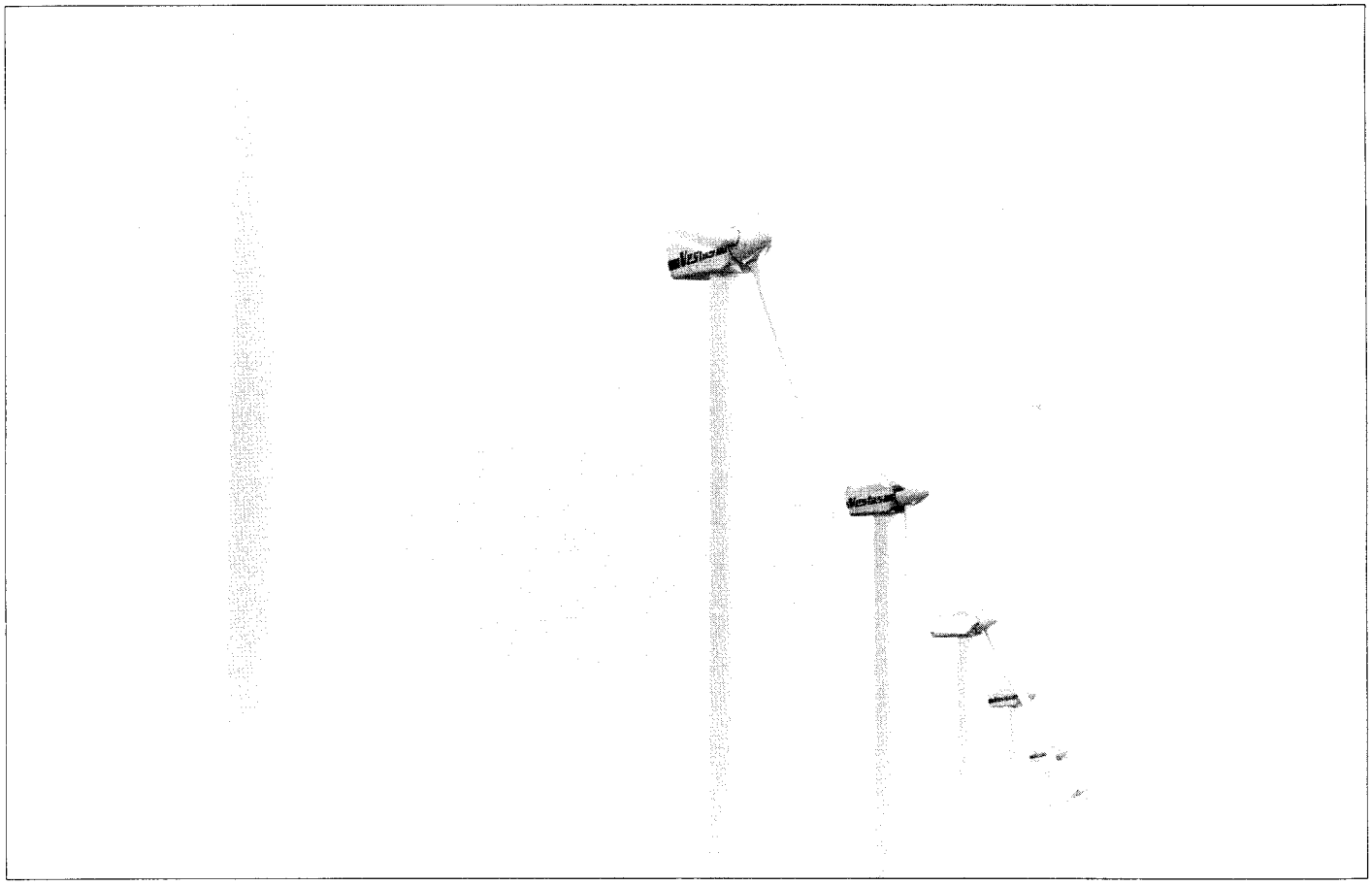
NO. 3, JUNE 1992

Acid News

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



WIND POWER

Potentialities seen

MEN HAVE BEEN USING the energy in the wind, even if only on a modest scale, for several thousand years. Now, when ever more people are coming to realize that the abuse of the environment must be checked, the outlook for wind power seems promising. Asking how America "can curb its dangerous dependence on scarce, nasty fossil fuels," TIME magazine recently averred, quoting Bob Dylan, "The answer, my friend, is blowing in the wind."

Wind power in the United States now has an installed capacity of 1700 megawatts. Most of the wind farms are in California, where the contrast in temperature between the warm landmass and the cooler ocean ensures reliable winds. The potential is however considerable in other states too. It is said, for instance, that ten Midwestern states could more than meet their electrical power needs from wind.

Because of previous failures of attempts to harness wind power, there is still some scepticism in America as to its possibilities. But as the article in TIME points out, things have happened since then. With today's wind turbines, 10 per cent of the US energy demand could be met, and within thirty years newer versions could supply a quarter of America's power needs.

Of the European countries, Denmark has come farthest in applying wind energy, with a capacity of 420 MW accounting for about 2 per cent of the total output. Plans for the year 2000 are for 2000 MW, which would mean that almost 10 per cent of the country's electricity will be derived from wind power.

There is a great potential in other countries too, although so far little has been done to realize it. The installed capacity in the Netherlands, for instance, is no more than 54 MW. The utility companies have however undertaken to make it five times as much by 1995, and the aim for 2000 is 1000 MW. Spain had 7 MW in 1990, and expects it to be 100 MW in 1995. Germany, which was late in start-

Continued on page 3

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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 fullfill 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

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- 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

Keeping at it

THERE HAS BEEN a distinct tendency of late for public attention to shift from acid rain to climate change and holes in the ozone layer. In fact one reputable magazine not long ago ran an article entitled "What happened to acid rain?" Well, one might say, not much. Acid rain still remains, together with the damage it is causing, largely unabated.

The problems of climate change, ozone depletion, and acidification are of course closely intertwined. It is all a matter of air pollution, and improvement in one area is likely to mean improvement in the others as well.

Our principal aim at this secretariat is to keep alive and increase awareness of the problems associated with air pollution – and so, aided by public pressure, to get emissions reduced. Eventually, of course, the amounts of airborne pollutants will have to be brought down to levels that the environment can tolerate without suffering damage. In other words, to below the so-called critical loads.

It is to this end we publish Acid News. Here we shall continue to report on the state of the environment as it is affected by air pollutants, as well as on the efforts that are being made – at the international, national, and even local level – to contain and reverse the process of acidification and other effects of air pollution.

Apart from this and other publishing activities, the secretariat is primarily engaged in keeping an eye on political trends and scientific developments that concern the environment, especially as regards acidification. It also serves as an information centre, in the first place for European environmentalist organizations, but also for media, government authorities, and researchers.

Further, it acts as coordinator of the international activities, including lobbying, of European environmentalist groups – as for instance in connection with the meetings of the UN ECE Convention on Long Range Transboundary Air Pollution.

At present, the international work of the secretariat is largely directed on the one hand towards eastern Europe, especially Poland, Czechoslovakia, and the Baltic states, and on the other towards members of the European Community, in particular Great Britain – all of which are countries whose emissions add significantly to the depositions of acid over Sweden.

Our activities in eastern Europe consist mostly in supporting and cooperating with the local environmentalist movements. Financial aid is for instance being given to the Polish Ecological Club to help it run an information centre for air pollution in Katowice, southern Poland, with a full-time staff of two.

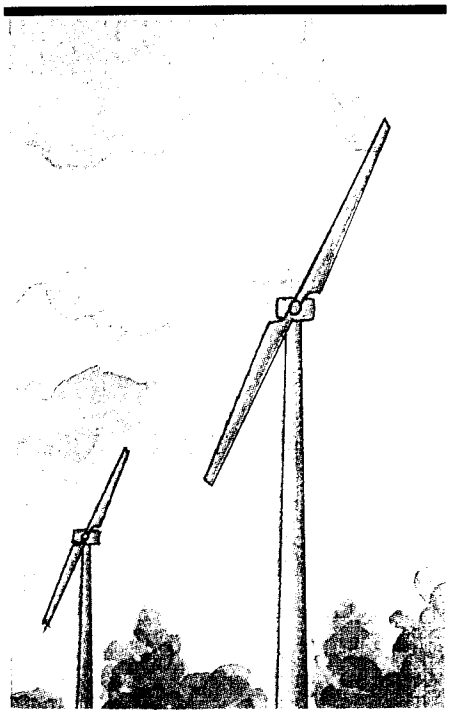
Recently, too, similar support has been provided to enable information offices dealing with energy and air pollution to be set up in Czechoslovakia, at Prague, Litvinov, and Bratislava, as well as in Estonia and Latvia. This year such centres are also to be started in Lithuania and Russia, in St Petersburg. In all cases they are being run by local environmental organizations.

An important part of the secretariat's work is the arranging of seminars for environmental NGOs to determine strategy. These have taken place every third year, from 1986 to 1992. Common objectives and cooperative projects have by this means been developed, and especially important has been the agreement that has been reached on the demands that should be made in international contexts – demands, that is, based on scientific data for critical loads.

Essentially these demands call for a reduction of the European emissions of sulphur and nitrogen oxides by at least 90 per cent, and those of volatile organic compounds and ammonia by at least 75 per cent. The need for action is becoming increasingly urgent, since the deposition of pollutants above the critical load limits has been going on for decades. Economic considerations apart, environmental reasons alone would make a prompt start on reduction imperative.

CHRISTER ÅGREN

A summarized report on the seminar that was held in Sweden earlier this year will be found on pages 6-11. Readers of Acid News will also receive a full version that will be available later in the summer.



Large versus small

Most of today's wind turbines are small to medium in size, with capacities of 100-400 kW. In Sweden and Germany large turbines are however being developed, with capacities around 3 MW (3000 kW). The advantage of large machines is that they generate more energy per unit of land area than small ones. One square kilometre may contain for instance thirty-six 200 kW windmills or eleven 3 MW plants, with four times as much electricity being produced from the wind farm with the larger units. It may on the other hand be easier to find sites for the smaller ones, as they melt more easily into the landscape. Moreover they produce energy at a lower cost than big units, which are still in prototype stage.

Continued from front page

ing, at the beginning of 1992 had 90 MW of installed capacity, and a current program will increase this to 250 megawatts.

There is as yet little wind power in Sweden, Norway, Great Britain, and Ireland, despite a considerable potential. The European Wind Energy Association, which has drafted a development program for the Community, has set 4000 MW as the goal for the year 2000, rising to 100,000 MW by 2030. Wind power would then account for 10 per cent of the electricity generated in the European Community.

The problem today is not technology, but the economic rules of the game. In most countries it costs nothing, or almost nothing, to release pollutants such as carbon dioxide, and sulphur and nitrogen oxides, to the atmosphere. The costs of the damage they cause should really be put on the type of energy that gives rise to them – as an environmental charge. This would on the one hand raise the price of energy, which would encourage more efficient use, and on the other discourage the use of the more polluting types. What is needed is not subsidies for wind power, but a more equitable market, where the environmental costs are included in energy prices.

This does not mean, of course, that research and development should be abandoned for renewable energy sources. Compared with what is being spent on nuclear energy, the development costs for wind power are minuscule. Through improved technology, better knowledge of favourable sites, and so forth, the cost of producing wind power can be lowered. According to TIME, the windmills now operating in California can produce energy at a cost of 7 cents per kilowatt-hour (kWh). In areas of steady high wind the turbines that are now coming into use will have reduced it to 5 cents by 1995, and more advanced designs are likely to cut off another cent by the year 2000.

The cost of producing wind power in Denmark is said to be 39 öre per kilowatt-hour, or about 6 cents. Coal-fired plants, without any cost for flue-gas cleaning or any environmental charge, can do no better than 31 öre. Between 1987 and 1990 the installation costs for wind power in Denmark had fallen by 25 per cent.

In Denmark, wind-power cooperatives are common. Fifty or so families will club together to buy a turbine, and then sell the power directly to the public network. There are now about 100,000 families share-owning a turbine. According to the Danish utilities' association, wind power should be a good investment, equal to a return of 26 per cent from money in a bank, assuming the present rules for taxation.

It may be worth noting the conclusion of the TIME article, by Dick Thompson: "If wind power does not fulfill its promise as a major energy source by the end of the century, it will not be a failure of technology. It will be a failure of vision on the part of society to make the necessary commitment."

PER ELVINGSON

Capacity and output

Watt (W) is a measure of capacity, i.e. how much energy a plant can generate at a certain moment. The capacity of a wind turbine may vary from 100 kilowatts (kW) to 3 megawatts (MW=1000 kW). That of a nuclear reactor usually lies between 500 and 1000 MW.

The amount of energy that is generated depends on the length of time the plant is in operation – in the case of a wind turbine, how long the wind blows. The whole installed capacity of the Danish wind farms, for instance, produces nearly 1,000,000 MW-hours (MWh), or 1 TWh, per annum.

Correction

IN THE LAST ISSUE the maps on page 13 unfortunately became misplaced. That on the left should be above the text on the far right, and the other two each moved one step leftwards.

The curves in the chart on page 12 refer to the situation in forest soil in Sweden today and yesterday and for various scenarios inbetween.

On the following pages

Ecosystem deranged

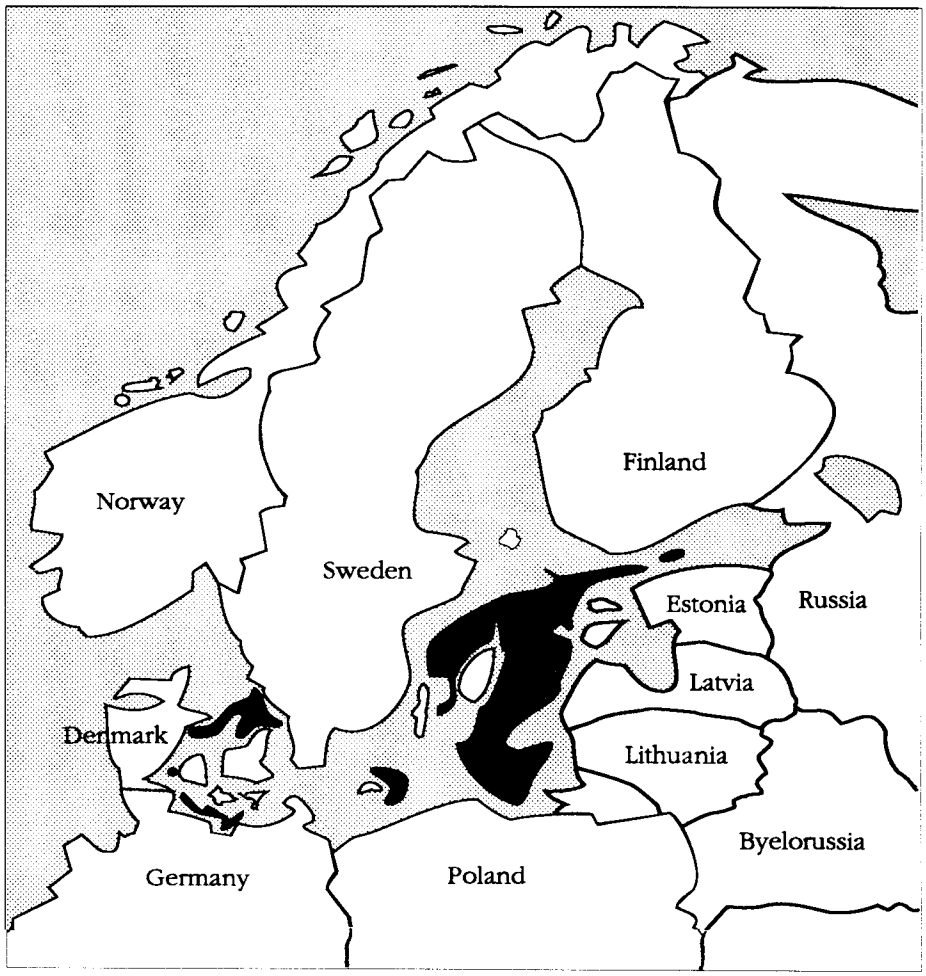
EVIL-SMELLING SWATHS of washed-up seaweed here and there lining the shores, algal blooms completely changing the colour of the water, its oxygen getting used up and leaving a lifeless sea floor – are all signs of a deranged ecosystem, due mainly to an oversupply of nutrients, and especially of nitrogen. Not only in the Baltic, but all around Europe eutrophication of the coastal waters is a growing problem, caused in no small measure by airborne pollutants.

Whereas phosphorus is what generally sets the limit to plant growth in lakes and streams, it is usually nitrogen that does so in the sea. When nitrogen enters in a form available to plants, phytoplankton and algae start to grow and proliferate. The water becomes less transparent, and because of the diminished light, large algal species such as bladder wrack can no longer survive at previous depths. In this way quite moderate additions of nitrogen can bring about extensive changes in the marine ecosystem.

Exceptionally favourable conditions can cause an explosive growth of plant plankton. Oxygen deficiency can then result when dead organic matter from algal blooms sinks down to the sea bed and decomposes – decomposition being a highly oxygen-consuming process. If the process continues, anaerobic bacteria will get to work, so that hydrogen sulphide is formed – poisonous and smelly.

The Baltic is in fact badly affected by eutrophication. The nitrogen load to this quasi-inland sea is now estimated to be four times as high as it was at the beginning of the century, and even in the Kattegat, at the entrance to the Baltic and close to the North Sea, it has doubled. In the Baltic generally the volume of phytoplankton has, since 1950, increased by 50 per cent.

Over the last thirty years the area of sea bed in the Baltic, where the water closest to the bottom lacks oxygen entirely, has increased ten times, now amounting altogether to some 100,000 sq kilometres (see map). The exchange of water in this sea goes on very slowly, taking 30-50 years for the whole water body. Mixing is hindered by a marked layering of the brackish water in the upper levels and the heavier saltwater nearer the sea bottom. The only occasions when the bottom layers become thoroughly oxygenated are when large amounts of saltwater are forced into the Baltic through the Danish sounds by storm winds. The last time this occurred was in 1978.



MAP: STEFAN BYDÉN

The area of sea floor in the Baltic that is lifeless from lack of oxygen now amounts to close on 100,000 sq kilometres. Even in a large part of the Kattegat, at the entrance from the North Sea, depletion occurs with similar results.

While the inflow of oxygen-rich saltwater from the North Sea is something beyond human control, the input of nutrients is not, and eutrophication could be dealt with in large part through a drastic reduction of the emissions of nitrogen.

Most of the nitrogen comes to the water through atmospheric fallout, leakage from farmland and forest soils, and sewage effluent. That which is deposited from the air consists almost equally of nitrogen oxides (from the combustion of fuel in road vehicles and stationary plants) and ammonia (evaporated from agriculture). Of the total input of nitrogen to the Baltic, about forty per cent will have fallen directly onto the water from the air.

To this direct deposition must be added the airborne nitrogen that first falls on land and eventually becomes transported into the sea via the rivers. Since the nitrogen cycle is complicated, however, it is difficult to determine how much that is. While the forest soil still seems to be capturing most of the nitrogen that is deposited on it, its critical limits for nitrogen saturation are being ex-

ceeded in most parts of central and northern Europe. Gradually leakage will start, and in consequence nitrogen will sooner or later reach the sea.

Leakage of nitrogen from forest soils has already been observed in South Sweden and along the North Sea coasts of Germany and the Netherlands. With growing saturation, the problem will in all probability worsen.

Better sewage treatment and improved handling of manure will be important for dealing with marine eutrophication. But it will also be essential to reduce the emissions of air pollutants. Most of those reaching the Baltic comes from the surrounding countries, which are responsible for two-thirds of the direct depositions. The additions from more distant places, such as Britain, Netherlands, France, and Czechoslovakia, are however also considerable (see table).

Deposition of airborne nitrogen to the Baltic Sea (in 100 tons N). Average for 1989 and 1990.

Germany	648
Poland	266
Great Britain	258
Former USSR	240
Denmark	232
Sweden	178
Netherlands	129
France	116
Finland	76
Czechoslovakia	66
Other countries	329
Total	2538

Source: EMEP/MSC-W Report 1/91

Among the littoral states, the organ for cooperation to improve conditions in the Baltic is the Helsinki Commission. There it was decided in 1988 that the inputs both of nitrogen and phosphorus should be halved by 1995, from 1987 levels. An extensive program for action that was adopted last April came in however for heavy criticism on the part of the environmentalist organizations that were present at the meeting (see below).

The declared aim of ministers 1990 was "to restore the ecology of the Baltic Sea." No critical limits have as yet been worked out, but according to calculations of the Swedish Environmental Protection Agency, the inputs both of phosphorus and nitrogen ought to be reduced by 75-80 per cent. Unfortunately the measures so far promised will not even result in a 50-per-cent reduction.

PER ELVINGSON

Life in the Baltic, with neither fresh water nor salt, is precarious for many organisms. Cod's eggs fail to hatch when insufficient salinity causes them to sink to depths where the oxygen has become depleted.

Further reading:

- **Acid/Enviro Magazine** No. 9, 1990. Special issue on nitrogen. Obtainable free of charge from the Swedish Environmental Protection Agency, S-171 85 Solna, Sweden.
- **Northern Europe's Seas & Environment.** A Nordic Council publication, can be ordered from the above address (No 38122464. Price Skr 71.00).
- **WWF Baltic Bulletin.** A quarterly published by the WWF International Baltic Campaign. Free of charge from the WWF Baltic Bulletin, c/o Box 26044, S-750 26 Uppsala, Sweden (fax. +46-18 46 95 59).

What needs to be done

COALITION CLEAN BALTIC is a network for cooperation and coordination among twenty-two non-governmental organizations around the Baltic. The following views were presented by an NGO Baltic Conference to the environmental ministers of the littoral states who were attending a meeting of the Helsinki Commission in April 1992.

☐ The action program costing ECU 18 billion that has been developed on behalf of the Commission concentrates too much on costly measures for dealing with emissions from a few odd sources. It ignores the fact that pollution from the Baltic Sea comes from the air and from millions of land sources in the whole drainage area.

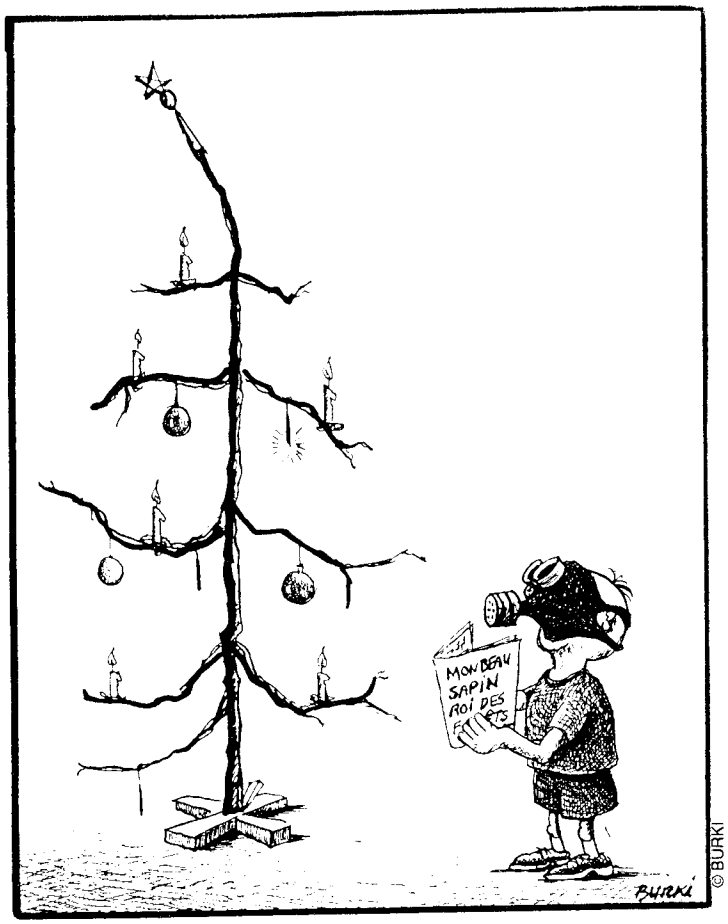
☐ It is not clear how the program is to be financed. Without financial provisions the whole program is pointless. Money for improving the environment could for instance be taken from each country's military budget.

☐ If the environmental problems of the Baltic are to be properly dealt with, measures must be taken in each and every country adding to the pollution. It will not suffice to concentrate on the coastal areas.

☐ The environmental advantage would be much greater if funds were applied to transformation of the energy and transport sectors and to reducing leakages from large-scale farming and forestry.

☐ Each country's government must act so as to ensure that the commitments made internationally are included in its home legislation, and are followed by concrete measures. That this is not being done today is one reason for the steady worsening of the Baltic environment.

The CCB's own proposal for a Baltic Action Plan was also handed to the ministers. That plan, as well as further information on CCB activities, can be obtained from CCB, c/o The Swedish Society for Nature Conservation, P.O. Box 4625, S-116 91 Stockholm, Sweden. ☐



East and West unanimous on strategy for abatement

Seminar participants agreed to press the European Community and the Economic Commission for Europe as well as their own governments for more stringent legislation to control air pollution.

IN APRIL THIS YEAR representatives of more than twenty environmentalist groups from eastern end western Europe met at a seminar in Göteborg, Sweden, to discuss strategy. Organized by the Swedish NGO Secretariat on Acid Rain, its aim was an agreement on renewal of the policies and action needed for bringing about a significant abatement of acid rain and its accompanying effects in Europe.

Various aspects of the work that is being carried on internationally for reducing emissions of acidifying air pollutants were presented in four addresses with which the meeting opened. Here they are given in digest form, but will be published in full in the report from the seminar which will be available later in the summer.

Basing their views on the scientific evidence, the delegates were unanimous in their conclusion that if the damage that acid rain is causing to the environment is to be stopped, a reduction of at least 90 per cent will be necessary in the emissions of sulphur and nitrogen oxides, and that this would involve drastic changes especially in the energy and transport sectors.

It was also noted that the response of governments to the damage caused by air pollutants had so far been totally inadequate, and all agreed to press the European Community and the United Nations Economic Commission for Europe (UN ECE) as well as their own governments for much more stringent legislation to control air pollution. The statement with an itemized list of requirements which was issued at the meeting is reproduced in full on the following pages.

The UN ECE Convention on Long Range Transboundary Air Pollution.

CHRISTER ÅGREN, *The Swedish NGO Secretariat on Acid Rain.*

THE UNITED NATIONS Economic Commission for Europe (UN ECE) takes in all the countries of Europe as well as North America. It is estimated that the ECE countries emit about 70 million tons of sulphur dioxide and some 45 million tons of nitrogen oxides, which is more than 40 per cent of the global anthropogenic emissions of these pollutants.

The Convention on Long Range Transboundary Air Pollution was signed in November 1979 by all the thirty-five members of the ECE. After ratification by twenty-four of the signatories, it entered into force in March 1983.

The Convention does not in itself require any binding commitment to undertake concrete measures to reduce specific pollutants. The text only says that countries shall "endeavour to limit and, as far as possible, gradually reduce and prevent air pollution, including long range transboundary air pollution," and that, in order to achieve this, they shall "use the best available technology that is economically feasible."

The actual requirements are set out in separate protocols, and to date three agreements for limiting the emissions of air pollutants have been added to the Convention.

A protocol on sulphur was signed in July 1985 by twenty-one parties to the Convention. It requires signatories to reduce their sulphur emissions or the transboundary fluxes by at least 30 per cent as soon as possible and at the latest by 1993, using 1980 levels as the basis for calculation.

In November 1988, twenty-five nations signed an agreement to limit emissions of nitrogen oxides. Specifically, the NO_x protocol stipulates that, after 1994, emissions are not to exceed the 1987 level. In other words, it does not call for any actual reductions, but only a freezing of emissions.

A protocol on volatile organic compounds (VOCs) was signed by twenty-one countries in November 1991. The prime aim is to reduce the magnitude and the number of episodes with high concentrations of ozone.

Most of the signatory countries have committed themselves to reducing their emissions of VOCs by at least 30 per cent by 1999, using 1988 as a base year. Three countries chose to confine their 30-per-cent reduction to certain specified areas within their country, while three others among the small-emitters undertook only to freeze emissions.

Since 1988 much attention has been given to developing a common understanding of the critical-loads approach and evolving abatement strategies based on this approach.

It has been agreed that the critical loads concept provides an acceptable, effects-based scientific approach for devising strategies for the abatement of air pollution. The essence of the critical loads approach is that reductions of emissions are to be negotiated on the basis of the effects of air pollutants, rather than on an equal percentage of reduction for all the countries involved. As stated, the goal is to reduce, in a cost-effective manner, the emissions of air pollutants to levels where, ultimately, critical loads are not exceeded.

Critical loads concept an acceptable approach

Here follows a rough outline of how the critical-loads approach is likely to be used in working out new agreements.

Each country is to make maps, depicting the critical loads and levels for areas, receptors, and pollutants in its own territory. Mapping is steadily proceeding, and by early 1992 thirteen countries had made and submitted critical-load maps for sulphur and/or total acidity. The resulting data is assembled and used in the production of Europe-wide maps for critical loads. By taking data on current depositions of pollutants, further maps are produced showing where and by how much the critical loads are being exceeded over different parts of Europe.

Countries will also set target loads. Reflecting a necessary stepwise approach, these may be regarded as intermediate objectives on the way towards bringing depositions down to levels corresponding to the critical loads. Computer models for integrated assessment will enable the cost and effectiveness of various strategies for abatement and achieving the target loads to be compared.

In order to arrive at new agreements on the reduction of emissions, there are to be international negotiations as to the target loads and strategies for abatement. Such agreements are likely to result in the setting of varying (intermediate) emission ceilings for each country, to be reached by a specified year.

A new sulphur protocol based on the critical loads concept is presently being negotiated, and a draft is expected to be ready for signing by the autumn of 1993.

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Methods for determining and mapping critical loads for acidity.

HARALD SVERDRUP, *Institute of Technology, Lunds University, Sweden.*

IT SHOULD BE NOTED that using the critical-loads approach involves a complex process. In the first place the critical load for acidity – how great an input of acidity various parts of the environment can tolerate without becoming damaged – has to be estimated and mapped. Then an assessment must be made of the possible ecological effects when the critical loads are exceeded in different extent. It is also useful to try and estimate the economic consequences of the ecological damage.

In practice, various calculations have to be made when estimating critical loads. Usually a particular ecosystem is first chosen, and then an indicator representative of that system's structure and functioning. After that a chemical limit or condition has to be defined, at which the indicator will be damaged or die, thereby signalling a decline of the whole ecosystem.

In forest ecosystems, for instance, trees have been selected as indicators – not necessarily because trees are the most sensitive species in such systems, but because in the case of trees the necessary informa-

tion was available, thus enabling critical chemical-limit values to be derived. For setting these limit values the concentrations of aluminium ions and the ratios between calcium and aluminium ions are being used. Fish are used as indicators in freshwater ecosystems, and similar chemical criteria have been defined.

Various models are used for calculating critical loads, the most simplified being the simple mass balance (SMB) method. Examples of more advanced models are the Dutch SMART, and the Swedish PROFILE. The latter requires more input data, but it also involves greater accuracy. In carrying out these calculations, countries aim both higher and lower, Sweden for instance has chosen to use a model with a high degree of detail, with as much of the input as possible being measured. In fact almost all the input data comes from field measurements. This is also the case with Finland and the Netherlands, and Switzerland will be following suit, whereas in Europe generally some of the parameters are estimated by using soil maps, values obtained from literature, and other means.

The individual countries' data will be fed into the European mapping procedure, where a grid of 150x150 km squares is used. The squares will show different colours according to sensitivity. In order to determine the sensitivity class for each square, cumulative distribution is used.

The resulting colour of the squares will also depend on percentiles. A 50-percentile map, for example, will show the critical load for each square after half of the most sensitive areas in that grid square have effectively been eliminated. Similarly, in a 5-percentile map, the most sensitive five per cent do not appear.

Different receptors, whether for forests, freshwater ecosystems, agricultural soils, raised bogs, or protective forests in alpine regions, all have different critical limits. Each of them will be given its own map. Countries producing a series of separate critical-load maps for various receptors may want to present the result on a single map. This can be done by mixing, and the value from the map showing the highest degree of sensitivity should then appear on the mixed map.

The ecological effects for forest trees have been be calculated, using data from Sweden. If acidification continues, there is a very high risk of widespread decline and forest damage. By simulating reduced deposition levels, the resulting soil chemistry and related health of forest trees can also be estimated. Reducing the deposition levels of sulphur and nitrogen by 60 and 30 per cent respectively, for example, turned out to be far from sufficient to protect the forests.

Different receptors all have different critical limits

Only when the depositions of sulphur and nitrogen are reduced by 90 and 60 per cent is there an approach to pre-industrial conditions.

Depending on the assumptions as to future deposition levels, estimates can be made of the resulting effects on forest growth. A continuation of present deposition levels will mean losses in forestry of about £1 billion a year for Sweden alone. And that is only the net harvest value. Inclusion of the processing value would mean the figure would have to be multiplied by a factor of three to five; in other words, there would be annual losses comparable to the cost of the Gulf war. That is what it costs to do nothing. A lot of abatement measures could be carried out for so much money.

Critical loads for nitrogen.

ANDREW TICKLE, *Earth Resources Research, London, England.*

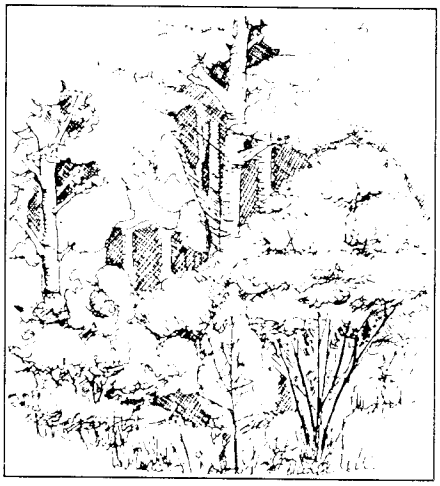
CRITICAL LOADS for terrestrial ecosystems are mainly defined with reference to forest soils, the aim being to preserve ecosystem stability or at least not change the vitality of forest trees. Using the simple mass balance (SMB) approach results in a critical load of 7-20 kg N per hectare and year, depending on the productivity of the forest.

A second approach that has been proposed, using a mass balance based on forest nutrition, may be more applicable for estimating loads in unmanaged forests and more natural systems. For natural forests in non-polluted areas it has been found that nitrogen is balanced within the system at an input of less than 2-5 kg N/ha/yr. Intuitively this could be regarded as a minimum critical load for such pristine systems.

Maps utilizing the two methods (SMB and the nutrition balance) have been produced for Sweden and show reasonable agreement. Actual field data from southern Sweden, in support of the nutrition balance method, also suggest that the critical load will be somewhere between 6-10 kg N/ha/yr. The areas where loads were shown to be exceeded also coincided with the pattern of observed changes in forest ground flora.

As regards critical loads for eutrophication effects on semi-natural ecosystems, there is now much clearer evidence of the effects of excess deposition of nitrogen on conservationally valuable components of Europe's flora, and critical loads (see table) have now been defined for various ecosystems, based mainly on changes in the composition of the flora community.

For forest trees decline occurs because of nutrient imbalances, which may be further aggravated, for example, by biotic (insect/fungi) or climatic stresses. As regards the



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Compared with highly managed parts of the landscape, semi-natural ecosystems are likely to be much more sensitive to increased inputs of nitrogen.

Critical loads for nitrogen (kg N per hectare and year) to (semi-) natural terrestrial and wetland ecosystems.

	Critical load	
Acid (managed) coniferous forests	15-20	*
Acid (managed) deciduous forests	<15-20	*
Calcareous forests	unknown	
Acidic (unmanaged) forests	unknown	
Lowland dry-heathlands	15-20	**
Lowland wet-heathlands	17-22	**
Species-rich lowland heaths/acid grasslands	7-20	*
Arctic and alpine heaths	5-15	(*)
Calcareous species-rich grassland	14-25	**
Neutral-acid species-rich grassland	20-30	*
Montane-subalpine grassland	10-15	(*)
Shallow soft-water bodies	5-10	**
Mesotrophic fens	20-35	*
Ombrotrophic bogs	5-10	*

** reliable, * quite reliable, (*) best guess

forest flora, the herb layer changes to more nitrogen-loving plants and declines in diversity. Effects on macrofungi (mushrooms/toadstools) may also be related to excess nitrogen, although so far they have only been found at rather high levels of deposition.

In lowland dry heaths (mostly around the northwestern coasts of Europe) excess nitrogen triggers increases in grass growth relative to heather, and outbreaks of heather-beetle plagues – thus causing large-scale destruction of the heather. In lowland wet heaths, *Erica* plants will be directly outcompeted by grass as the nitrogen load increases. In grass and herb communities within both types of heathlands excess nitrogen is lowering pH, causing loss of diversity and local extinctions. Since arctic and alpine heathlands are adapted to very low nutrient inputs, the critical loads are likely to be extremely low in such systems.

Wetlands, which include fens and bogs, are known to be very sensitive to atmospheric nitrogen. This is especially so in systems dominated by various species of *Sphagnum*, due to their total reliance on atmospheric inputs. Fens may respond with changes in the balance between different species, whereas bogs can be entirely destroyed at very low levels of input.

Especial emphasis should be given to the threat to semi-natural ecosystems, since they represent a far greater part of our natural heritage and biodiversity than commercial plantation forests. These systems are also likely to be much more sensitive to increased inputs, as compared with highly managed parts of the landscape. Unfortunately semi-natural systems have tended to be largely ignored in work in respect of critical loads.

As regards surface waters the current state of knowledge suggests that the nitrogen-cycle of lakes is easily disrupted below pH 5.6 and that, as with soils, nitrate can then be leached from the system. Calculations for Finland show that in the southeastern region critical loads are exceeded in 80 per cent of the lakes, and in Lapland about 10-30 per cent. A reduction of around 90 per cent in the deposition of total acidity (nitrogen and sulphur combined) would be needed to wipe out the excess.

Excess nitrogen in surface waters is also likely to lead to eutrophication, causing shifts in the composition of the phytoplankton community. It is however difficult to determine critical loads for nitrogen eutrophication without reference also to phosphorus; usually, however, the acidifying effect of nitrogen is likely to be the more important determinant of change.

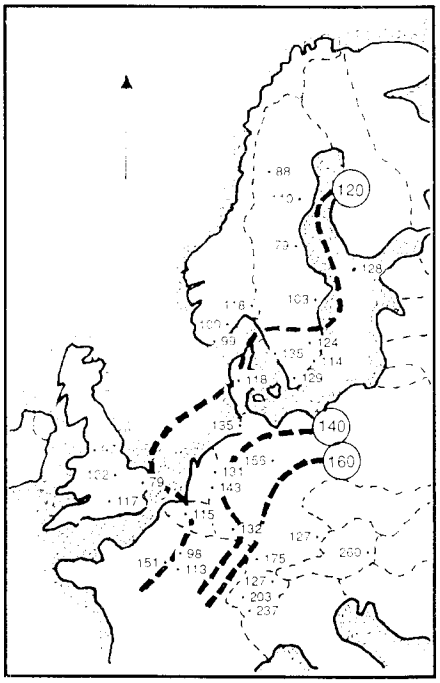
Only recently have the effects of atmospheric nitrogen on marine waters been evaluated. Significant eutrophication effects (e.g. algal blooms) are now well known in European coastal waters, and atmospheric deposition of nitrogen constitutes a significant contribution to the total input of nitrogen in these areas. But because of the lack of quantification of many of the fluxes of nitrogen (and also phosphorus), critical loads for marine waters cannot yet be calculated with any accuracy.

The critical levels for ozone and the necessary reduction of the emissions of ozone precursors.

PERINGE GRENNFELT, *Swedish Environmental Research Institute, Göteborg, Sweden.*

THE PROBLEM of ozone may be regarded as twofold - since there are two different "kinds" of ozone. First there is the regional kind, characterized by episodic peaks in its concentrations. The VOC protocol is aimed primarily at controlling the problems it involves. Then there is the so-called free tropospheric ozone, meaning the concentrations in the free troposphere, that is, from the ground up to the tropopause, at a height of about 10 kilometres. The free tropospheric ozone is also known as "background" ozone. The concentrations of free tropospheric ozone are continually increasing, constituting a problem of greater importance than that of regional ozone.

The highest peak levels of ozone have been found in Germany, Switzerland and Austria. It is likely that there are also high levels in some eastern European countries, although there monitoring data is lacking. The episodic peak values contribute surprisingly little to the ozone dose accumulated over the



Boundaries of average ozone concentrations, April-September 1986 (µg/m³), with local peak values, depicted in 98 percentile.

year. The major part of exposure to ozone of ecosystems and human beings comes from the background ozone.

A comparison of present levels of ozone with those of a hundred years ago leads to the conclusion that today's background concentrations are at least twice as high. The increase in the levels of background ozone is something that concerns the northern hemisphere. It is found from about 20 to 70-80 degrees N, and stretches in a band around the entire globe.

A set of critical levels for ozone was internationally agreed for the first time in 1988. They range from a half-hour peak value to long-term vegetation-season mean values. Monitoring data shows that these critical levels are being exceeded over almost the whole of Europe, and even in North Norway. From this it can be seen that the one-hour critical level of 150 $\mu g/m^3$ was exceeded at about 75 per cent of the measuring stations. The eight-hour and the seasonal mean critical levels were exceeded at 100 per cent of the stations.

At a UN ECE Workshop on Critical Levels, held in the UK on March 23-26, 1992, a fresh concept for critical levels for ozone was developed. The formula is now to be: [x] ppb-hours above [y] ppb baseline. This concept is so new, however, that the exact figures for x and y have yet to be derived and agreed upon, but in the course of discussion 40 or 50 ppb were suggested as baseline figures. The baseline figure will need to be

Statement from the NGO seminar on strategy, April 10-12, 1992

AIR POLLUTANTS from combustion plants, transport, industrial and agricultural sources all contribute to the heavy environmental stress affecting human health, ecosystems and materials throughout Europe. For example, it is estimated that acid, resulting from emissions of acidifying air pollutants, is being deposited in amounts that are damaging to the environment over three-quarters of Europe. As a result, forests, soils, ground and surface waters will inevitably be affected.

Therefore, drastic reductions in emissions of air pollutants are urgently needed if sensitive elements of the environment are not to be further damaged. In order to stop the ongoing deterioration of the environment, concentrations and depositions of air pollutants must be reduced to below the critical loads.

Critical loads can be defined as a quantitative estimate of an exposure to one or more pollutants above which adverse effects on receptors, such as plants, ecosystems or materials, may occur. To express it more simply, critical loads are the maximum amount of pollutants that ecosystems can tolerate without being changed or damaged.

REQUIRED REDUCTIONS

Based on up-to-date and internationally agreed scientific data on critical loads, we have jointly decided on the following objectives concerning total European emissions of air pollutants:

- ☐ at least a 90 per cent reduction in emissions of sulphur dioxide (SO_2);
- ☐ at least a 90 per cent reduction in emissions of nitrogen oxides (NO_x);
- ☐ at least a 75 per cent reduction in emissions of volatile organic compounds (VOCs);
- ☐ at least a 75 per cent reduction in emissions of ammonia (NH_3);
- ☐ at least a 75 per cent reduction in concentrations of tropospheric ozone, which is to be achieved by meeting the objectives for NO_x and VOCs, as above.

The reductions are based on the emission levels in the early 1980s and refer to western and eastern Europe, including the European part of Russia.

These are minimum demands, but they do not necessarily imply that every country or region must achieve equal reductions. In areas with very high emissions, greater reductions will be necessary, while in some other areas needed reductions may be lower.

Furthermore, as a result of improved methods of scientific research and increased knowledge, the data on critical loads is likely to be continuously reviewed and revised. Following such revisions, also the objectives for emission reductions should be reconsidered.

The critical loads concept must not be used to determine the amounts by which concentrations and depositions of pollutants can be allowed to increase in areas currently receiving pollutants below the present critical loads.

TIMEFRAME

The response of governments to the damage caused by air pollutants has so far been totally inadequate, although progress has been made in some countries primarily in reducing sulphur emissions. As a result of this, and international agreements such as the 1985 Sulphur Protocol to the UN ECE Convention on Long Range Transboundary Air Pollution (CLRTAP), reductions of 23 per cent in European sulphur-dioxide emissions were achieved between 1980 and 1989.

The emissions of nitrogen oxides, volatile organic compounds and ammonia, on the other hand, still constitute a growing problem. Despite this, only limited commitments have been made to control emissions of these pollutants.

Nevertheless, scientific evidence confirms that drastic reductions are required in order to safeguard forests and other sensitive ecosystems over large areas of eastern and western Europe. As regards acid deposition, it is estimated that critical loads are exceeded over three-quarters of Europe. In some central and northwestern parts of the continent the depositions are twenty times higher, if not more, than the critical loads.

As critical loads are widely exceeded, and have been so for several decades, the need for action to curb emissions is consequently increasingly urgent. From an environmental point of view, the above reductions are required immediately.

ACHIEVING REDUCTIONS

Bilateral, multilateral, and international agreements and arrangements should be used to achieve reductions as a matter of urgency. Nations should act unilaterally, however, to make faster progress than international measures require.

Priority must be given to preventing pollution at source, by establishing this as a central criterion in both energy planning and economic development.

It should be noted that the strategy we propose for reducing emissions of sulphur dioxide, nitrogen oxides and volatile organic compounds (including methane), has significant implications for energy use, and thus will also lower atmospheric concentrations of ozone, carbon monoxide, and carbon dioxide, which are some of the main pollutants contributing to global warming.

as low as 20 ppb, if the earlier critical levels are to be replaced by these new ones.

Putting the baseline figure as high as 50 ppb would mean that only the peak levels were reflected, and the problem of increasing background levels consequently ignored. The lower the y figure is set, the more the increasing background levels will be taken into account. The free tropospheric ozone is of relatively greater importance than the episodic peak values, especially in the fringe areas around the European continent.

The question is which type of pollutant, nitrogen oxides (NO_x) or volatile organic compounds (VOCs), is most important to control in order to reduce the problems of ozone. That depends on whether one is aiming at controlling the regional ozone or the free tropospheric ozone, and also on the emission density of the area in question.

In urban environments, with high emission densities, the formation of ozone is limited by the amounts of VOCs that are available. The further away from the urban areas – or, in a regional perspective, from central Europe – the more important NO_x becomes. So reductions of VOCs will be effective for controlling ozone in central Europe, whereas in other parts of the continent it will be more important to control NO_x.

The use of a so-called roll-back model indicated a need for at least a 75-per-cent reduction in precursor emissions. Modelling work carried out by EMEP has shown that even with a 75-per-cent reduction of European emissions of both NO_x and VOCs, the critical levels for ozone would still be exceeded in some extent. □

The urgency of meeting the reduction targets demands that a range of measures be adopted, including:

☐ using renewable energy sources;
☐ increasing the conservation of energy;
☐ increasing the efficiency of energy production, transmission, and use;
☐ switching to less polluting fuels;
☐ applying best available techniques in the energy, transport, industry, and agriculture sectors.

The price of fuel and electricity should more readily reflect the real cost to society of the social and environmental impacts of air pollution and the inefficient use of energy and other resources.

The European countries and the European Community should base their transport policies primarily on environmental criteria. Priority should be given to the development of modes of transport with the least environmental impact.

Measures to reduce air pollutants from the transport sector include:

☐ the implementation of volume control, including for example that no new major roads should be built, investment in public transport and railway freight systems should be increased;
☐ the adoption of plans and timetables to *reduce significantly* the total European volume of road and air traffic;
☐ the adoption of standards for increasing the fuel efficiency of all new motor vehicles, including aeroplanes and ships;
☐ the adoption of properly regulated emission standards for all new motor vehicles, including off-road vehicles, aeroplanes and ships;
☐ the adoption of speed limits for road traffic at a maximum of 100 kph.

Progressive environmental standards should not be regarded as trade barriers. Any harmonization that affects environmental standards should be at the the most stringent current level.

Financial incentives and disincentives, such as levies on petrol, diesel and kerosene, can be useful tools in reducing air pollution. Income from environmental levies should be used to finance measures for pollution prevention, including investments in public transport, as well as to restore damage caused by pollution.

Relations between West and East

It is particularly important that eastern countries avoid duplicating the western countries' wasteful pattern as regards especially energy use, transport and consumerism. The transition in economic and political systems in Central and East Europe now offers a historic opportunity for innovation towards sustainable energy and transport systems.

Western European countries should undertake, bilaterally or jointly, concrete projects to assist eastern European countries in their implementation of pollution prevention programs.

Priority should be given to projects which discourage energy wastage and instead focus on improving energy efficiency within the energy and industrial sectors. Renewable energy sources have a particularly important role to play, bearing in mind their advantages over nuclear and fossil-fuel-based technologies. Projects could include:

☐ development of domestic pollution control and energy-saving industries through joint-venture schemes, for both domestic and export applications;
☐ transfer of know-how in pollution prevention techniques, effective resource management, environmental monitoring and energy planning policy;

It should be ensured that the development of new pollution control activities does not create new environmental hazards in solving old problems or involve the transfer of undesirable technology from the West.

In the development of such projects, full consultation should take place with both the public and non-governmental organizations, ensuring the need for proper environmental impact assessment (EIA).

Access to information

All data held by authorities in European states as well as by the European Commission concerning the emission, transport, concentration, and deposition of pollutants should be made publicly available.

Participants

The meeting was organized by the Swedish NGO Secretariat on Acid Rain and attended by representatives from twenty-two non-governmental environmentalist organizations from fifteen countries in Europe.

INTERNATIONAL ORGANIZATIONS:

- European Environmental Bureau
- Greenway Central and East European Network

NATIONAL ORGANIZATIONS:

- Bond Beter Leefmilieu, Belgium
- The Danish Society for Nature Conservation
- Clean Air Action Group, Hungary
- Community Atgaja, Lithuania
- Earthwatch, Ireland
- Ecological Projects Centre, Russia
- The Environmental Federation in Sweden
- Estonian Green Movement/FoE
- The Finnish Society for Nature and Environment
- Friends of the Earth UK
- Global 2000, Austria
- Green House Litvinov, Czechoslovakia
- Greenpeace Czechoslovakia
- Lithuanian Green Movement
- The Netherlands Society for Nature and Environment
- The Norwegian Clean Air Campaign
- Polish Ecological Club
- Slunicko Foundation, Czechoslovakia
- Socio-Ecological Union, Russia
- The Swedish NGO Secretariat on Acid Rain

THE STATEMENT IS ALSO SUPPORTED BY:

- Greenpeace International
- Friends of the Earth International

ON LAND

No improvement

THE AMOUNT of fuel consumed in European car traffic remains as high as ever it has been – at least since 1971. While cars have certainly become more efficient, the general development of road transportation has been such as to cancel out that effect. Traffic jams, higher speeds and more traffic on the motorways, and fewer people travelling in each vehicle, have led to the result that just as much energy is being used to convey one person one kilometre today as in 1971.

There are however definite possibilities for bringing down fuel consumption. A number of models and prototype cars already exist, which have a lower fuel consumption than the majority of current models. Making vehicles lighter would also reduce consumption by 25 per cent per car and distance travelled.

In the view of Claire Holman, whose report for the European Environmental Bureau reveals these findings, electric cars are hardly likely to solve Europe's problem of air pollution. For one thing a great part of European electricity is produced by burning coal. Because of the low performance of electric cars, people are also reluctant to buy them.

Car fuel consumption. A report for the European Environmental Bureau (EEB). By Claire Holman. The EEB is a joint organ of the European environmentalist organizations.

Trams back

THE FIRST TRAMLINE to be built in Great Britain since the 1930s has been opened in Manchester. Like most other European cities, Manchester did away with its tramway system during the fifties. To restore it, even partially, is now costing the city £139 million.

The new line, Metrolink, combines a fast commuter service for two towns north and south of Manchester with ordinary traffic through the city.

Just now there is a boom in tramways in Britain. Sheffield and Birmingham are first in line, but the possibilities are being examined for forty other cities as well. □

AT SEA

Emissions curbed

The Aurora *carries passengers, vehicles, and freight across the Öresund between Sweden and Denmark. With modified diesel engines and the use of a catalyzer the emissions of nitrogen oxides are much less than they would ordinarily be.*

THE BIGGEST SHIP EVER to be equipped with a catalytic converter for cleaning the exhaust gases has just started operating as a ferry between Denmark and Sweden. Engine modification and a special adaptation of the catalytic principle have, in combination, enabled the emissions of nitrogen oxides (NO_X) to be considerably reduced.

Propulsion is diesel-electric, with four diesel engines, of which three are designed for low emissions. Making them operate at a lower pressure and temperature than conventional marine diesels has resulted in a lowering of NO_X emissions by about 40 per cent. The catalyzer fitted to the fourth engine eliminates more than 85 per cent of the nitrogen oxides, hydrocarbons, and carbon monoxide.

This is the first time a diesel catalyzer has been put into regular operation on a large vessel anywhere. The nearest other case is that of an American freighter, with a catalyzer that is only used when the vessel is lying in port.

The catalyzer on the Danish-Swedish ferry consists of a rectangular box of stainless steel, filled with ceramic material that is coated with various noble metals. Urea in suspension is injected into the exhaust gases just before they enter the catalyzer, and becomes converted into ammonia. The latter reacts in turn with the nitrogen oxides, and the final result through the action of the catalyzer is nitrogen gas and water. Exhaust cleaning in this way increases the ferry's operating costs by about 3 per cent.

Injecting urea was one of the modifications that had to be made in order to adapt an onshore technique for use aboard ship. Ammonia, which normally would be used, was considered too dangerous to have at sea on a passenger vessel. Otherwise modification was mostly a matter of reducing the size of the catalyzer.

The firm that has developed the system envisions a growing market for marine diesel catalyzers, especially in California and northern Europe. Ferry owners want to be rid of the pollution stigma. It may also be hoped that the process will be furthered by international regulations for the control of emissions from all shipping. Differentiating harbour dues in favour of ships with good environmental characteristics is another possibility.

PER ELVINGSON

In turn for mapping

A more complicated procedure than in the case of sulphur, but a method has now been developed for assessing the acidifying effect.

A METHOD FOR MAPPING the extent to which nitrogen compounds contribute to acidification has been developed by the Stockholm Environment Institute (SEI). The intention is for it to be used in working out new strategies and policies for the abatement of emissions both at the national and international level.

Sulphur and nitrogen compounds falling on soil and water cause them to become acidified. Ecosystems can also be upset by the fertilizing effect of nitrogen. Since sulphur does not get taken up to any appreciable extent by vegetation, and does not become immobilized in the soil, it may be assumed that all the sulphur that is deposited will have an acidifying effect. It is a different matter however for nitrogen, which on the one hand is an important nutrient and on the other partakes in complicated soil-chemistry processes.

Critical-load maps have for the most part concerned acidification in general (see Acid News 1/92 and 2/92). While the critical limits of tolerance for sulphur can be relatively easily read off, that is more difficult, as has just been indicated, in the case of nitrogen compounds, and the Stockholm institute has now proposed a method for assessing the acidifying effect of the nitrogen coming from anthropogenic sources.

While critical limits for sulphur can easily be read off, it is more difficult for nitrogen

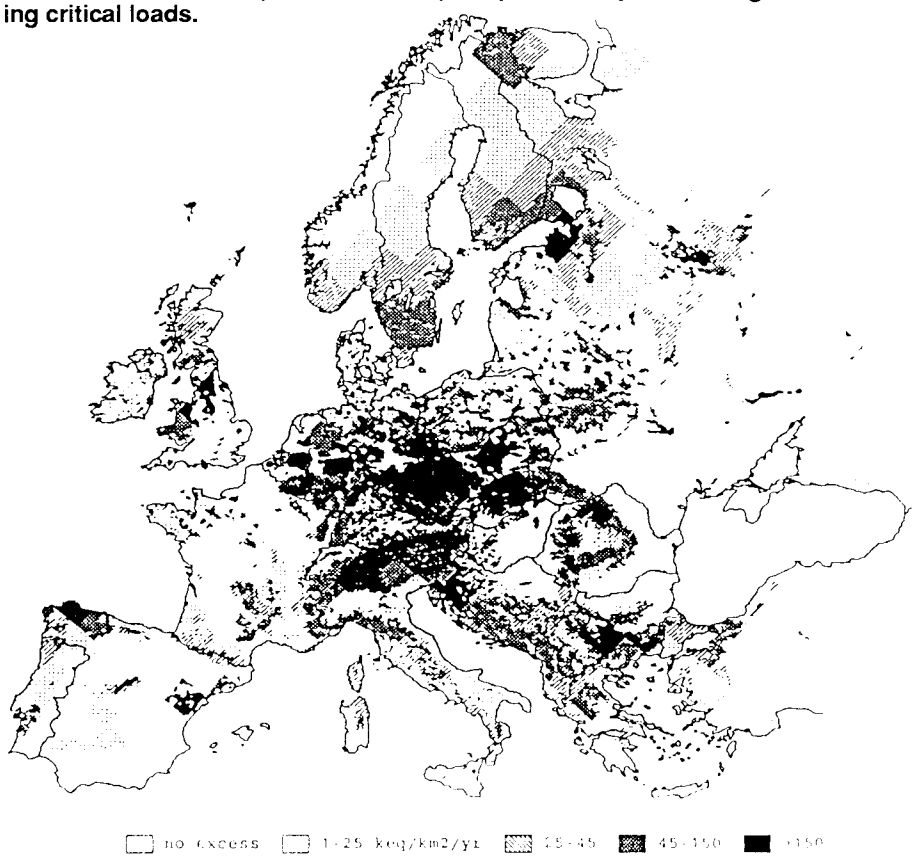
The SEI method makes assumptions as to the way a number of factors influence the part played by nitrogen compounds in the acidification process. Among them are: the removal of biomass by harvesting, the accumulation of organic matter, the drainage properties of soils, and denitrification. Maps of Europe are then made to reflect the various factors' influence on a geographical scale.

By combining the data so obtained with figures of the actual depositions of nitrogen compounds, nitrogen's contribution to acidification can be deduced. Once the acidity input due to nitrogen has been calculated, it may be added to the acidity from sulphur to get the total acidity input coming from anthropogenic depositions. A comparison can then be made with the critical loads to see where the latter are being exceeded.

The SEI had previously evolved a method for assessing critical loads for acidity and published maps to show them (see Acid News 2/91). These have now been compared with the combined acidic input of sulphur and nitrogen in order, just, to get an idea as to where and by how much the critical loads are being exceeded (see map). The SEI notes that nitrogen will assume greater importance if the depositions turn out to be greater than has been supposed – as may well happen as a result of increased accuracy in the estimating of emissions.

CHRISTER ÅGREN

The extent to which depositions of sulphur plus acidity from nitrogen are exceeding critical loads.



The acidifying input of nitrogen depositions to ecosystems: A preliminary method to allow comparison to critical loads for acidity. By J. Kuylenstierna and M. Chadwick. Obtainable from Stockholm Environment Institute, Box 2142, S-103 14 Stockholm, Sweden.

Chief stumblingblock

TRUE TRASH! So commented the NGO newsletter *Eco* in a big headline after the final text of the Framework Convention on Climate Change had been adopted in New York on May 8. The newsletter had been regularly reporting on the proceedings throughout the whole period of the negotiations.

The resulting text does not contain any concrete commitments for stabilizing emissions of carbon dioxide. Instead of presenting a set timetable for the limiting of emissions, it merely calls on countries to develop national programs for action which are to be evaluated at later international conferences. The only mention of levels is for 1990, as a guide-line and in a separate paragraph.

A despairing prayer "...and dear God, make it that CO_2 emissions will be reduced at least by 10 per cent." Far from the figures generally mentioned.

This is especially unfortunate, since an effective climate convention, with concrete commitments, was widely considered to be the cornerstone for success of the UN Conference on Environment and Development in Rio de Janeiro. Because of President Bush's refusal to hew to the line of the other OECD countries for a stabilization of CO_2 emissions, the international efforts to combat global warming have now been brought to a halt, and there is a danger that there will be no decision on the stabilization or reduction of emissions before 1998, when the convention is to be reviewed.

As Greenpeace has put it, the US is the real climate criminal in this world when it comes to the emissions of carbon dioxide. The US is responsible for 23 per cent of the global emissions, as against 13 per cent for the European Community.

Also because of US policy, the Community itself is now hesitating to adopt the necessary measures for stabilizing CO_2 emissions. In the case both of Europe and the United States, lobbying by industrial organizations has had a strong influence on government climate policy. The decision as to whether or not to impose a combined carbon and energy tax, equivalent to $3 on a barrel of oil, has been postponed by the Community until after Rio. The EC has in any case hinted that it will not introduce such a tax unless the US and Japan follow suit.

Speaking in New York, the EC Environment Commissioner, Carlo Ripa di Meana, indirectly criticized the US attitude, saying amongst other things "I consider a convention on this basis as completely unacceptable," and "Vague pledges are not suitable material for conventions." But in the end the EC accepted the vague text of the convention.

Vague pledges are not suitable material for conventions

During the last few months it has been shown in various studies that CO_2 emissions could be stabilized in the industrialized countries without any further cost. According to one published by the Verein Deutscher Ingenieure last March, there is a potential for energy saving in Germany of at least 30-40 per cent. Even a US government report from as late as April suggests that the existing energy-efficiency programs for lighting, electric motors, and air conditioning equipment will probably be sufficient to ensure that the emissions of carbon dioxide in the United Sates will be no higher in 2000 than in 1990.

One last hope for change in the US attitude may perhaps lie in the manoeuvrings of the election campaign. A bipartisan coalition, comprising 150 members of the House of Representatives and including ten committee chairmen, has for instance co-sponsored a proposal for a Global Climate Protection Act that would mandate the United States to join the rest of the developed world in stabilizing CO_2 emissions. Moreover sixty or so representatives have co-sponsored a resolution calling upon the US and other industrial countries to go even further than proposed in the above bill, and reduce carbon-dioxide emissions by 20 per cent below the current level by the year 2000.

REINHOLD PAPE

Step needed beyond the stabilization of emissions

A REPORT entitled *Back from the Brink, Greenhouse Gas Reductions for a Sustainable World,* recently published by Friends of the Earth UK, aims to show how science can determine policies for the reduction of emissions. The basic question, it says, is what rate of temperature increase is tolerable, and what it implies as regards the reduction of greenhouse gases.

The FoE report demolishes any illusions that a Convention objective based on ecological limits can be achieved without a prompt "second step" commitments by the industrialized countries – beyond a mere stabilizing of CO_2 emissions. It notes that the only concrete proposal put forward during the negotiations for a Climate Convention – stabilization by the industrial countries, even without US support, by the year 2000 – falls far short of what is required to meet such an objective.

An examination of the scenarios of the IPCC, the US EPA, and independent consultants shows, according to FoE, that global reductions of CO_2 of 20-35 per cent from 1990 levels will be needed by 2005, and 45-55 per cent by 2050. To minimize the risks beyond the end of the 21st century, cuts of 80-100 per cent may be required, rather than the 60 per cent suggested by IPCC, the Intergovernmental Panel on Climate Change.

The draft commitment for stabilization might, it says, perhaps be construed as a first step towards meeting ecological limits. But without "prompt and significant" commitments involving a second step – the reduction of emissions – the Convention objective will be no more than a gesture.

As revealed by FoE research, all projections of future temperature changes fall into the realms of uncertainty and surprise. While such developments would not be entirely without precedent, they have usually been accompanied by dramatic changes in ecosystems and the extinction of species, and have occurred prior to large-scale human activity. The risk of climate destabilization may also be underestimated because the computer models do not take into account biogeochemical feedbacks.

The rate of climate change will, says the report, be of prime importance, both to ecological and human systems. The presumably safe limit for future rises in temperature and sea level have been defined as 1-2°C and 20-50 centimetres above the pre-industrial state. Beyond these limits the risk of grave damage and climate instability would increase rapidly. And a rise of more than 2.5°C would take the human race into essentially uncharted territory.

By way of illustrating the effects of climate change, the FoE report notes that during the last 10,000 years, swifter-moving tree species have migrated northwards at rates of 30-40 kilometres per century, while some more slothful species in North America, such as chestnut, beech, maple, and balsam fir, have only managed to extend their range by about 10-20 kilometres per century.

Under the imminent new climate regime, the projections of future temperature under a business-as-usual scenario would imply poleward movements in temperate zones of 200-600 kilometres over the next century.

In June, 1990, the IPCC Energy Industry subgroup warned that to defer stabilization of emissions until 2030 would lead to an increase in concentrations of CO_2 of 100 ppm by 2060, or more than the increase from the pre-industrial period to present. It added that early action to reduce emissions would be better than later action.

The world community may, FoE says, soon accept the ecological targets principle as its "ultimate" objective. But without early action to reduce CO_2 emissions substantially, that principle may swiftly become as irrelevant as an extinct species. Nature's tolerances should form the basis for the objectives of a climate convention.

Adapted from an article by Fiona Weir in **Eco**, December 1991.

Publications

Acid Rain and the Environment 1988-1991

By Lesley Grayson. This is the third volume in a series of bibliographies concerning international research on acid rain, which now covers the period from 1980 to the present. 217 pp. £34.00, including postage. Can be ordered from Technical Communications Ltd, 100 High Avenue, Letchworth, Herts, England SG6 3RR.

Environmental technology transfer to eastern Europe: A selected bibliography (1991)

By Eve Johansson. The matter of this study concerns research into the mechanisms and process of technology transfer and the conditions for its success, with emphasis on the conceptual questions of the description and analysis of technology transfer and of the roles of the parties involved. Covers material from 1985 onwards in all western languages.

25 pp. Published by Stockholm Environment Institute, Box 2142, S-103 14 Stockholm, Sweden. Telefax +46-8-723 0348.

The effects of acid deposition on nature conservation in Great Britain (1991)

A report from a seminar on acid rain and air pollution arranged by the Nature Conservancy Council in March 1989, edited by S. J. Woodin and A. M. Farmer. Papers dealing with different aspects of the problem, such as freshwater acidification, forest damage, and effects on vegetation of the deposition of atmospheric nitrogen.

Price £8.00. 84 pp. Can be ordered from Public Affairs Branch, English Nature, Northminster House, Peterborough, England PE1 1UA.

Energi och miljö i Norden (1991)

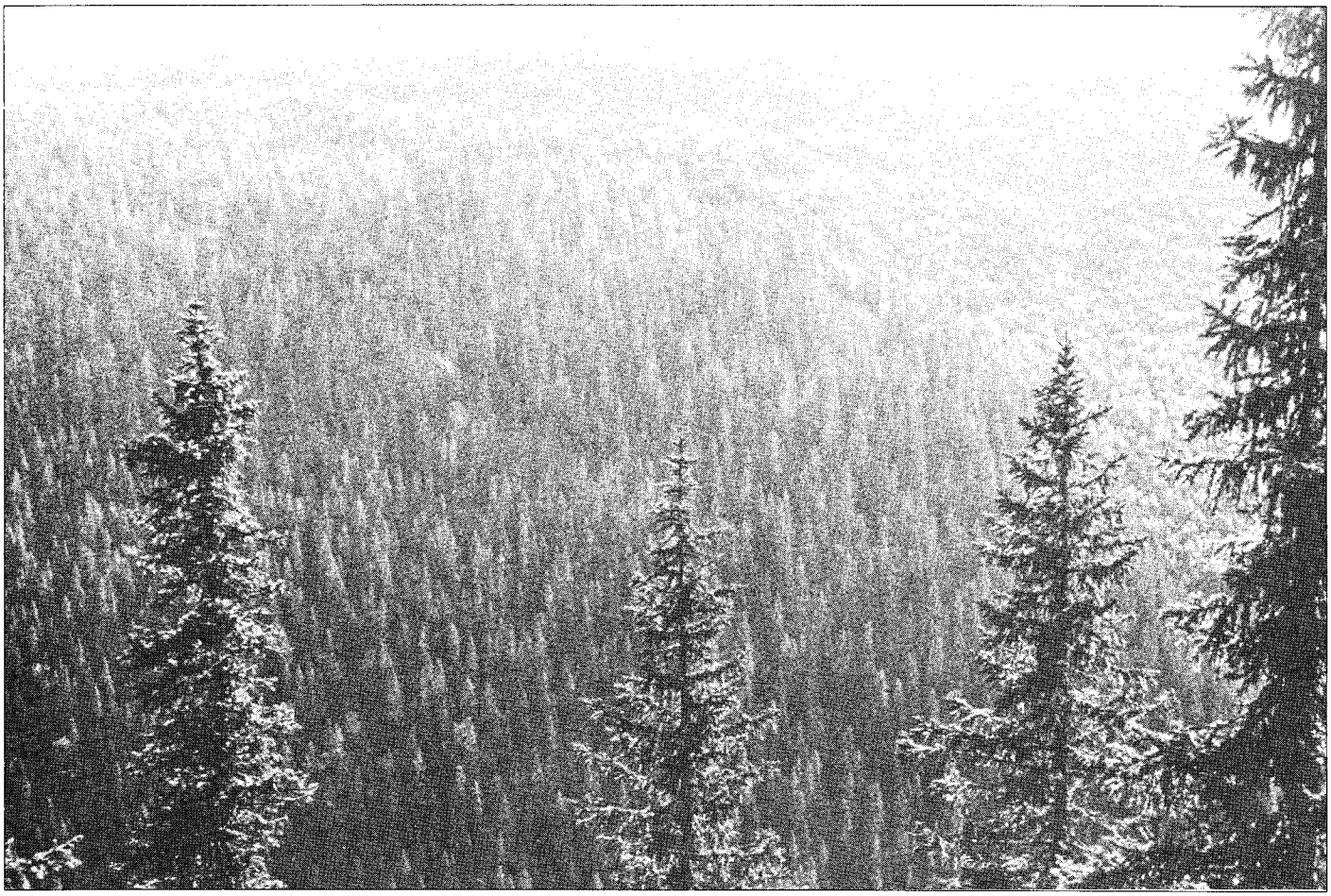
Report from the Nordic Council of Ministers on the way taxes and charges can be used as levers to control developments in the energy sector. Also touches on transportation.

Swedish only. 250 pp. Obtainable from The Nordic Council of Ministers, Store Strandstraede 18, DK-1255 Köbenhavn K, Denmark.

Enviro No. 13, 1992

Latest issue contains articles on a variety of subjects bearing in some way on air pollution. The various standards for vehicle emissions are compared, as are alternative fuels and renewable energy sources. Lake acidification is lengthily reviewed.

Subscription free of charge. Apply to the Swedish Environmental Protection Agency, Information Department, S-171 85 Solna, Sweden.



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BOREAL FORESTS

International alert

ENVIRONMENTALISTS are now focusing attention on the forest regions that encircle the globe in high northern latitudes. Groups in northern Europe, Russia, and North America are joining together to combat a growing threat to the forests in these parts, where heavy industrial development, mining, and large-scale logging are causing concern.

There are already alarming examples of what can happen on the Kola Peninsula and in the area around Norilsk, where nickel smelters emit at least 1,000,000 tons of sulphur dioxide a year, devastating thousands of hectares of forest in the surroundings.

Environmentalists are now especially concerned at the possibility of an explosive exploitation of the natural resources in the Siberian part of Russia. It is feared, for instance, that the recent signing of the European Energy Charter will mark the start for intensified extraction of coal, gas, and oil in Siberia for export to western Europe. This could affect large areas of forest. Moreover western companies have already begun to obtain logging concessions in the taiga region.

At the beginning of April two international meetings directed at the environmental problems of the Boreal region were held, in Alaska and Norway. The Alaskan meeting, with participants from the United States and Canada, resulted in the forming of a North American-Russian network.

At the same time the Norwegian and Swedish Societies for Nature Conservation were laying the groundwork for a big international scientific conference and NGO meeting in Jokkmokk in Swedish Lapland, to take place from September 30 to October 4 this year. The main subject will be the threat to the boreal forests.

In both cases the meetings were attended by a broad spectrum of environmentalist organizations, such as nature conservation societies, Greenpeace, and Friends of the Earth, as well as the Socio-Ecological Union from Russia. It is hoped to start a more formalized international network at Jokkmokk.

Western environmentalist organizations have also begun giving financial support to similar groups in Russia. The Pacific Energy and Resources Center is for instance supporting environmentalist groups in the Siberian part of Russia.

The Norwegian Society for Nature Conservation is using funds from the Norwegian Ministry of Foreign Affairs to aid environmentalists on the Kola Peninsula. A Centre of Environmental Organizations, which will coordinate the activities of some twenty groups in that area, has been set up in Murmansk. Swedish environmentalists are also about to join in and help Russian groups to build up and strengthen their organizations, as well as to campaign against environmental destruction in the Boreal forest region.

REINHOLD PAPE