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This is the concluding
report of the Turin January
Conference to which Jean Brunet,
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contributed.



FONDAZIONE SANDRO DI TORINO

G. ZAMPAGLIONE.

ATMOSPHERE, CLIMATE AND MAN

INTERNATIONAL CONFERENCE

CONCLUDING REPORT

Turin, January 16-18, 1989

FOREWORD

The unintended effects of economic growth and development in altering the quality and behaviour of global atmospheric processes now constitute a major threat to international security and the future of the global economy.

The effects of global warming, ozone-layer depletion, and acid depositions are becoming increasingly evident. Further unanticipated consequences are likely to be discovered as scientific knowledge advances. Latest predictions show severe economic and social dislocation for present and future generations. Geographical variations in national contributions to the causes and in national exposure to risk and negative consequences of adverse environmental impacts, can easily serve to worsen international tensions and threaten the moral solidarity upon which peace is based.

It is therefore imperative to act now in a wide range of human endeavours in a collective and mutually supportive way to strengthen the bases for a human response to global atmospheric change.

The impact of human activities on climate and on the quality of global environment has been under scientific investigation during recent years. The challenges launched by the report of the Commission on Environment and Development (Brundtland Report), have been discussed at various international meetings, such as the Toronto Conference on "The changing atmosphere: implication for global security" and the Hamburg World Conference on "Climate and Development".

The Fondazione Sanpaolo di Torino, has convened an International Conference in Turin (Italy) on "Atmosphere, Climate and Man: society and the greenhouse effect, ozone layer depletion and acid rains", from 16th to 18th January 1989.

This Conference calls upon all governments, the United Nations and its specialized agencies, industry, trade, and commercial groups, educational institutions, non-governmental organizations, and social groups, families, and individuals, to consider and take appropriate action to mitigate the impending crisis caused by pollution of the atmosphere and, in particular, urges the development of a broad plan of action for the protection of the atmosphere harnessing the efforts of all nations and peoples.

Recognizing that we are only in the early stages of what will inevitably be a long struggle for scientific understanding, effective monitoring and

management, identification and evaluation of policy options, and agreement on concerted and collective action, the Turin Conference urges that substantially increased financial resources be made available from public and private sources to address all aspects of this complex situation.

Moreover, recognizing that past irreversible actions have already committed the globe to some significant climate change, sea level rise, and further depletion of the ozone layer, the Turin Conference calls for special attention to the needs of the most vulnerable nations, and groups within nations, and asks that as a matter of urgency special steps be taken to assist in the strengthening of the research, management, response and adaptive capacity of those most vulnerable and most at risk. This also considering the generational gap between those who are now contributing to the build-up of environmental problems and those who will suffer from them in future times.

While there is little room for doubt concerning the severe consequences of atmospheric pollution, there is continuing uncertainty concerning the process of atmospheric chemistry which requires major research and monitoring.

Neither the scientific uncertainty nor the lack of precise knowledge concerning the social and economic interactions with the atmosphere is reason for delay or inaction. On the contrary, the time lag between emissions and their effects means that unless preventive action be taken urgently, it will be too late.

The actions proposed are therefore both reasonable and prudent. They are a means of reducing risk and an insurance policy against more extreme consequences. Furthermore, many of the proposals made here can be supported on grounds other than concern about atmospheric change: energy conservation and improved efficiency, for example, are justifiable on economic and other grounds.

Considering the profoundly disruptive effects that atmospheric pollution is likely to have, and considering the totally inadequate response capacity of many of the poorer and less-developed countries, the Turin Conference calls upon national governments in industrialized countries, bilateral and multi-lateral aid agencies, the World Bank, the International Monetary Fund, the General Agreement on Tariffs and Trade (Uruguay Round) and other financial institutions including commercial banks to take the impending effects of atmospheric change into account in all their planning, investments, and macro-economic policies, especially in relation to those

national economies which are already most pressed and least able to respond to adverse environmental change.

The Conference expresses gratitude to the Fondazione Sanpaolo di Torino on its initiative in sponsoring and organizing this important international event focused on Atmosphere, Climate, and Man, and recommends that the conclusions be widely distributed.

The following paragraphs address in turn the problems of the greenhouse effect, ozone layer depletion, and acid depositions and include specific recommendations for action.

The recommendations which follow, preceded by brief statements of the individual problems, summarize the discussion which took place in Turin at the International Conference on "Atmosphere, Climate and Man".

1. GREENHOUSE EFFECT

Certain gases, present in the Earth's atmosphere in trace quantities, are transparent to incoming solar radiation, but absorb and re-emit the infra-red radiation from the Earth's surface. This heat-trapping process is called the "greenhouse effect".

This effect is not in itself bad. Quite the contrary, it has been calculated that if it were not for the presence of natural, background concentrations of greenhouse gases in the atmosphere, especially CO₂ and water vapour, the mean temperature of the Earth's surface would be - 18°C, that is 33°C lower than the present mean of +15°C.

In other words, this natural greenhouse effect has created our present climate and has provided the conditions to support biological evolution over millions of years. Now, however, as a consequence of man's economic activities and especially the pattern and the quantity of his energy use, man is altering the composition of the atmosphere in a way that constitutes a menace for the future. The increasing concentration of carbon dioxide (CO₂) and of other greenhouse gases due to human activities, is causing a rise in average global surface temperature. If current trends continue, the resulting rapid warming may do very serious damage to agriculture, may lead to a significant rise in the level of the oceans and may increase the frequency of extreme weather events (including droughts, floods, etc.).

The dynamics of the greenhouse effect are not perfectly understood in all their complexity. Mathematical models and reasonable assumptions are used to estimate the cause and effect relationship between the concentrations of various chemical compounds in the atmosphere and its future temperature. In addition to carbon dioxide, other gases also produce a greenhouse effect. These gases include methane, ozone, chlorofluorocarbons and nitrous oxide (N_2O). The concentration of these gases into the atmosphere has continued to increase in recent years, particularly for methane.

Due to the high risks associated with rapid climate change, we in Turin consider it urgent for national governments to adopt an "Insurance Policy" that is preventive action, to slow the rate of emissions growth. This would, in effect, "buy time" for additional research and allow the development of adaptive measures to those climate changes which are now unavoidable.

The causes of this dangerous situation are as follows: as a result of human activities, mainly the burning of fossil fuel and the destruction of forests, the concentration of carbon dioxide in the atmosphere has risen by about 25%, that is from 280 ppm to almost 350 ppm, from 1860 to the present day. Over the same period the average global surface temperature of the planet has risen by about $0.6^{\circ}C$. There seems to be a cause and effect relationship between these two data.

World consumption of energy during the last hundred years has risen much faster than population. Indeed, for a long time energy consumption was rising exponentially. The fossil fuels (coal, oil and natural gas) are the predominant commercial energy sources and together account for almost 90% of world energy supplies. Consumption of these fuels now exceeds 7 billion toe (tons of oil equivalent) per year and results in the release of about 20 billion tons of carbon dioxide into the atmosphere annually.

Various sources estimate that between 10 and 30% of the increase in atmospheric concentration of carbon dioxide has been caused by deforestation; that is, by the cutting down and destruction of forests, especially the tropical forests. In the past, deforestation took place on a vast scale in Europe and North America. It is now a phenomena in countries like Brazil, Zaire, Nigeria and Indonesia. Once forest cover is gone, heavy tropical rain then leads to massive soil erosion which reduces the ability of the cleared land to sustain farming. The loss of fertility promotes further

deforestation to gain new agricultural land in a vicious circle. In semi-arid areas the final result is desertification.

To put an end to this process, large scale social forestry and reforestation programmes must be initiated and further irreversible destruction of the forests avoided. It is well known that the process of photosynthesis which creates organic matter takes place with fixation of carbon dioxide from the atmosphere. For example, we know that we need a minimum of approximately 400,000 km² of new forests to absorb about one gigaton of carbon dioxide per year.

Assuming continued increase in world population and a moderate increase in per-capita income in the various parts of the globe, it is likely that energy use will continue to grow for the next 50-100 years. Many recent studies suggest a high probability of a resulting temperature rise of 2-4°C at the equator, with even greater rises at higher latitudes, with a consequent shift of the rainbelt. Food production will be seriously affected. Over the same period, the sea level could rise by between 30 and 150 cm, in part because of thermal expansion of water and in part as a result of melting of the ice caps.

Even if global fossil fuel consumption stabilized at its present level, the atmospheric concentration of carbon dioxide would continue to grow and the planet would continue to warm. The only way to reduce the risks of rapid climate change is to reduce the rate of greenhouse gas emissions to levels that can be removed naturally by bio-geochemical cycles or by other natural cycles.

Proposals follow for both monitoring and research to increase understanding of the greenhouse effect and for energy policies designed to limit the increase in greenhouse gases in the atmosphere.

A. Monitoring and research on the greenhouse effect:

- Extend and maintain the monitoring network to measure changes in atmospheric carbon dioxide and other greenhouse gases, increasing especially coverage of the Southern Hemisphere.
- Improve the monitoring of ocean levels and coast-line movements.
- Undertake further study of relationships between the build-up of greenhouse gases in the atmosphere and the regional distribution of

warming and of climatic effects, taking account of all the key feedback mechanisms.

- Building on the WMO-UNEP World Climate Programme, the International Geosphere Biosphere Programme and the Human Response to Global Change initiative, expand and coordinate multidisciplinary international natural science research on the dynamics of the dissolving of carbon dioxide in sea water and of subsequent biological and geochemical changes. Simultaneously, expand interdisciplinary social science research on the human interactions with these linked atmospheric problems.

- Study changes in the kinetics of processes of photosynthesis and respiration due to increased carbon dioxide concentrations in the atmosphere and of the resulting effects on biomass production, including food production.

B. Energy policies:

- Echoing the call to action of the "Toronto Conference on our Changing Atmosphere", we assembled in Turin urge all industrialized countries to reduce their CO₂ emissions by 20% from present levels over the next 15 years. We recognize that a least 50% of this reduction can be achieved through improved efficiency and the remainder by shifting the fuel mix.

- Establish reasonable strategic objectives and policies within each country or group of countries for simultaneously improving energy efficiency and stimulating economic growth.

- Promote recycling of energy-intensive materials (e.g. metals and glass), protect products and industrial plant from corrosion to increase their life, and encourage replacement of energy-intensive and materials-intensive products by others with less-intensive requirements and energy efficiency.

- Establish performance standards, for energy consumption in the manufacture and use of specific products (e.g. cars, domestic appliances, light bulbs, heating appliances etc.), and encourage investment to achieve these standards while providing economic disincentives for those products which do not meet them.

- During the planned transition by 1992 to a single internal market within the European Community, adopt common standards for cars that

incorporate "state of the art" pollution controls, with incentives for maximum vehicle efficiency.

- Encourage the development of high-efficiency energy technologies (e.g. cogeneration of electricity and heat, fuel cells and advanced gas turbines) and less carbon-intensive energy sources as an alternative to fossil fuels (i.e. renewable energy sources, geothermal power, nuclear power with enhanced, inherent, and passive safety).

- Encourage cost-effective use of thermal insulation and solar heating, including passive solar heating techniques for buildings.

- Promote and encourage research and development aimed at drastically reducing the energy intensity of industrial processes (e.g. aluminium and steel), transport (cars, trains), dwellings (thermal insulation) and agriculture (fertilizers).

C. Halting Deforestation:

- To set reasonable targets for reducing the rate of destruction of tropical forests so as to reverse current trends together with a set of internationally coordinated policies to facilitate achievement of these objectives (limitations on imports of tropical woods, development funds designed to replace structurally sources of income related to deforestation); mechanisms linking debt relief of developing countries to projects for reafforestation and preservation of existing forests.

- Study of techniques to increase the productivity of forests in temperate zones, estimate costs and benefits, and encourage their adoption in the most favourable cases.

2. OZONE LAYER DEPLETION

The small amount of ozone in the upper atmosphere protects the planet from harmful ultraviolet radiation. Loss of ozone is thought to contribute to skin cancer, cataracts, and the destruction of marine ecosystems. The progressive destruction of the ozone layer in the upper atmosphere (15-30 km altitude) has been accurately observed, particularly during the spring season in Antarctica. This destruction is attributed to the presence in the atmosphere of growing quantities of chlorofluorocarbons and

fluorobromocarbons. The photochemical breakdown of these compounds produces atomic chlorine and bromine that catalytically destroy ozone. An additional cause of destruction of atmospheric ozone is represented by nitrogen oxides both produced naturally and in agricultural and industrial processes.

Chlorofluorocarbons and fluorobromocarbons (CFCs and halons) are chemical compounds synthesized for a number of industrial and consumer market uses (refrigeration, air conditioning, expanded foam for packaging, propellants for aerosols, fire-extinguishers etc.). They are manufactured by a relatively small number of chemical companies. The problem of the possible adverse effects of these compounds on stratospheric ozone has been known since 1974. The Montreal Protocol committing the producer states to reduce the amount of such products, hopefully leading to a halving of output of chlorofluorocarbons by 1998, has only come into effect this year.

While research is proceeding, national governments should:

- Strengthen and accelerate the limitations on production of these compounds provided for by the Montreal Protocol, encouraging rapid elimination of the most dangerous CFCs and halons.
- Encourage the development of safe substitutes by introducing taxes designed to discourage the use of conventional CFCs and halons, and by encouraging action to recover and recycle these compounds wherever possible, thus preventing their release into the atmosphere.

3. ACID DEPOSITIONS

The increase in the acidity of rain which has occurred in the last thirty years, principally in industrialized countries, is attributable to the formation of sulphuric and nitric acids in the atmosphere. These acids are produced by hydration and oxidation of sulphur and nitrogen oxides formed largely through combustion of fossil fuels.

Though there are natural phenomena which result in the presence of sulphur and nitrogen oxides in the atmosphere (volcanic activity, lightning), it is estimated that emissions of these gases resulting from human activities have now exceeded natural production world-wide and are markedly higher in the most densely populated industrial regions. It is estimated that in

Europe today sulphur dioxide emission amounts to 40-50 million tons/year, almost double the figure for North America. It is also estimated that 15-20 million tons of nitrogen oxides (NO_x) are emitted in Europe annually.

Circulation of air in the upper atmosphere, stimulated by storms, leads to long-range transport of these air pollutants. The problem of acid rains is therefore an international question, requiring political agreements to prevent individual countries suffering serious damage from acid rains caused by emissions originating outside their own territory.

In the last 10-15 years, following alarm signals, notably the devastating acid pollution of lakes above all in Scandinavia and the progressive destruction of forests, restrictions have been imposed in various industrial countries on the amounts of sulphur and nitrogen oxides released into the atmosphere from thermal power stations and other fixed industrial plants, as well as from domestic heating systems and road transport.

To limit future risks, all countries must redouble their efforts to minimize future emissions of these dangerous pollutants. Some industrialized countries, particularly those in Eastern Europe, and practically all developing countries have not adopted measures to limit emissions, so that today the urban areas of these countries are among the most polluted parts of the world.

Tackling acid rains requires both corrective and preventive strategies for reduction of emission through the following:

- Increased energy efficiency and the replacement, where possible, of sulphur-containing coal and oil by other less-polluting energy sources.
- Reduction of the sulphur content of fuels by appropriate treatment.
- Adoption of both advanced combustion techniques and processes that limit future emissions.

4. ENVIRONMENT, SOCIETY AND DEVELOPMENT

The effects of climate change and ozone layer depletion depend not only on the degree of environmental change but also upon the capacity of social and economic systems to adapt to the changes which are now inevitable.

There is an urgent need to expand research on the social, economic, health, legal, and technical aspects of global environmental change to complement the scientific work in progress.

In particular, the aims of social and economic policy studies should be to enable international agreements to be reached on the basis of common understanding and informed world public opinion.

Although some regions may be more severely affected by climate change than others, no country can now be confident that it would profit from a rapid global warming. Additional research is needed to identify the differential vulnerability of human societies with a view to finding and proposing ways in which the places and people most at risk might be protected and their response capacity improved.

Concerted international action in response to global environmental change will be more difficult to achieve without renewed commitment to the achievement of a much higher degree of equity between nations and peoples.

The majority of the pollutants which have accumulated in the atmosphere and those currently produced (starting with carbon dioxide) come from industrialized countries. The increase in population predicted for developing countries and the gradual raising of their standards of living might alter that situation.

There are real limits to be found in the environment, which make it unlikely that developing countries can reach an economic level comparable with that enjoyed by industrialized countries today by following a similar pattern of development, in terms of intensity of energy and raw material use and pollution generation. Levels of efficiency in the use of energy and other resources and the state of environmental protection are currently much lower in developing than in industrialized countries, especially in the West.

It is therefore necessary for developing countries to leapfrog certain traditional stages of industrialization, aiming directly at the use of the most advanced technologies which are more efficient and less damaging to the environment than those that have been used before.

Richer countries should help the less developed to make this transition. But it is impossible for them to do so unless they act simultaneously and quickly to improve their own modes of producing and consuming goods. Only if they show that they are willing and able significantly to reduce their own

consumption and scrupulously to protect the environment can they really help developing countries. A marked reduction in emissions, especially of carbon dioxide, in industrialized countries is also essential given a seemingly increase in consumption of energy in developing countries, determined by their need to construct large infrastructures and raise the standard of living of their population.

Our recommendations in this area are as follows:

- Study the possibility of an international tax on fossil fuels and the creation of a World Atmosphere Fund, with the aim of promoting the transition to other forms of energy and energy saving measures.
- Accelerate research and demonstration projects on the efficient use of biomass, and other renewable energy sources, which could rapidly improve the situation particularly in developing countries.
- Make the provision of aid and loans for the construction of large energy plants conditional on demonstration that the investment required is less than that required to save the same amount of energy by other means.

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FONDAZIONE SANPAOLO DI TORINO

INTERNATIONAL CONFERENCE "ATMOSPHERE, CLIMATE AND MAN"

CONCLUSIONS AND RECOMMENDATIONS

The International Conference on "Atmosphere, Climate and Man", organized by the Fondazione Sanpaolo di Torino has reached certain conclusions and recommendations.

In listing the ten recommendations of the different environmental problems discussed during the Conference, we must keep in mind that the definition and accomplishment of a defence strategy of the environment and the protection of the climate of our planet depends on an interdisciplinary research effort which includes not only technology and physics, biology and chemistry but economics and the social sciences as well.

GREENHOUSE EFFECT

1. Extend research on climate and meteorology; study their correlations with the concentration of CO₂ and of other greenhouse gases (methane, nitrogen oxides, etc.) in the atmosphere. Investigate the relationships between temperature, concentration of CO₂ and photosynthesis.
2. Throughout the world, improve energy efficiency, establishing standards based on the best available technologies, encouraging the recycling of energy-intensive materials and discouraging, through



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economic disincentives, the production and use of products not meeting the standards.

3. Encourage the development and the diffusion of renewable energy sources and of highly efficient energy technologies (for example in the production of electricity).

4. Halt deforestation and promote reforestation projects world-wide, especially in tropical developing countries. Link assistance projects for developing countries to the need to preserve forests.

OZONE

5. Strengthen the limitations provided for by the Montreal Protocol, imposing more stringent limits to the production of CFCs and halons, encouraging research to identify substitute products.

6. Undertake public campaigns to discourage the use of CFCs and to avoid when possible their emission into the atmosphere.

ACID RAINS

7. Promote the increase of energy efficiency and when possible, the substitution of fossil fuels. Adopt advanced combustion techniques with lower pollution levels and increase the efficiency of energy use.

ENVIRONMENT AND DEVELOPMENT

8. Study the possibility of an international tax on fossil fuels and the creation of a World Atmosphere Fund for the protection of climate.

9. Encourage research and the development of biomasses for energy use to provide a valid



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alternative to fossil fuels, particularly in developing countries.

10. Make the provision of aid and loans for the construction of large energy plants conditional on demonstration that the investment required is less than that required to save the same amount of energy by other means.

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