-depletion effects into account improves the agreement between ob-

servations and model-predicted global warming during the last century.

- Significant advances have been made in the development of coupled ocean-atmosphere General Circulation Models which may lead to improved estimates of future changes in climate variability.

- The buildup of methane has slowed, but the atmosphere lifetime of that gas is longer than previously believed.

Dr Michael Oppenheimer, senior scientist with the Environmental Defense Fund, commented, "These findings underscore the wisdom of the governments of almost all of the world's industrial nations in pressing for limits on carbon-dioxide emissions, the major cause of greenhouse warming. The US government stands alone in ignoring the scientific message."

New greenhouse-gas emission scenarios were developed for the science update, reflecting the London Amendments to the Montreal Protocol and recent developments in Eastern Europe and the former Soviet Union. Industry lobbyists made a concerted effort to challenge the scenario assumptions and pressured US delegates into proposing multiple scenarios to replace the 1990 Business-As-Usual scenario (BAU). The six "Reference" scenarios in the 1992 Update span a wide range of possibilities, but the two central cases, IRS 92 a and IRS 92 b, are very similar to the 1990 BAU scenario.

It is obvious to anyone who looks at these scenarios that the central cases represent the most likely business-as-usual path. It is ironic to suddenly have the coal industry telling us that their output may not grow, even without a treaty. If that is the case they shouldn't oppose emission limits. Despite coal-industry attempts to create a smoke screen, the international scientific community has once again made it clear that cuts in emissions of carbon dioxide and other greenhouse gases are urgently needed if unprecedented global warming is to be avoided.

DANIEL LASHOF

Natural Resources Defence Council. Article in **Eco**, February 1992.

More effort needed against warming

IN FEBRUARY the Chairman of the Intergovernmental Panel on Climate Change (IPCC), Professor Bert Bolin, presented the 1992 IPCC Supplement to delegates at the climate change negotiations in New York.

Professor Bolin drew the delegates attention to the IPCC's conclusion that the commitments by many OECD countries to stabilize CO₂ emissions would only result in a 4 to 6-per-cent reduction in future in-

Findings of research since 1990 do not affect understanding of greenhouse effect

creases of atmospheric carbon dioxide relative to a baseline scenario. In an apparent reference to the United States and perhaps Australia, he commented that "I am worried that even a very modest achievement to reduce the rate of increase of carbon dioxide in the atmosphere as aimed for by some OECD countries might be compromised by special allowance amongst those countries." In a warning to all delegations he added: "The scenarios show that more far reaching efforts are required than are now being contemplated, in order to achieve a major reduction of the rate of carbon dioxide increase in the atmosphere."

He also stressed that the IPCC had carefully considered and rejected the objections of some scientists to the 1990 Scientific Assessment. The IPCC concluded that "the findings of scientific research since 1990 do not affect our fundamental understanding of the science of the greenhouse effect." A few scientists, such as Dr Richard Lindzen, had argued that reductions in the water-vapour content of the upper atmosphere would prevent significant warming

from increased greenhouse-gas concentrations. Professor Bolin noted that model studies and observations both contradict this hypothesis.

He then discussed the role of ozone depletion and sulphur emissions in masking some of the warming expected from greenhouse-gas increases. Taking these findings into account gives, he said, "added confidence in the IPCC-assessed sensitivity of the climate system to increasing atmospheric concentrations of greenhouse gases." The IPCC reiterated its conclusion that the sensitivity of global mean surface temperature to a doubling of carbon dioxide is unlikely to lie outside the range of 1.5 to 4.5°C.

Professor Bolin also noted:

- The anomalously high global mean temperatures of the late 1980s have continued into 1990 and 1991, which are the warmest years on record.

- Small low-lying island states and large populations living in low-lying coastal areas will be increasingly vulnerable to the combination of sea level rise, storm surges, and coastal flooding.

- New analyses support the IPCC 1990 conclusion that the impacts of climate change on forests could have significant socio-economic consequences.

- Energy conservation and improved efficiency in the production, conversion, distribution and end-use of energy is one of the most effective options available now and in the future.

- Reducing global anthropogenic methane emissions by 15-20 per cent can slow a rise in its atmospheric concentration and halt it. Important options for reducing methane emissions from anthropogenic sources have been identified and they are potentially powerful.

DANIEL LASHOF

Natural Resources Defence Council. Article in **Eco**, February 1992.



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ENERGY

Better ways proposed

THE EUROPEAN Energy Charter that was signed at the Hague last December could – according to Greenpeace – “be a prescription for a climate disaster.” In the letter to M Jean Ripert, chairman of the Intergovernmental Negotiating Committee (INC) for a Framework Convention on Climate Change, Greenpeace expressed “deep concern” that the Energy Charter, which was signed by more than thirty countries, implied that “giant reserves of oil and gas in the Russian Republic could be tapped on a business-as-usual basis.” This and other measures, said Paul Hohnen from Greenpeace International, mean that the Charter runs directly counter to the objectives of the Second World Climate Conference (SWCC) agreed last year by 137 countries, and is “entirely inconsistent with the climate protection objectives of the Framework Convention.”

The Charter, drawn up with the help of the European Commission's Energy Directorate, will be a non-binding political declaration backed by EC, EFTA, Japan, US, Canada, and the former COMECON countries. It will be followed by legally binding protocols, most of which seem set to promote trade in energy and its con-

sumption rather than efficiency and renewable energy.

Greenpeace notes that scientists of the Intergovernmental Panel on Climate Change have stated that a 60-per-cent cut in global CO₂ emissions will be necessary to stabilize present atmospheric concentrations. Hence, it says, a business-as-usual approach, which implies increases in the use of fossil fuels and the emissions of CO₂, is “environmentally irresponsible.”

Greenpeace has also released a document revealing how, during the negotiation of the Convention, and in opposition to all other OECD countries, the US and Japan had blocked a key move to include the costs of the environmental damage, caused by energy generation, in energy prices.

Greenpeace furthermore has launched details of its proposal to create a new international agency, dedicated to the promotion of Technologies for Renewable Energy and Efficiency (TREES). This, said Hohnen, would be “the single most decisive act to implement the SWCC and other Ministerial calls for greenhouse gas reductions,” involving “a high profile political decision to give a long overdue boost to energy efficiency and to renewable

sources of energy at a global level.”

In a detailed 16-page document distributed to delegates from more than 100 countries at the Geneva climate talks, Greenpeace says that TREES could meet energy demands, particularly in developing countries, while cost-effectively reducing emissions of greenhouse gases.

In an earlier submission to the INC, Greenpeace had proposed Convention Protocols establishing targets for a 3-per-cent annual increase in national energy efficiency and a 5-per-cent annual increase in renewables capacity. It pinpointed twelve potential functions for the agency, ranging from assistance to countries in meeting climate-policy targets to help in identifying reserves of potential renewable supply within countries.

Greenpeace points out that nuclear energy, “providing less than 5 per cent of total global energy requirements, has its own international agencies, and fossil fuels are promoted through other intergovernmental bodies. TREES are the ‘Cinderellas’ offering scope for development of clean new industries on a global basis.”

From **Eco**, December 1991.

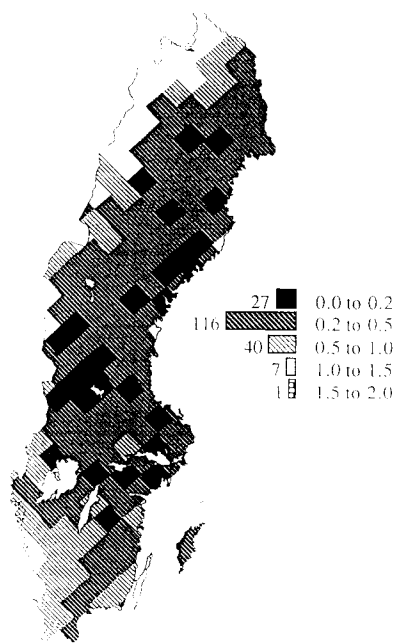
Getting a forward look

THE PRESENT international agreement for reducing emissions of sulphur dioxide only goes as far as 1993. In other words it is high time to start seriously negotiating fresh commitments for reductions within the framework of the ECE Convention on Long Range Transboundary Air Pollution. This time we have the advantage of computer models which enable us to see beyond the present into the future. It will thus be possible, for instance, to gauge roughly the effects of various strategies for curbing acidification.

Researchers all over Europe have lately been engaged in mapping the sensitivity of various ecosystems to acidic depositions. To the preliminary maps that they have developed has been added data on actual depositions. From such a combination it appears that ecosystems almost everywhere are being subjected to a greater amount of acidic fallout than they can tolerate (see *Acid News* 1/92, pp 12-13). By using computer models, estimates can also be made regarding the future state of the soil in the light of various assumptions as to the extent of the acid depositions. It will thus be possible to show the effect of any program for abatement in a readily comprehensive manner.

As a rule a so-called "steady state mass balance model" is used for constructing the maps. This enables the input of acidity to a selected ecosystem (say, through the deposition of acidifying air pollutants) to be set against the neutralizing processes within that system. One can then determine the maximum addition of acid that the system can neutralize without risk to the particular receptor that has been chosen. In the case of forest soil, that will usually be the trees that are growing on it. For surface water (lakes and streams) it may be some species of fish that is sensitive to acidity, while for groundwater the touchstone is likely to be the quality in terms of drinking water.

It is thus the ecosystem that has to be picked out in the first place, and then a suitable indicator organism, such as trees generally, or cer-



Critical loads for acidity (keq/ha/yr) for forest ecosystems, giving protection to 95 per cent of the forest resource (5-percentile).

tain selected species. The critical limits for the indicator must also be known, as regards for instance pH, alkalinity, base saturation, and concentration of aluminium ions.

The next step is to estimate the amount of acid that can flow in without causing the critical (tolerance) limits of the indicator organism to be exceeded. The acidifying effect will come from the accretion of biomass (the net effect of extraction) and the nitrification of ammonia as well as from atmospheric deposi-

tion. The weathering of the soil minerals constitutes the chief neutralizing process, although in some areas the deposition of alkaline substances may also have a considerable effect. Steady state occurs when the acidifying and neutralizing processes balance each other, as shown in principle in Figure 1.

If inputs of acidifying substances are so great as to upset the balance according to Figure 1, it will mean that the limit for critical load has been passed. It should be noted here that in the case of intensively managed forests the acidification from biological causes may be so great that there can be no allowance for inputs from atmospheric deposition. A great advantage of the steady-state model is that the mapping of critical loads can be combined with any conceivable figure for deposition. Whatever amount of deposition may be selected, the steady state can be calculated both backwards and forwards in time. The data required for calculating the various elements of the equation can be seen from the factfile.

In the European Monitoring and Evaluation Programme, the acidic depositions are mapped on a grid with 150x150-kilometre squares (see *Acid News* 4/91, pp 10-11). While that size of square is considered well adapted for atmospheric modelling, it is altogether too large for mapping critical loads. Even over short distances the variations in soil characteristics can be very great. If all types of soil appear

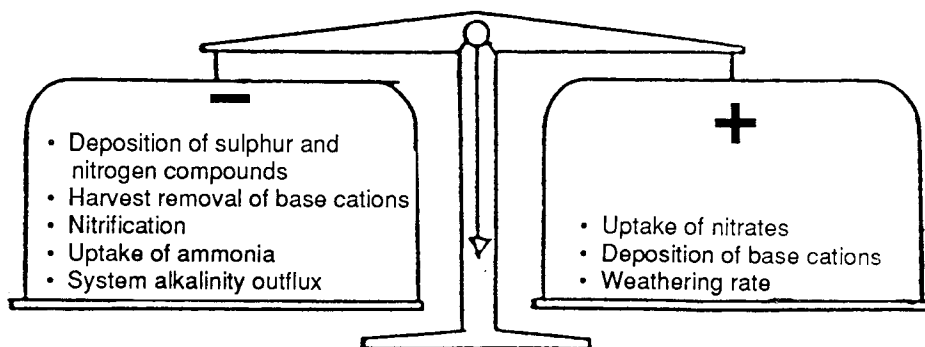
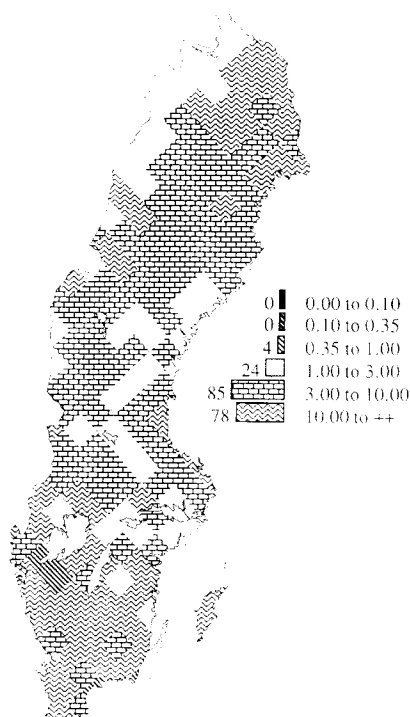


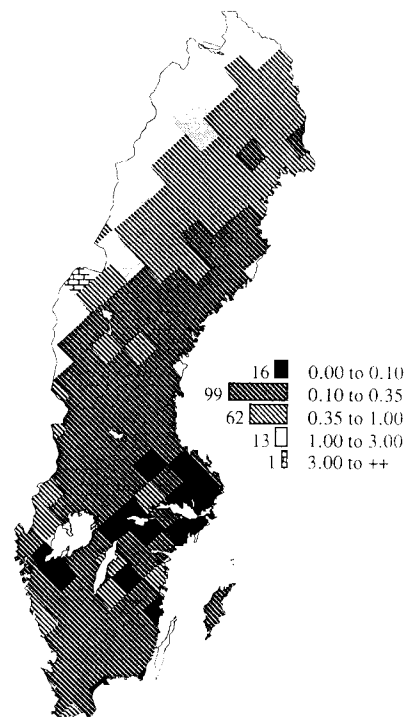
Figure 1. Principle for calculating critical loads according to the mass-balance method. Steady state occurs when acidifying processes (left) and the neutralizing ones (right) balance each other.

in the data applying to a certain square, it may well turn out that there will be at least one sampling point where there is a great sensitivity to acidification. A strict application of the critical-load concept, aimed at protecting the most sensitive parts of the ecosystem, would mean classifying the whole square according to the sensitivity at that point. The usual criterion for critical loads under the ECE Convention is however that "specified sensitive elements of the environment" are to be protected from "significant harmful effects." For that reason, amongst others, as well as to avoid having maps with a completely uniform colour, the practice is to leave out a certain fraction of those sampling points where the sensitivity is greatest.

The fraction so left out is expressed as a percentage. Thus a 5-percentile map will show the sensitivity to acidification for each square after elimination of the most sensitive 5 per cent of the sampling points. A 1-percentile map would only omit 1 per cent, while only half of the squares' sampling points would be represented in a 50-percentile one. The effect of the choice of percentile on classification for sensitivity will depend on how great the soil variations are in the square in question. It would be well to note however that although the fraction chosen for elimination only represents a very small area in each square, that area may house a



Steady-state soil solution, showing the ratio between base cations (Ca+Mg+K) and aluminium ions (Al) in Swedish forest soils at a depth of 30-50 cm in 1840 (5-percentile).



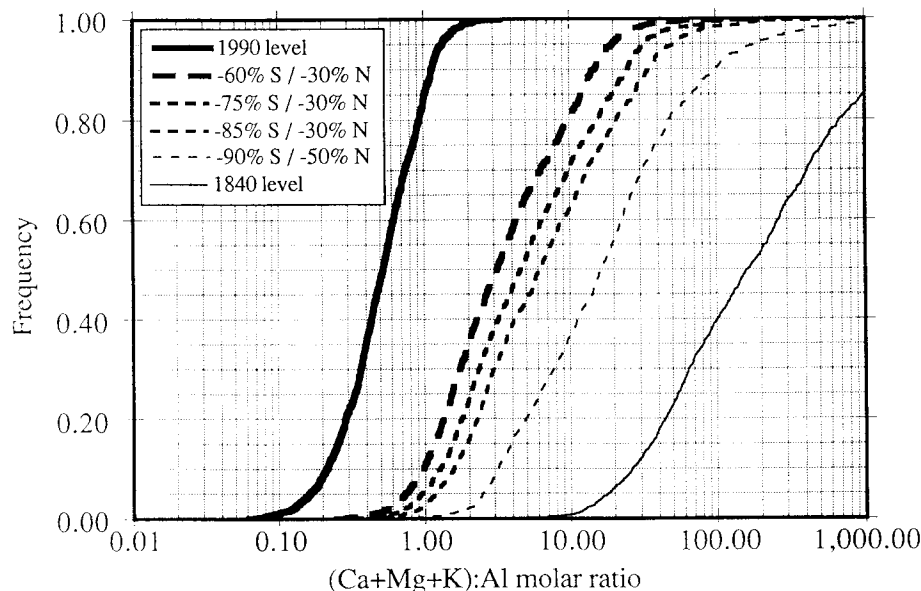
Steady-state soil solution, showing the ratio between base cations and aluminium ions in Swedish forest soils at a depth of 30-50 cm in 2020, assuming continued constant acid deposition at the 1990 level (5-percentile).

unique ecosystem, which could be condemned to extinction if the process of soil acidification were to be allowed to continue. It is therefore important, for the sake of biological diversity, to ensure that the maps that are presented – and will later be used to base decisions for action –

should also take account of the most sensitive ecosystems.

As an example of the utility of mapping, we may take the state of forest land in Sweden – yesterday, today and tomorrow. Here the maps are generally of the 5-percentile type. The calculations, carried out with the PROFILE steady-state model, are based on the sensitivity of the trees to soil acidification. One effect of such acidification is a reduction by leaching of the availability of important mineral nutrients, the so-called base cations (Ca^{2+} , Mg^{2+} , K^{+}), with an accompanying entering into solution of toxic aluminium ions. It has been concluded from a number of studies that the critical limit, beyond which damage starts to appear in the trees, is reached when the ratio between base cations and aluminium ions is less than 1. The maps show clearly that a great reduction will be required in order to bring emissions down to levels where soil acidification will no longer continue with unremitting force.

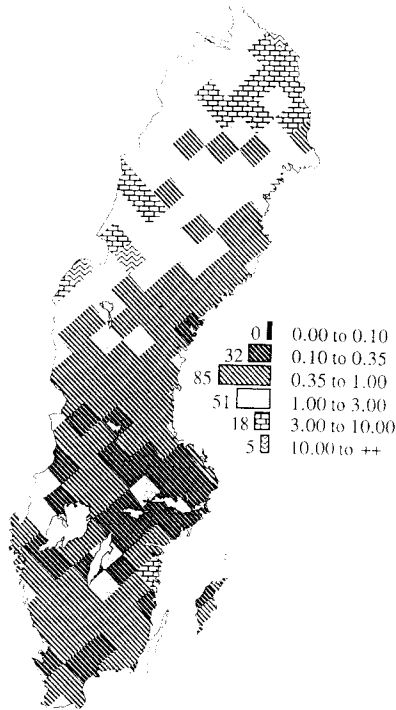
Finally it may be noted that the maps that purport to show the tolerance of ecosystems to acid deposi-



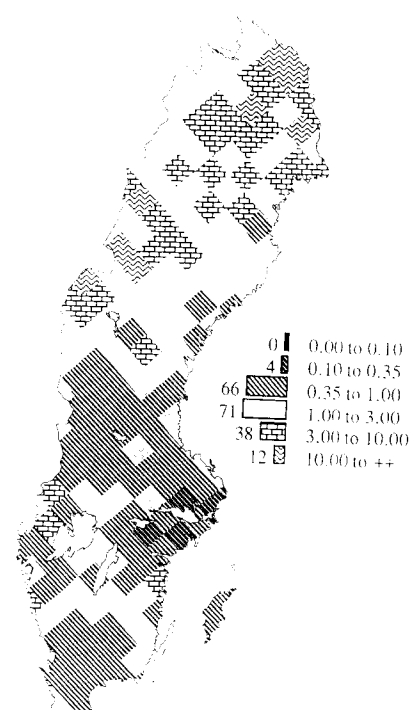
Area-weighted distributions of the ratio between base cations and aluminium ions at various future deposition levels in relation to a continuation of the 1990 level. The line at the far right shows the pre-industrial distribution.



Steady-state soil solution, showing the ratio between base cations and aluminium ions in Swedish forest soils at a depth of 30-50 cm in 2020, assuming respective reductions of 60 and 30 per cent for sulphur and nitrogen, as compared with 1990 levels (5-percentile).



Steady-state soil solution, showing the ratio between base cations and aluminium ions in Swedish forest soils at a depth of 30-50 cm in 2020, assuming respective reductions of 85 and 30 per cent for sulphur and nitrogen, as compared with 1990 levels (5-percentile).



Average observed acidity (pH-value) of Swedish forest soils at a depth of 30-50 cm in 1983-87, according to the Swedish Forest Survey Programme (5-percentile).

tions usually stray from a strict application of the critical-load concept in two respects. In the first place they exclude, through selection of a certain percentile, the most sensitive ecosystems. They are also based on forest trees, which are probably not the most sensitive type of organism in the system. But forest trees have been chosen because in their case most is known about the connection between the chemistry of the soil and the health of the organism. The advantage of such simplification is, on the one hand, that it enables the maps to be made illustrative, and on the other hand that the results can be expressed in economic terms – such as decision-makers can understand and, it may be hoped, act on accordingly.

PER ELVINGSON
CHRISTER ÅGREN

Further reading: **Mapping critical loads** by H. Sverdrup, W. de Vries and A. Henriksen. A guidance to the criteria, calculations, data collection and mapping. Miljörapport 1990:14. Available from the Nordic Council of Ministers, Store Strandstaede 18, DK-1255 København K, Denmark. **Mapping critical loads for Europe** – referred to in Acid News 1/92.

FACTFILE

TO CALCULATE the critical load by means of the steady state mass balance method, it is first necessary to decide on the type of ecosystem and the indicator organism, and ascertain the critical limits for the latter.

Then considerable information must be obtained for each point at which the critical load is to be calculated. Viz.

- ☐ The rate of weathering (keq/ha/yr) as determined from the soil mineralogy (content in per cent of specific minerals).
- ☐ The uptake of base cations by vegetation (keq/ha/yr).
- ☐ The uptake of nitrogen by vegetation (ditto).
- ☐ The total deposition of sulphur and nitrogen compounds and base cations (ditto).
- ☐ Temperature.

☐ Annual average precipitation and runoff.

The above parameters are determined mainly by measurements. Data on the fallout of acidifying substances can be obtained from the EMEP. The weathering rate is one of the most important factors and that about which it is most difficult to obtain data. The solution has been to use calculations from modelling.

In Sweden data on the soil chemistry is taken from about 2000 sampling points spread over the whole country.

Also used is measured data concerning various soil-chemistry parameters, such as pH, calcium ions, magnesium ions, acid-neutralizing capacity (ANC), total aluminium, and dissolved organic carbon – as means of comparison and to control the functioning of the model as well as the results.

Trading pollution credits

IN AMERICA the Environmental Protection Agency has proposed regulations that will allow industries to buy and sell rights to emit SO₂ and NO₂. The proposal is aimed mainly at electric utilities, since they are responsible for 60 per cent of the emissions of sulphur dioxide in the eastern United States. The rules were welcomed by both environmental groups and industry, and are generally seen as the most cost-effective method of pollution control. William Reilly, administrator of the EPA, said the buying and selling of pollution rights would cut the utilities' compliance costs by \$1bn per year, and that only the most polluting plant would have to seek extraordinary rate increases.

Under the proposal, an industry that does better at cleaning up sulphur dioxide than required could accumulate credits for sale to another company that failed to clean up enough. In theory, companies that can reduce pollution cheaply by changing fuel or by persuading their customers to conserve energy would recover some of the cost by selling their pollution rights to companies that could only do so by adopting costlier measures, such as installing scrubbers. The air would be just as clean, but the cost would be lower.

The trade in pollution credits is acceptable to utilities because of the lower overall costs of compliance. Environmental groups, on the other hand, have praised the scheme because it addresses the pollution of the industry as a whole. Its comprehensive nature means that it is unlike other, inflexible, regulations that force polluters to meet predetermined emission levels, in that each business can reduce emissions as it sees fit. At the same time the total output of the industry is reduced. This regulatory scheme will, it may be hoped, mark the beginning of a policy trend that keeps sight of the large-scale health of the environment as its goal.

SCRUBBERS OR CLEAN COAL

In the latter part of 1991, utilities in the United States began coming to terms with the new acid-rain

regulations of the 1990 Clean Air Act.

They are having to decide what measures they will take to meet the deadline set by the Clean Air Act for January 1, 1995 for reducing emissions of sulphur dioxide to about half of their 1989 levels. They face a

Coming to terms with new regulations of the Clean Air Act

difficult choice between installing scrubbers and switching to "clean" or low-sulphur coal. The apparent least-cost option is fuel switching. Some studies, however, indicate that in the long run scrubbers are a more predictable and cost-effective alternative because of the variable costs for mining and transportation that fuel switching will entail. Moreover, the cost of low-sulphur coal itself could rise on account of the increased demand. In many cases political pressure may play a role and tip the balance in favour of scrubbers.

The American Electric Power Company (AEP) of Ohio would, for example, like to switch to low-sul-

phur coal. This would mean using out-of-state instead of locally mined coal. The prospect of local economic hardship and unemployment is fueling political pressure on AEP, as well as other power generators, to adopt scrubber technology. In June, the Ohio State legislature passed a \$1-a-ton tax credit for utilities that burn Ohio coal. The Ohio public utilities commission has also ordered AEP to keep the scrubbing option open. Political pressure is evident in other states as well. Illinois is considering a law to mandate the use of scrubbers, in order to protect high-sulphur mining jobs in southern Illinois. The proposal has passed one house of the legislature but faces opposition from the governor.

Different utilities are making different choices. The Allegheny Power System was first to place an order for a wet scrubber in the wake of the Clean Air Act of 1990 – considering scrubbing to be the most flexible and cost-efficient way to comply with the act. On the other hand, the Southern Co. will switch to clean-coal technology (interestingly it also cited future flexibility as the impetus for its choice). Indiana's largest utility has decided to combine both options in its power plants.

ERIC WILKINSON

"Smog exchanges"

SOUTHERN CALIFORNIA has already approved a plan to put the idea of trading in pollution credits into practice. A Regional Clean Air Incentives Market would act as a kind of stock exchange for 2800 of the biggest polluters in the Los Angeles area. Permits would be issued having a certain value in pounds of pollutants per quarter, and companies that reduce emissions below the permitted level could sell the credits so gained to others for whom similar action would be uneconomic.

The plan would affect businesses that emit four tons or more of several pollutants per year, and each year the value of the "stock" would shrink, forcing

companies to reduce their emissions.

According to Mr Henry Wedaa, chairman of the South Coast Air Quality Management District which regulates air pollution in the Los Angeles area, by 1997 the plan will have saved businesses about \$670m.

Further east, the Commodity Futures Trading Commission has just approved a proposal for a "smog exchange" at the Chicago Board of Trade. Analysts think that credits may sell at \$400 to \$1000 per ton of sulphur dioxide.

Sources: Daily Telegraph, Svenska Dagbl.

To settle a controversy



© DAN RAPP

AN ANALYSIS of the acidic water in 1180 lakes and 4670 streams in the United States has recently been made to try and settle a controversy as to whether all the lakes and streams had become acidified from atmospheric deposition, or whether some were naturally so.

The study was carried out by three scientists from the Environmental Protection Agency – Lawrence Baker, Alan Herlihy, and Philip Kaufmann – in collaboration with Joseph Eilers of Environment Chemistry Inc. They set out to infer the source of the source of the waters' acidity by analyzing their chemical composition. Lakes that are naturally acidic should contain more organic than inorganic compounds, while the reverse should be true for lakes that are primarily affected by acid deposition.

The evidence indicated that in 75 per cent of the lakes and 47 per cent of the streams the acidity was due to atmospheric deposition. In the remaining 25 per cent of the lakes it

was natural. Most of the naturally acidic lakes were in Florida and the upper midwestern states. About 25 per cent of the streams were acidic because of mine drainage rather than natural acidity or atmospheric deposition.

It was also found that the regions most clearly affected by atmospheric deposition were in the southwestern Adirondack Mountains in New York State and in the mid-Atlantic Highlands. Many experts believe however that the acid-rain problem in the Adirondacks has reached a steady state, so that the lakes are not becoming more acidic and in high elevations the rate of destruction of the forests is slowing down. On the other hand concern is being expressed that nitrogen deposition might continue to play a role in forest damage.

ERIC WILKINSON

Research Associate of the Pacific Energy and Resources Center of Sausalito, California.

Further publications

Airborne pollution load to the Baltic Sea 1986-1990 (1991)

Airborne pollution has been shown to constitute a considerable fraction of the total load of marine pollution. The total deposition of nitrogen to the Baltic Sea has been found, for example, to be approximately 300 thousand tons N per year. Of this, about 60 per cent is in the form of oxidized nitrogen. The main contribution comes from the countries surrounding the sea. Other large contributors are the UK, France, and the Netherlands.

Monitoring data has been collected within the framework of the Baltic Marine Environment Protection Commission – the Helsinki Commission – since 1983.

Baltic Environment Proceedings (No. 39 in the series). 160pp. Available from the Baltic Marine Environment Protection Commission, Mannerheimintie 12A, SF-00100 Helsinki, Finland.

The impact of material administration developments in the Swedish business sector (1991)

Of late the trend of material administration in many countries has been towards "just-in-time" deliveries, partly as a means of reducing the cost of warehousing. The situation in Sweden is here analysed, together with the effects of the method in the way of polluted air, accidents, congestion, etc. There is also an examination of the possibilities of developing systems that will eliminate a good part of these undesirable effects.

The report comes from the Swedish Transport Research Board. 64 pp. Available from Allmänna Förlaget, Customer Service, S-106 47 Stockholm, Sweden.

International lake and watershed liming practices (1991)

This book is the outcome of an international symposium on liming that was held in Massachusetts, USA, in November 1990. The authors of the various chapters have provided an international perspective of liming activities that address acidic surface water management.

Price us\$69. 245 pp. The report may be ordered from The Terrene Institute, Inc, 1000 Connecticut Ave. N.W., Suite 802, Washington, D.C. 20036, USA.

Skogsskjötsel i en utslippstid (1992)

Forest management in a time of emissions is the title of this well-illustrated book by Birger Braadland and Per A. Rognerud describing the effects of air pollution on forests and what can be done to mitigate those effects.

Norwegian only. 80 pp. Nkr80. Obtainable from Det norske Skogsselskap, Wergelandsveien 23B, N-0167 Oslo 1.

Starting an international project for schoolchildren

A COMMON PROJECT for schools on the subject of air pollution is being arranged by environmentalist organizations in Scandinavia in conjunction with similar bodies in Poland, Hungary, Czechoslovakia, Great Britain, and the Baltic States. The aim is to get air pollution onto the curricula for more than 150,000 pupils aged 12-14 in twelve countries during the next school year.

The project will start in September 1992 and run to June 1993. Classes that have received invitations are asked to announce their intention of participating at latest by June 1.

AIMS

The project is intended to give pupils as well as teachers a deeper insight into the causes and effects of air pollution, and to show what can be done to reduce it. It is hoped that the increased awareness resulting from this focusing of attention on air pollution will lead to a higher priority being given to the matter in government circles. There is naturally also the hope that through their schoolwork, and its extension by way of studies in the natural environment, pupils will acquire a knowledge and experience of nature that will stimulate them to further study and engagement in local environmental projects.

THE PROJECT

The idea of the present project stems from the experience of the Norwegian Society for the Conservation of Nature and the WATCH Trust for Environmental Education in Britain in organizing similar projects on the subjects of acid rain and low-level ozone. Those projects were notably successful in engaging pupils

and teachers in these environmental problems. The intention now is to combine them both in a single package, and also include a program for six subordinate studies that classes can carry out individually. All the assignments will include excursions into the countryside, making observations and taking samples, as well as proposals for further study.

A study handbook in the language of each country will contain special sections for that particular country, saying how and where classes will be able to obtain further information, and how each can get publicity for its own project.

LINKAGES

Another aim of the project is to encourage contacts between young people in East and West Europe. A coupling of classes is therefore being arranged by which each participant class will be given the name and address of a corresponding class in another

country. By writing letters, or communicating in some other way, they can then get to know each other. Experience has shown that such exchanges can also lead to reciprocal visits.

FINANCING

Funds for the project will come, on the Western side, from fees paid by the participants. For Czechoslovakian, Polish, and Hungarian classes, aid will be available through the environmental agreements between Norway and each of the East European countries. As regards the Baltic States, grants are being sought from the Nordic Council of Ministers.

KNUT T. SMEDSVIG

RESPONSIBLE FOR THE PROJECT:

The Norwegian Society for the Conservation of Nature, Box 2113 Grunerløkka, N-0505 Oslo, Norway
Att. Knut T. Smedsvig, project coordinator, or Sissel Dobson, project adviser.

COOPERATING ORGANIZATIONS:

Sweden: The Swedish Society for Nature Conservation, att. Ingemar Zachrisson, Hemsjö 2524, Myster, S-441 96 Alingsås. Phone +46-322-500 95

Denmark: The Biological Association, att. J.O. Ravn-Nielsen, Mosvitvej 2, 8450 Hammel. Phone +45-8696-3384

Finland: The Finnish Youth Association for Environment Protection, att. Jaana

Hinkkanen, Tallberginkatu 1 D/113, SF-00180 Helsinki. Phone +35-8-0694 7899

Iceland: Landvern, att. Svanhildur Skafadottir, Skólavörðustígur 25, 101 Reykjavík. Phone +35-412-5242

Poland: Polish Ecological Club (PKE), att. Maria Guminska, Ul. Garbarska 9, 31-131 Krakow. Phone +48-12-227 400

Czechoslovakia: Czech Union for Nature Conservation, att. Jana Ledvinova, Slezska 9, 120 29 Praha 2. Phone +42-2-215 2977

Hungary: The Ministry for Environment and Regional Policy, Research and Education Department, att. Maira Galambos, Fo u. 44-50, H-1011 Budapest. Phone +36-1-201 4133

Great Britain: WATCH, The Green, Witham Park, Waterside South, Lincoln LN5 7JR. Phone: +44-522-544 400

Estonia: The Estonian Youth Nature House, att. Maris Laja, Mustamäe road 59, EE 0108 Tallinn. Phone +70-142-527 793

Latvia: Information Centre on Energy and Air Pollution, Latvia University, att. Diana Sulga, c/o Ecological Centre, Rainis Boulevard 19, Riga 226098. Phone +70-132-225 304

Lithuania: Lithuanian Greens Club "Zvejone", att. Antanas Kontautas, Dancs 17, Klaipėda LT 5800. Phone +70-1261-12902/12936