A more important and fundamental limitation of equation (8) is the range of applicability of solubility parameters and hence molar attraction constants. HILDEBRAND and SCOTT[16] have warned against the use of the solubility parameter concept for polar compounds unless the dipole is well buried within the molecule and specific directional forces are unimportant. In order to overcome this problem various attempts have been made lately to extend HILDEBRAND and SCATCHARD's equation to polar compounds such as acids, alcohols and ketones by the use of polar[17] and even 'three-dimensional' solubility parameters[18], but the success has been very limited. There is no reason why the above analysis of the inter-relationship between π and F could not be re-examined in such a manner but it is doubtful whether there would be any significant improvement in the π values calculated for partition between water and 1-octanol and for polar groupings in general. It is therefore concluded that F values are only a rather inaccurate measure of relative partition coefficient that ignore differences in molar volumes of functional groups. In view of the uncertainties associated with F values[9] and the problems of applying regular solution theory to polar systems, it seems highly advisable to use experimentally measured parameters such as π for structure activity correlation.

Calculated and experimental π values

Functional group	Cyclohexane		1-Octanol	
	Calculated π	Experimental π[a]	Calculated π	Experimental π[b]
$-CH_2-$	0.65	0.65	0.60	0.50
$-OH$	−3.75	−3.50	−1.78	−1.2
NH_2-	−1.22	−2.3	−0.74	−1.3
$-Cl$	0.55	0.7	0.62	0.47
$-CHO$	−0.47	−1.2		
$-COOH$	−3.14	−2.5	−2.3	−0.47
CH_3CO-	0		−0.51	−0.7
$-CH{=}CH_2$	2.6			
CH_3COO-	0.07	−0.2	1.0	−0.3
$-CO$	−0.65	−0.5		
$-CN$	−1.8	−1.25	−1.1	−0.84
Phenyl	1.85	2.75	2.1	1.9[c]
Cyclohexyl	3.85	4.2[d]	3.65	2.51[c]
Sum of squares of differences between calculated π and experimental π	3.8		6.3	

[a] Reference [14]. [b] Reference [15]. [c] Reference [2]. [d] Estimated from solubility data.

Zusammenfassung. Molare Anziehungskonstanten wurden herangezogen, um Beziehungen zwischen chemischer Struktur und biologischer Wirkung zu verstehen.

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[15] C. HANSCH and S. M. ANDERSON, J. org. Chem. *32*, 2583 (1967).

[16] J. H. HILDEBRAND and R. L. SCOTT, *Regular Solutions* (Prentice Hall, Engelwood Cliffs 1962).

[17] R. F. BLANKS and J. M. PRAUSNITZ, Ind. Eng. Chem. (Fundamentals) *3*, 1 (1964).

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PRO NATURA INTEGRA

Editor's note. Under the title of 'Pro Natura Integra', papers on fundamental research in the field of bio-protection will appear. Over-population, under-nutrition and changes in environment have led to ecological disturbances in the balance of Nature which threaten the existence of mankind. Man is faced with uncertainty through the changes in his environment. This most critical crisis can only be over-come by a society which has the will to carry out a biophylaxis which is scientifically founded, ecologico-economically co-ordinated and biopolitically responsible. H. M.

The Environmental Crisis. Commentary on the 1970 European Conservation Year

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This is an attempt to give a survey of recent studies of the environmental crisis in the United States and some activities to control it. The dimensions of this problem are much too large to be dealt with in some depth within the scope of this paper. Emphasis has therefore been given to developments which have led to issues in the scientific and public debate.

Conditions in the United States have caused a more precipitous development of the environment crisis than in in Europe. The interaction of various factors involving the response of the public to the environmental crisis, new scientific findings on the effects of pollutants (DDT) and the coinciding popularization of ecological concepts lead to a consensus of opinion on bio-political measures such as the 'Environment Policy Act' passed in December, 1969.

A review of these developments in the United States was written at the suggestion of Professor H. MISLIN, who is concerned with the formulation of a biopolitic for Europe, based on Ecology[1].

Through the good offices of Dr. N. SOMBART of the European Council I have become acquainted with the excellent and estensive long-range planning of European countries to control environmental pollution. These efforts will receive particular emphasis during the 1970 European Conservation Year, to which this article is presented as a tribute.

The past decade has witnessed an extraordinary steady growth of technology associated with an alarming decline of the quality of the environment. Although conservationists and some ecologists have always expressed their concern about the growing environmental deterioration it was not until Rachel Carlson's book[2] *The Silent Spring* appeared in 1962 that the environmental pollution became a matter of extensive public discussion. It took 7 years until the partial restriction of DDT was announced. We enter the seventies with a full 'Environmental Crisis' and are confronted with the need for far-reaching decisions.

The global scale of environmental pollution has been clearly documented in the 1968 AAAS Symposium[3] to which I refer in the subsequent discussion. Recent studies of atmospheric CO_2 have led to the conclusion that about half of all fossil CO_2 released by man since the 19th century has not been taken up by the terrestrial biomass and the oceans but has accumulated in the atmosphere. The CO_2 excess (compared with the atmospheric CO_2 level in the year 1850) found in 1968 in the atmosphere is estimated at 11% and is projected to rise to 27% by the year 2000 (J. M. MITCHELL[4]). Using a mathematical model of the whole atmosphere, MANABE[5] calculated that a 25% increase in atmospheric CO_2 by the year 2000 would result in an increase of 0.8 °C in atmospheric temperature which could have a significant effect upon the climate on the earth's surface. Although the rise of atmospheric CO_2 is a widely accepted fact, there is not agreement on the possible effects on the world climate. The most recent review of the atmospheric CO_2 problem[6] discusses the role of photosynthesis and calcium carbonate coral reef building in the maintenance of the atmospheric CO_2 level. The rate at which the oceans can absorb CO_2 from the atmosphere is slow in comparison with the rate at which industrial man is adding it. World-wide climatic and ecological consequences of an increased atmospheric CO_2 level cannot be predicted with certainty, but the likely prospects call for international actions to control emissions. The CO_2 problem is also discussed in the broad context of air pollution in a recent special report of the American Chemical Society[7]. The same report also discusses in depth water pollution, solid waste disposal, and pesticides in the environment.

The recent rapid spread of cities across the United States and the associated increase in automobile traffic had lead to a massive increase in air contamination. V. SCHAEFER[8] reported a 10-fold increase in airborne particles during the last 10 years in many places in the United States. Plumes of pollutants arising from large cities near the oceans, like New York, have been found for hundreds of miles out at sea. Similar observations have been made over the seas surrounding the British Isles and other parts of Europe (HOGAN[9]). Inadvertant weather modifications have been caused by atmospheric pollution. A good example has been reported by CHAGNON[10]. He observed in the downwind area of Chicago-Illinois-Gary-Indiana urban complex of large steel mills and highways a 31% increase in precipitation, 38% rise in the number of thunderstorms, and 240% increased of hail incidences since 1925. These changes in weather were found to show a correlation with steel production over the years.

The oceans are considered the ultimate sink for many pollutants. It is well known that DDT is transported by rivers and collected in the oceans. DDT produced in the United States has been found in the penguins of the Antarctic region. Winds also play a great role in the transport of pesticides. GOLDBERG[11] reported that pesticides used in Africa were transported 6000 km across the Atlantic Ocean to the Caribbean Islands. LUNDHOLM[12] has emphasized the significance of the interaction between oceans and terrestrial ecosystems for the transport of pollutants. DDT which may concentrate in oil slicks on the oceans because of its high lipid solubility can easily be broken up in breaker zones along the coasts and become airborne. Acid rains may develop when hydrogen sulfide escapes from polluted marine environments. LUNDHOLM reported a marked increase of the acidity in the rains during the last 10 years in Sweden.

The effect of DDT on the food web in the marine environment has been extensively studied in recent years demonstrating the accumulation of DDT and resulting reduction in population size of carnivores particularly birds. The latter stand at the top of the trophic structure (phytoplankton–zooplankton–carnivores of several levels) and DDT is greatly accumulated going through this food chain. DDT is considered to account for a significant degradation of the oceanic ecosystems and has been found to impair the harvest of foods from estuary regions. WOODWELL[13]. L. BERKNER and L. MARSHALL[14,15] have warned of the danger that increasing amounts of pesticides in the ocean could adversely affect phytoplankton production and thereby cause a decrease of worldwide oxygen production which depends to a great extent on photosynthesis of oceanic phytoplankton.

There is a conflict today between demands for more food depending on an agricultural technology requiring more chemical fertilizers and pesticides and the demands for a clean environment. The worldwide application of nitrogen in manufactured chemical fertilizers has increased from 4.3 million tons in 1948 to 19.8 million tons

[1] H. MISLIN, *Toward a Human Ecology and Biopolitic*, Experientia *25*, 224 (1969).
[2] R. CARLSON, *The Silent Spring* (Houghton-Mifflin, Boston 1962).
[3] F. SINGER (Ed.), *Global Effects of Environmental Pollution*, Sympos. Am. Assn. Adv. Sci., Dallas, Texas, Dec. 1968.
[4] J. M. MITCHELL, *A Preliminary Evaluation of Atmospheric Pollution as a Cause of the Global Temperature Fluctuation of the Past Century*, AAAS Sympos., Dec. 1968.
[5] S. MANABE, *The Dependence of Atmospheric Temperature on the Concentration of Carbon Dioxide*, AAAS Sympos., Dec. 1968.
[6] E. I. PETERSON, *Carbon Dioxide Affects World Ecology*, Environmental Sci. Technol. *3*, 1162 (1969).
[7] American Chemical Society, *Cleaning our Environment. The Chemical Basis for Action*, Report by the Subcommittee on Environmental Improvement, Committee on Chemistry and Public Affairs (A.C.S., Wash. D.C. 1969), 249 pp.
[8] V. J. SCHAEFER, *The Inadvertent Modifications of the Atmosphere by Air Pollution*, AAAS Sympos., Dec. 1968.
[9] A. HOGAN, *Experiments with Aitken Counters in Maritime Atmosphere*, J. Rech. Atmos. *3*, 53 (1968).
[10] S. A. CHAGNON, *LaPorte Weather Anomaly, Fact or Fiction*, Bull. Am. Met. Soc. *49*, 4 (1968).
[11] E. D. GOLDBERG, *The Chemical Invasion of the Oceans by Man*, AAAS Sympos., Dec. 1968.
[12] B. LUNDHOLM, *Interactions between Oceans and Terrestrial Ecosystems*, AAAS Sympos., Dec. 1968.
[13] G. M. WOODWELL, *Changes in the Chemistry of the Oceans: The Pattern of Effects*, AAAS Sympos., Dec. 1968.
[14] L. V. BERKNER and L. C. MARSHALL, *On the Origin and Rise of Oxygen Concentration in the Earth's Atmosphere*, J. Atmosp. Physics *22*, 225–261 (1965).
[15] L. V. BERKNER and L. C. MARSHALL, *Potential Degradation of Oxygen in the Earth's Atmosphere*, Memo for file.

in 1967, and it must double again within the next 10 years to provide enough food for the world population (BYERLY[16]). COMMONER[17] has emphasized the threat to the stability of the nitrogen cycle in nature caused by the nitrogen fertilizers. He pointed out that in a normal environment nitrogen is largely in the reduced state in combination with hydrogen. The nitrogen compounds introduced into the environment by fertilizers and automobile exhausts are almost entirely in oxidized forms, which lead to environmental hazards. A large part of the nitrates, to which nitrogenous fertilizers are converted by soil bacteria, drain off into groundwater and into rivers and lakes giving rise to an intensive growth of algae. 'Algal blooms' are the end result of eutrophication of lakes, the water resources are destroyed by being burdened with organic matter (algae), which upon decay cause depletion of oxygen affecting fish and other animal life. Farmland drainage and urban sewage wastes are considered to contribute equally to the eutrophication[17,18].

BYERLY[16], on the other hand, claims that the nitrates from fertilizers do not play such an important role, but nitrogen from animal and human wastes and in particular phosphorus from detergent products are the principal causes of advanced eutrophication of lakes for which Lake Erie in the United States and Lake Zurich in Switzerland are prime examples. COMMONER also pointed out the health hazards associated with the high nitrate in some foods (particularly spinach) and drinking water. High nitrate content of drinking water is known to have caused fatal methemoglobinemia in some infants (COMLY[19]).

The World Health Organization has recommended a limit of 50 mg NO_3/l in drinking water. According to the U.S. Public Health Service[20], who recommended a limit of 45 mg NO_3/l in 1962, cases of infantile nitrate poisoning have occurred in the USA with sufficient frequency and widespread geographic distribution to compel assigning a limit to the concentration allowed in drinking water. More recently, U.S. National Technical Advisory Committee on Water Quality Criteria[21] set the permitted levels of nitrate plus nitrite in public water supplies at 10 mg N/l and the desirable limit as 'virtually absent'. (The permitted level expressed as 10 mg N/l is not significantly different from the older standards.) The Committee pointed out, however, that nitrite ion is the substance actually causing methemoglobinemia, and thus the criterion should include nitrite and nitrate. KOEPF[22] reported that about 4% of the public waterworks in the Federal Republic of Germany supply water containing more than 50 mg NO_3/l. KOEPF was able to relate the higher nitrate content of the groundwater to the type of land use, e.g., to the extent of use of nitrogeneous fertilizers on crop land. Regulatory measures for the application of nitrogeneous fertilizers with the objective to cut down the residual mobile nitrogen in the soil have been discussed by KOEPF[22] as well as by COMMONER[17].

COMMONER has discussed the conflict between further extension of modern agricultural technology and a clean environment. Is it prudent to continue depletion of the organic nitrogen content of the soil (humus) and disturb the long-term equilibrium of the nitrogen cycle? COMMONER is aware that such new approaches to soil improvement might have to be done at the cost of a lower yield of crops at a time when food supply of the world is short. Obviously far-reaching economic, political and moral issues are involved. Very recently the same problem was discussed in an editorial in *Science* by CANTLON[23] under the heading 'Confrontation or Cooperation in the Cornfield'. CANTLON stated that the gains made by agricultural technology during the last decades resulting in increased yields and lower unit costs were bought at the expense of the hidden costs of environmental pollution. CANTLON apparently received a loud response to his challenge of 'bogus bookkeeping' by various groups who insist that there is no alternative to the use of present agricultural techniques and the associated accelerating degradation. CANTLON states that, 'the restlessness among thoughtful people and many college students is aggravated by a growing awareness of this ultimately lethal flaw in our technology'. He foresees demands for improved food production and sees some hopeful sign in the inclusion of broader environmental viewpoints in the curricula of agricultural schools, e.g., the teaching of ecological principles as they apply to agriculture.

In discussing environmental quality and agricultural technology both COMMONER and CANTLON touch on the problem of the quality of food produced by the current specialized strategies for maximum food production. It is easy to predict that this problem of food quality will come more into the foreground in the years to come. Additional impetus for investigations in this direction has come from the health hazards caused by food additives such as cyclamates.

In connection with the global pollution it should be noted that the radioactive fallout from nuclear explosions encompasses every region of the earth. The growing concern of the scientific community about the consequences of the environmental crisis is expressed very well in a satyrical article by the chemist MAX THÜRKAUF of Basle University[24]. He cites the theory that the Roman Empire declined because of widespread lead poisoning caused by the use of lead drinking and eating vessels. Of course the Romans did not have any science which could teach them that lead is poisonous. We have this science today, but that does not prevent generating a general lead poisoning of city dwellers. The lead content in the blood of the average city dweller in the United States has been found to be 0.25 ppm, which is 100 times higher than the average blood lead in people living in the country. At 0.5 ppm typical symptoms of lead poisoning occur[24]. Professor G. E. HUTCHINSON of Yale, the dean of American ecologists, with his characteristic scholarly ingenuity has given another example of the ecological consequences of ancient Roman imprudence[25]. From his analyses of the sediments

[16] T. C. BYERLY, *Nitrogen Compounds Used in Crop Production*, AAAS Sympos., Dec. 1968.

[17] B. COMMONER, *Threats to the Integrity of the Nitrogen Cycle: Nitrogen Compounds in Soil, Water, Atmosphere and Precipitation*, AAAS Sympos., Dec. 1968.

[18] G. A. ROHLICH (Chairman), *Eutrophication: Causes, Consequences, Correctives* (National Academy of Sciences, Wash. D.C. 1969), 661 pp.

[19] H. H. COMLY, *Cyanosis in Infants by Nitrates in Well Water*, J. Am. med. Ass. *129*, 112 (1945).

[20] U.S. Public Health Service, *Drinking Water Standards*, revised 1962, P.H.S. (Publ. No. 956, U.S. Government Printing Office, Wash. D.C. 1962), 61 pp.

[21] *Federal Water Pollution Control Administration. Water Quality Criteria* (Report of the National Technical Advisory Committee to the Sec. of Interior, U.S. Government Printing Office, Wash. D.C. 1968), 234 pp.

[22] H. H. KOEPF, *Relations between Soil Management and the Quality of Surface- and Groundwater Supplies*, Qualitas Plantarum et Materiae Vegetabilies *17*, 45 (1968).

[23] J. E. CANTLON, *Confrontation or Cooperation in the Cornfield*, Editorial, Science *166*, 19 (Dec. 1969).

[24] M. THÜRKAUF, *Die Römer und das Bleitetraäthyl*, Techn. Rundschau *40*, 19 (Sept. 1969).

[25] G. E. HUTCHINSON, *Eutrophication, Past and Present*, in *Eutrophication: Causes, Consequences, Correctives* (National Academy of Sciences, Wash. D.C. 1969), p. 17.

of Lago di Monterosi he has shown a pulse of eutrophication resulting from the soil erosion and other changes attendant upon Roman road building.

Changes in the global scale of environmental pollution will depend to a great extent on the action taken at a *regional level*. Planning is an important government function in the United States and in Europe[26]. But the environmental science – ecology – has been brought into the regional planning only to a limited extent. The systems approach which characterizes modern Ecology has been developed far enough to provide a good tool for the determination of the limits of capacity of a region for development, industrial, and other uses (ODUM[27]). Not only industry and governments have been remiss in coping with the environmental crisis. The academic community, as evidenced by the lack of emphasis in university curricula, have not provided enough specialists of the right kinds for the struggle ahead. Public health has not received sufficient emphasis in medical curricula; many colleges and universities with strong geology and chemistry departments do not offer geochemistry; in biology the emphasis has shifted from natural history (the mother of ecology) to molecular biology and biochemistry; and many engineering colleges have neglected civil for the more popular and remunerative electrical and chemical specialities.

In limiting ecosystems studies to small well-defined regions such as a watershed, important basic information about hydrological and chemical input and output, were obtained by BORMANN and LIKENS[28], which allowed a good evaluation of nutrient budgets, erosion, and weathering in a northern hardwood forest ecosystem. The BORMANN and LIKENS paper illustrates the usefulness of the ecosystems approach to a small region yielding precise data on which environmental planning and management can be based. The general awareness of ecology has still a long way to go until environmentally determined limits for technological development are generally accepted. This is difficult in an age of such a rapid technological development and in particular in the United States where the wide-open opportunities ('The sky is the limit') prevailed for such a long time for technological development. Even if the ecological studies are in many cases only rudimentary and have not produced the desired hard data, they have provided a framework for the work of interdisciplinary groups to express broader environmental viewpoints for planning of smaller and larger regional projects such as National Recreation Area project of the Connecticut River Region[29].

The ecological systems approach has as its functional units plant and animal communities and populations, but there is a most important area left where a basis still has to be developed, that is the application of ecology to the human individual. Human Ecology is largely used as a descriptive term which means many things to many people. The interaction of human individuals with their environment involves factors not amenable to analysis by the ecosystem approach. Some limited insights into individual Human Ecology can be derived from the lessons of environmental physiology and submarine and space medicine[30–33]. But to come to grips with the whole problem of the individual's relation to his environment, a considerably broader approach is needed, perhaps in the form of 'scientific humanism' as advocated by RENÉ DUBOS[34]. It is characteristic for the dimensions of the 'Environmental Crises' and the coinciding 'Social Crisis' that we are forced to think about the total problem going beyond the viewpoint of the specialist in a narrow field to which we are accustomed. HARRER[35] stresses the point, that 'too little effort is made to achieve an integrated approach to the identification of the root causes of current world problems and to take concerted action towards their solution'. W. W. HARMAN[36], the director of the Educational Policy Research Center set up by the United States Office of Education at Stanford University in 1968, comes to the conclusion that the '*loss of the self image of man* is underlying the social ills of our time'. But he takes an optimistic view. He believes that there is a new science in the making which will undertake systematic exploration of the vast imperfectly known universe of man's own being. It is the students' revolt which makes us especially aware that the environmental crisis and the social crisis are intimately connected. Gifted with a strong moral sensitivity (KENISTON[37]) they injected moral issues into the social crisis as well as into the environmental crisis, asking about the moral aspects of man's relation to nature. These questions have brought another dimension to the scientific and social aspects of the environmental crisis, resulting in a conscious resistance to existing trends of our technical civilization. It is quite revealing that our 'futurologists', who published their forecasting for the year 2000 in 1967 and based their predictions on a continuation of present trends, failed to take the conscious resistance of youth into consideration[38,39]. The astute critic JOSEPH WOOD KRUTCH[40] emphasized this point in his review of the published predictions of future developments, in which he questioned the validity of normative forecasting. Normative forecasting underlies many of present-day planning activities, which are based on the assumption of a continuing steady growth of the scientific and technical development and the growth of the gross national product. RENÉ DUBOS has pointed out that this is a matter of the past and that we are approaching a 'steady state' in the development[41].

The most disturbing analysis of the multitude of crises society faces today has been given by JOHN PLATT[42]. He produces a crisis intensity chart and ranks the environmental crisis second in the order of 'seriousness' following

[26] Council of Europe: *Regional Planning a European Problem* (1968).
[27] E. P. ODUM, *Ecology* (Holt, New York 1963).
[28] F. H. BORMANN and G. E. LIKENS, *The Watershed – Ecosystem Concept and Studies of Nutrient Cycles*, in *The Ecosystem Concept and Natural Resources q.v. Management* (Ed. S. VAN DYNE; Academic Press, New York 1970).
[29] K. E. SCHAEFER, *Environmental Regional Planning. Limits of Capacity, Ecological Study of the Connecticut River Region* (1968).
[30] K. E. SCHAEFER, *Man's Dependence on the Earthly Atmosphere* (Macmillan, New York 1962).
[31] K. E. SCHAEFER, *Environmental Effects on Consciousness* (Macmillan, New York 1962).
[32] K. E. SCHAEFER, *Environmental Physiology of Submarines and Spacecraft*, J. Environmental Health *9*, 320 (1964).
[33] K. E. SCHAEFER, *Contributions to Individual Human Ecology. Lessons from Submarine and Space Medicine*, in *Ecological Study of the Connecticut River Region* (1968).
[34] R. DUBOS, *So Human An Animal* (Ch. Scribner's Sons, New York 1968).
[35] J. G. HARRER, *Crises in Human Ecology*, Proc. natn. Acad. Sci. *61*, 357 (1968).
[36] W. W. HARMAN, *The New Copernican Revolution*.
[37] D. KENISTON, *Morality, Violence and Student Protest*, Yale Alumni Magazine (Nov. 1969).
[38] American Academy of Arts and Sciences, *Towards the Year 2000: Work in Progress* (Daedalus, Summer 1967).
[39] H. KAHN and A. WIENER, *The Year 2000, a Framework for Speculation of the Next Thirty-three Years* (Macmillan, New York 1968).
[40] J. W. KRUTCH, Saturday Review (28 Jan. 1968).
[41] R. DUBOS, *A Social Design for Science*, Science *166*, 823 (1969).
[42] J. PLATT, *What we Must Do*, Science *166*, 1175 (1969).

the crisis of possible total annihilation by nuclear war. If mankind is still in existence 20–50 years from now, he foresees a population and ecological balance and the existence of an integrative philosophy. PLATT's time–intensity chart leaves one with the ominous feeling that it might be already too late to find solutions to the problems, and makes it more urgent to follow the recommended action for development of a 'science of survival'. There is a growing pessimism that present overloaded bureaucratic administrations cannot adequately respond to the challenges of the environmental crises and that the whole social system is not capable of handling the tasks ahead of us. There is no need to succumb to this pessimism! There are still a lot of reserves which have not come into play.

An imaginative approach to enlist the resources of the people has recently been originated by Governor Dempsey of Connecticut. He has formed a Committee on Environmental Policy consisting of over 100 citizens representing Industry, Agriculture, Science, Government, and some teachers and students to help implement large-scale changes in environmental policy. This committee is asked to assess the impact of the functions or activities of life on the environment, list alternatives with lesser effects on the environment, and come up with recommendations for action. While the recommendations of the Environmental Policy Committee have to be general in nature they hopefully provide the stimulus and public support for the in-depth research necessary to 'reverse the existing order of relationships between economy, technology and the biology of the natural environment (COMMONER[43]). Connecticut's Environmental Policy Committee was preceded by the Governor's Clean Air Task Force. The deliberations and recommendations of these citizens' groups have reformed state policy in the management of the water and air resources. Volunteer citizens' groups have also played their role, for example, the Commecticut Air Conservation Committee, a satellite of the Tuberculosis and Respiratory Diseases Association, a volunteer health organization recently sponsored the Second Connecticut Conference on Clean Air to review progress on the state's air quality program. Dr. ERIC J. CASSELL, Professor of Clinical Community Medicine at the Mt. Sinai School of Medicine in New York, spoke at the conference about the bases for air quality standards. He stressed that health was a continuum, and that the simplistic concept of one-cause one-disease was archaic, and inadequate to assure quality air. Poor health has a multiplicity of causes. He pointed out that sulfur dioxide at some level in inspired air will have direct health effects, but at much lower levels accompanied by particulates in the air, deleterious effects on lungs can be seen. Perhaps the particle surface acts as a catalyst producing sulfuric acid from the reaction between water and sulfur dioxide. This is in line with suggestions previously expressed by F. VERZÁR[45]. We would add to that idea, the likely failure of the normal bronchial ciliorary barrier to the passage of particles due to chronic bronchitis from cigarette smoking. A holistic approach is thus necessary in setting air quality standards, and so also we might add in the case of water quality standards, as emphasized by BENOIT[46].

This reseach should be oriented to determine the *Limits of Capacity* of a *Region* by documenting the effects on recycling the nutrients, the existing disturbance of the natural diversity of plant and animal species in a region, the disturbance of food chains and set up a basis for regional ecological management. Establishing Regional Limits of Capacity is the first step. Any planned technological or other development has to fit in the ecological management. To accomplish this it is probably necessary to enlarge existing regional planning agencies and give them the power to control technological developments which disturb the ecological balance. In this way it appears possible to stop the exploitation of nature and begin to pay back the *environmental debt*, which we have incurred.

I have given a report of the environmental crisis as viewed from the United States. In Europe the situation is somewhat different. The disadvantage of not having such wide open spaces available as in the United States has lead early to the recognition of limits and the need to set up regulations limiting the impact of technological developments.

However, the continued development of industrialized countries is beginning to reach a point at which the environmental crisis begins to threaten the stability of the system. There is certainly a phase difference in the severity of environmental crisis between the United States and Europe. However the danger exists in Europe, that a 'crisis of crises' in PLATT's terminology may develop, when everything gives away at once, because the system has been reasonably protected for a long time.

It is therefore of great significance that the European Council has declared 1970 as the European Conservation Year and has done a gread deal to stimulate joint efforts of the European countries to plan for the management of the environment in tomorrow's Europe. However, the European Regional Planning Activities show – like in the United States – a noticeable lack of contributions by ecologists. In order to cope with the environmental problems the science of ecology needs much stronger support in Europe than it has been receiving in the past. The European Council could play an important role in stimulating a comprehensive support of the ecological sciences.

Europe has a big problem to come to a consensus on agricultural production. This has been a political football and it appears to be a problem still hopelessly bogged down. Viewed from the recent developments in the United States (see CANTLON[23], *Confrontation or Cooperation in the Cornfield*), this very problem would provide a good practical test for the fruitfulness of the ecological approach. In setting up a European Council Committee on Ecology, which focuses its attention on the interrelations of agricultural technology – environmental quality and food quality – important contributions could be made to overcome the present impasse and develop a Biopolitic based on Ecology as suggested by MISLIN[1]. This type of work might be carried out in conjunction with the work of another European Council Committee concerned with the documentation of Regional Capacity Limits. The organization of scientific conferences on these subjects would be helpful to enlist a larger interest and support by the scientific community[47].

[43] B. COMMONER, *Technology and the Natural Environment*, Forum (June 1969).

[44] E. J. CASSELL, *A Right or a Privilege*, Address given at 2nd Connecticut Conference on Clean Air, Hartford, Conn., 20 Nov. 1969, Proceedings in press (Connecticut Air Conservation Committee, East Hartford, Conn.).

[45] F. VERZÁR, *Physiological and Toxicological Significance of Atmospheric Condensation Nuclee*, in *Man's Dependence on the Earthly Atmosphere* (Ed. K. E. SCHAEFER; Macmillan, New York 1962), p. 350.

[46] R. J. BENOIT, *Self-Purification in Natural Waters*, in *Analysis in Water and Water Pollution* (Ed. L. L. CIACCIO; Marcel Dekker Inc., New York, to be published in 1970), chap. 6.

[47] I gratefully acknowledge the helpful criticism, advice and suggestions of Dr. ROBERT BENOIT in preparing this manuscript.