Comprehensive Study of European Forests Assesses Damage and Economic Losses from Air Pollution

Damage to forests from air pollution will cost Europe at least US $30 thousand millions per year over the next 100 years unless drastic measures are taken to curb sulphur emissions, according to the results of a four-years' study by the International Institute for Applied Systems Analysis (IIASA) in Laxenburg (near Vienna), Austria. 'The value of annual forest losses from sulphur pollution alone is about three times as much as Europe's political leaders have committed to spend each year to control air pollution,' said Professor Sten Nilsson, Leader of IIASA's Forest Research Project. 'Only quick action to make drastic cuts in emissions of sulphur and other major airborne pollutants will begin to make a difference, and even then it is probably too late [to save] some forests in Czechoslovakia and the eastern regions of Germany, which will simply die over the next decade.'

IIASA research workers estimate that damaging levels of sulphur deposition are being inflicted on 75% of all European forests, while 60% are affected by levels of nitrogen deposition that exceed critical limits. Sulphur dioxide, nitrogen oxides, and ammonia, are the three main air pollutants that damage forests. The study concludes that these high levels of pollution will result in annual losses in timber of 48 million cubic metres for Western Europe, 35 million cubic metres for Eastern Europe, and 35 million cubic metres for the European part of the USSR.

This IIASA study is the first comprehensive attempt to quantify the effects of acid air pollution on all European forests, from Scandinavia to the Urals, and to estimate the economic costs of the damage. The basis of the study is an unparalleled data-base assembled with the help of more than 125 collaborators, representing all European countries. The study's assessment of economic losses from air pollution is conservative, as it is based solely on the effects of sulphur emissions on forests. Any comprehensive assessment of the full costs of air pollution would have to include the impacts of other pollu-

TABLE I

Estimated Losses Attributable to Air Pollution, by Volume and Value.

	Potential harvests (million m^3/yr)			Value of harvest reduction[a)] (million 1987 $US/yr)			
Country and Region	Without air pollution	With air pollution as per current reduction plans	Losses attributable to air pollution	Roundwood	Industrial products	Non-wood benefits	Total
Finland	59.1	54.6	4.5	234.9	317.7	635.0	1,187.6
Norway	20.6	19.8	0.8	42.0	54.9	113.5	210.4
Sweden	75.6	69.8	5.8	302.8	406.0	818.3	1,527.1
NORDIC	155.3	144.2	11.1	579.7	778.6	1,556.8	2,925.1
Belg. & Lux.	4.0	3.3	0.7	52.0	60.1	140.5	252.6
Denmark	3.3	2.9	0.4	22.6	33.6	60.9	117.1
France	56.7	53.2	3.5	232.1	314.0	627.5	1,173.6
Germany (West)	49.4	37.5	11.9	700.9	1,018.6	1,894.5	3,614.0
Germany (East)	14.6	9.7	4.9	250.4	233.2	677.2	1,160.8
Italy	20.3	17.2	3.1	333.5	595.1	901.9	1,830.5
Netherlands	0.9	0.7	0.2	13.3	18.1	36.0	67.4
UK & Ireland	15.3	11.4	3.7	234.0	306.5	632.6	1,173.1
EEC-9	164.5	135.9	28.6	1,838.8	2,579.2	4,971.1	9,389.1
Austria	17.1	13.7	3.4	191.8	206.1	515.5	913.4
Switzerland	7.5	5.1	2.4	140.4	140.2	379.6	660.2
CENTRAL	24.6	18.8	5.8	332.2	346.3	895.1	1,573.6
Greece	2.8	2.7	0.1	4.1	8.1	11.2	23.4
Portugal	7.4	5.9	1.5	64.5	95.1	174.5	334.1
Spain[b)]	17.8	17.8	n.a.	n.a.	n.a.	n.a.	n.a.
Turkey	27.0	24.2	2.8	125.4	206.9	339.1	671.4
Yugoslavia	23.2	20.4	2.8	175.3	119.3	474.0	768.6
SOUTHERN	78.2	71.0	7.2	369.3	429.4	998.8	1,797.5
Bulgaria	8.6	6.4	2.2	107.6	122.5	290.8	520.9
CSFR	23.7	14.2	9.5	540.6	369.5	1,461.1	2,371.2
Hungary	8.5	5.5	3.0	171.0	156.6	462.3	789.9
Poland	30.5	19.4	11.1	585.0	491.8	1,581.7	2,658.5
Romania	40.2	36.4	3.8	219.3	185.0	592.8	997.1
EASTERN	111.5	81.9	29.6	1,623.5	1,325.4	4,388.7	7,337.6
EUROPE (All)	534.2	451.9	82.3	4,743.5	5,458.9	12,820.5	23,022.9

[a)] Preliminary data.
[b)] Spanish data insufficient to allow calculation of pollution effects.

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tants, as well as impacts on human health, damage to buildings and infrastructure, and effects on various biological systems.

Three main factors were identified in this study as contributing most to the overall *economic* loss from the damage caused by airborne sulphur pollution on forests, namely:

1) The value of losses in commercial-wood harvest due to air pollution; the total value of the lost timber is estimated to be $6.3 thousand millions per year.

2) The losses in value added through industrial processing of wood, amounting to an annual total of $7.2 thousand millions.

3) The value of lost non-timber and social benefits on estimated total annual loss (tourism, recreation, wildlife habitat, protection of soil and water, etc.) amounting to $16.9 thousand millions.

'Our conservative estimate is that sulphur pollution alone is costing Europe $30.4 [thousand millions] per year in forest losses', said Professor Nilsson. 'This economic argument for urgent action on the part of governments represents only one aspect of the losses from air pollution, since in addition to their commercial value the forests that are being damaged have an environmental and social value that is incalculable'.

Studies by IIASA further indicate that investments of US $9 thousand millions per year, agreed to by European countries to curtail air pollution, will not achieve their objective. An effective approach would require agreement by European policymakers to increase greatly investments to cut continent-wide emissions of sulphur and nitrogen gases, through additional measures to install scrubbers and emission-control equipment, to increase efficiency and reduce burning of fossil fuels. The accompanying Table I gives details, and further information may be obtained from the undersigned.

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Leading Conclusions of the (first) International Conference on River Conservation and Management

This Conference, which was organized by the British Nature Conservancy Council and held at the University of York, England, UK, during 10–13 September 1990*, provided for the first time an opportunity for global exchange of information, experience, and ideas, concerning its widely significant but too-often-neglected subject. Research scientists and managers who are concerned with static water in lakes and reservoirs have had previous international and regional discussions; but flowing water is more complex, and in spite of its enormous importance as a natural resource, the study has lagged behind many other aspects of the environmental movement. It is hoped by the undersigned participants of this auspicious Conference that such lagging will be remedied henceforth through updating conferences of similar nature at suitable time-intervals of a few years.

Rivers, as understood by this Conference, range from the largest in the world to little tributaries and brooks. Their study, conservation, and uses by and for Mankind, range through pertinent physical, chemical, and biological, factors which need to be integrated into plans for conservation and wise use. To help in this, all normally-inhabited continents of the world were represented by some 300 delegates assembled from 29 different countries of whom a large proportion addressed the meeting or displayed their experience and exhibited their problems by means of posters.

Although there was no attempt at this pioneering Conference to formulate resolutions or pass a general statement or imperative, the vast store of information that was presented and discussed led to general agreement on a number of points which include the following twelve chosen and elaborated by the undersigned.

1) *Flowing-water ecocomplexes exist in a matrix* of terrestrial and more or less dynamic aquatic environments which impress upon the river or stream their own characteristics — to the extent that river conservation is largely a problem of conservation of catchment areas, some of which should be preserved as a whole whereas others are insufficiently notable.

2) Conservation of a river should be related to conservation of its *entire catchment area*. This is difficult and sometimes impossible with large international rivers of which the catchment is shared by several countries; but it is usually possible for small rivers and streams where the quantity and quality of water-flow can be related to local geological and/or edaphic features, plant and/or animal populations, and human activities.

3) The *supply of water* carried in many rivers has shrunk in recent years as a result of extraction, while the quality of the water which they carry has been affected — often extremely seriously — by pollution; these factors, and foreseeable future changes in them, need to be taken into account in all river and stream management.

4) Although *floodplains* are often of great importance, their study has been widely neglected — especially as to how their advantages and disadvantages for Nature may be involved most advantageously in river management.

5) Policies for regulating activities within river basins tend to be conditioned mainly by the *high economic potential* of water and the energy which it carries when flowing and falling: here again all local economic and political interests should be subservient to long-term conservational ones. Particularly to be borne in mind are the effects of large dams on the river systems and floodplains lying downstream of them.

6) To the aesthetic and academic objectives of conservation that are usually cited should be added *utilitarian values* of aquatic resources such as those of fisheries, drawdown agriculture, and floodplain forestry — noting, however, that all of these have the capacity to alter the nature of the ecocomplex very substantially if pursued incorrectly.

7) In engineering projects that are intended to increase flow in rivers, and/or to drain wetlands which are related to rivers, there are many opportunities for *ecological*

* as described on page 376 of this issue. It is expected that 'an edited book, based on the Conference', will be published in 1991 (P.J. Boon, *in litt.*). — Ed.