

Europe's environment ministers

Information and ideas from the Ecologist

Back issues still available contain major articles on:

Population

No standing room: Population control for Britain? by Aubrey Manning. July, 1970. Population and inflation by W. M. S. Russell. February, 1971. The sardine syndrome: Overcrowding and social tension by Claire and W. M. S. Russell. August, 1970.

Energy and Resources

Eskimo Knell: The Alaskan oil boom and the Eskimo by Robert Allen. July, 1970. Is there a peaceful atom? The dangers of nuclear power by Peter Bunyard. July, 1970. Mined out! Our diminishing natural resources by Preston Cloud. August, 1970. The power crisis by Peter Bunyard. September, 1970.

Food and Agriculture

The farm drugs scandal: Antibiotics and factory farming by Joanne Bowers. August, 1970. Green revolution: genetic backlash. A discussion by four experts. October, 1970. Green revolution: social boomerang. FAO's 2nd World Food Conference by Michael Allaby. September, 1970. Integrated pest control and the human environment by Walter Ryder. March, 1972. Man-made plagues: Return to natural controls in Malaysia by Gordon R. Conway. October, 1970. One jump ahead of Malthus: Can we avoid world famine? by Michael Allaby. July, 1970. Spanner in the soil: Destruction of Britain's farmland fertility by L. B. Powell. December, 1970. Where have all the hedges gone? by Michael Allaby. October, 1970. Why not ban DDT? by Michael Allaby. April, 1972.

Pollution

The ailing air by Eric Albone. September, 1970. Britain's dying chalk streams by D. S. Martin. April, 1971. Can the seas survive? Long-term effects of pollution on marine life by J. David George. March, 1971. PCBs by John Noble and Harry Rothman. January, 1971. Pollution and the individual by J. McLoughlin. August, 1972. SO2: acid in the sky by R. T. Briggs. November, 1972. Trace elements in the human environment by Henry A. Schroeder. May, 1971.

Economics

Economics and entropy by Nicholas Georgescu-Roegen. July, 1972. The economics of hope by E. J. Mishan. January, 1971. The stationary-state economy by Herman E. Daly. July, 1972.

Health

Development and disease in Africa by Charles C. Hughes and John M. Hunter. September and October, 1972. The medicine of industrial man by John Powles. October, 1972.

Tribal minorities

The Amerindian tragedy by Shirley Keith. April, 1972. The last hunters of the Sahara: the Nemadi of Mauretania by Bruce Chatwin. August, 1970. Progress to oblivion: the Australian Aborgines by R. A. Gould. September, 1972. Robbed of a future: the Brazilian Indians by John Hemmings. November, 1972. Tribal minorities: What can we do? by Robert Allen. November, 1972. Tribal societies in the modern world by Robin Hanbury-Tenison. November, 1972.

The Stockholm Conference

The UN Conference on the Human Environment: Special issue. June, 1972. Can Stockholm survive New York? by Robert Allen. October, 1972.

Other important issues

Affluence and the elderly by W. Ferguson Anderson. April, 1972. A Blueprint applied: a workers' cooperative industry by Michael Allaby. October, 1972. The costs of urbanisation by Kenneth E. F. Watt. February, 1972. The dangers of chemical and biological warfare by Judith Nottingham. February, 1972. Education and environment by Walter P. Fenwick. August, 1972. A land in balance: Disruption of Great Plains ecology by L. J. and A. Milnes. November, 1970. Low energy housing by Andrew MacKillop. December, 1972. A model of behaviour by Edward Goldsmith. December, 1972. Russian roulette: Environmental disruption in the Soviet Union by Marshall Goldman. December, 1970. The stable society: Can we achieve it? by Edward Goldsmith. December, 1970. Will man adapt to megalopolis? The modern city and social health by Rene Dubos. October, 1970.

Back issues cost 30p each, including postage.

Complete volumes are also available: Vol. 1 (18 issues) at £5.50 including index. Vol. 2 (12 issues) at £3.00 including index. ECCOLOGIST Vol. 3 No. 8 August 1973

Lead in our drinking water

The maximum allowable concentration of lead in drinking water has recently been increased from 0.05 to 0.1 mg. per litre, in both European and international drinking water standards. This is a very disturbing development to anyone who knows the effect of lead pollution on human health and one might well ask whether this change has occurred for toxicological or for economic and political reasons.

It is alleged that lead is no longer used as a material for plumbing installations, but we find that the majority of pre-1945 houses in the United Kingdom have at least a lead service pipe and we have noted from extensive travels in Europe that lead piping is apparent in hotels and domestic premises everywhere.

Our reaction to the new WHO limit was to look at its implications as far as the new-born are concerned, and the values shown in the table were compiled for this purpose. In columns 1, 2 and 3 the relationship between age, weight and water intake per day during the first six months is given; whilst columns 4 to 6 refer to the daily intake of lead based on different parameters. The figures in column 4 are derived from the statement in the WHO International Standards that "The maximum acceptable load of lead from food and beverages has been tentatively placed at 0.005 mg. per kg. per day". If these are compared with the lead intake which would occur should the baby be given drinkingwater contaminated to the WHO limit of 0.10 mg. per litre, column 5, it will be seen that the maximum acceptable load is exceeded in every case by more than 160 per cent, a self-contradictory standard.

These figures are, of themselves worrying enough, but when synergism is taken into consideration in our

Age Months	Weight Kg	Water intake per day Litres	Daily intake based on			
			0.005 mg/kg Threshold mg Pb	0.10 mg/1 Conc n	0.10 mg Pb/1 Conc n 0.05 mg As/1 Conc n mg	
0.25	3.4	0.44	0.017	0.044	0.066	
0.50	3.6	0.50	0.018	0.050	0.075	
1	4.0	0.56	0.020	0.056	0.084	
2	4.8	0.66	0.024	0.066	0.099	
3	5.7	0.78	0.0128	0.078	0.117	
4	6.3	0.84	0.031	0.084	0.125	
5	7.0	0.88	0.035	0.088	0.132	
6	7.6	0.97	0.038	0.097	0.145	
1	2	3	4	5	6	
	-					

view the situation becomes alarming. For example, recent work in the Soviet Union has shown a synergistic effect when both arsenic and lead are present in drinking-water. They are toxicologically additive and limiting values need to be halved when these substances act together. The additive effect is shown in column 6 whose values are approximately four times those in column 4 and with a normal distribution of incidents we would expect a most probable concentration of about 100 per cent in excess of the column 4 figures.

continued on page 282

Population lobby campaign

Two recent events this year concerning Britain's population have propelled this subject into the political arena:

Population Day succeeded in gathering and co-ordinating national concern over Britain's population problem, and this must continue. The Report of the Population 2 Panel which was presented to Parliament in March 1973. Its main significance is its recommendation that the Government should concern itself with the subject of population. The Rt Hon James Prior MP, Lord President of the Council and Minister with special responsibility for population, said "The Government do not propose to determine their attitude towards the recommendations made by the Panel until there has been an opportunity for public opinion to crystallise." He has promised to make a statement on the Government's plans at the beginning of the Autumn parliamentary session.

Because of Mr Prior's statement, it is essential that MPs (and through them, Mr Prior himself) are made aware that public opinion has crystallised already. Although most MPs would probably accept that there is a population problem, they are unlikely to consider it further unless it is brought personally to their attention.

PS has drawn up a detailed plan of action for one or more people to visit their MPs in their constituency and question them. Several groups have already done this with unexpected success.

If you are interested, please contact: PS Lobby Campaign, Flat 2, 5 Riverdale Road, East Twickenham, Middx.

In this issue 292 The octopus that eats its own legs by Norie Huddle and Michael Reich Industrial pollution in Japan: the effects and reactions 296 Facing the future by Vanya Walker-Leigh Four European ministers for the environment interviewed 298 Limits to growth? The Club of Rome replies to the main criticisms of the MIT study 304 Evolution and health by Stephen Boyden Man evolved into a natural environment within which he was healthy. Then he altered the environment 310 Asbestos and cancer by Edward Goldsmith The evidence against asbestos 283 The built environment First report of the preparations for the UN 1976 Vancouver Conference 281 News 287 Comment Better pick the edelweiss! Growing market for military seizures Can we feed the world? 289 Notebook 311 Friends of the earth 312 Down to earth Composting for conservationists 313 Books 315 Letters 320 Classified advertisements 314 Coming events

Note : While every care is taken with manuscripts submitted for publication, the Editors cannot guarantee to return to their authors those not accepted.

Publisher: Edward Goldsmith; Editors: Robert Allen, Peter Bunyard, Edward Goldsmith; Managing Editor: Michael Allaby; Associate Editors: John Davoll, Jimoh Omo Fadaka, Gerald Foley, Lawrence D. Hills, Brian Johnson, Jean Liedloff, Andrew MacKillop, John Papworth, Graham Searle. Robert Waller, Richard Willson. All communications should be sent to The Editors, Ecologist. 73 Molesworth Street, Wadebridge, Cornwall PL27 7DS. Telephone Wadebridge 2996/7. All advertising enquiries to Interpress, 19 Anne Boleyn's Walk, Cheam, Surrey. Tel. 01-642 5826.

Published by Ecosystems Ltd., registered office 73, Molesworth Street, Wadebridge, Cornwall, PL27 7DS and distributed by the Hachette Group, Continental Publishers and Distributors Ltd., 4 Regent Place, London W1R 6BH, Telephone: 01-734 5259; Telegrams: Alibrairi London W1; Telex 25114. Subscriptions to: The Ecologist, 73, Molesworth Street, Wadebridge, Cornwall PL27 7DS. Printed by The Garden City Press Ltd., Pixmore Avenue, Letchworth, Hertfordshire SG6 1JS.

© Ecologist, August 1973

Lead in water continued from page 281

Unfortunately, this is not the end of the story. It is known that both lead and arsenic have the property of inhibiting sulphydryl enzymes, but so also have cadmium, mercury and selenium. Again, arsenic is a recognised environmental carcinogen; and it is seldom, perhaps never, possible to state a threshold of malignancy for any given substance. Is this another property to be shared, additively, with the other synergists we have discussed? Finally, recent work in Czechoslovakia has shown that arsenic in a concentration of 0.015 mg. per litre is lethal to human embryonic-lung cells; the WHO maximum allowable concentration in drinking-water is 0.05 mg. per litre.

We have noted, with some regret, that in the WHO International Standards an argument such as "It is difficult to reach a lower level in countries where lead pipes are used", is given as a reason for the increased lead limit in drinking-water. Two other reasons are also given; they are "Because this level has been accepted in many countries" and "The water has been consumed for many years without apparent ill effect". May we respectfully submit that for any environmental chemical levels established, especially where the substances are ingested by man and figures are issued with the authority of the World Health Organisation, that toxicological evidence from human health only is used as a criterion. Otherwise arguments which favour inefficiency are admitted, and the integrity of the standard is open to doubt.

Where do these lines of investigation end? It appears that so far as multiple effects of toxic substances are concerned we have seen only the tip of the iceberg, and then only from a distance.

To conclude, there is no doubt that there is overwhelming evidence in favour of reducing the World Health Organisation's maximum allowable concentration of lead in drinking-water from 0.10 to 0.05 mg. per litre, or even less.

This figure may be "difficult to reach" without causing economic disruption; but let us get our priorities right. If it is economic to poison people then there must be something wrong with economics.

C. D. Reed and J. A. Tolley Both authors are chemists working at the Municipal Laboratory, University of Liverpool.

192

The built environment

"I am convinced that if there are ecodisasters in the next decade or so, they are likely to occur in the large cities of the developing world," says Maurice Strong, executive director of the United Nations Environmental Programme. Such a disaster, Lady Barbara Ward Jackson predicts, could take the form of the "great epidemic one has nearly forgotten about".

Strong and Lady Jackson made these observations in Vancouver, British Columbia early this summer. They were there to preside over a meeting of a worldwide "panel of experts", called in to advise on the framework for a UN conference/exposition on Human Settlements being planned for Vancouver in June 1976.

Confex '76, as the Vancouver conference has been called during its early planning stages, will focus on solutions to the problems posed by rapid and massive urbanisation. The unique aspect of Confex '76 is its worldwide "exposition". This will not be an international trade fair or conference in the conventional sense. Rather, it will consist of a series of perhaps 100 (one or more from each member country) "experiments" in improving the physical quality of cities around the world and the quality of life of those who live in them. Some of these experiments are already completed or going on. Others will be worked out, built and analysed during the next three years.

The emphasis will be on actual working models which have been tried and found to be acceptable. They could range all the way from a toilet which recycles its own water and needs no sewer connection (developed by the Canadian government's Central Mortgage and Housing Corporation and Ontario Research Foundation over the past decade) to a complete experimental model city, such as the one being developed by the US government in Minnesota.

There will also be attempts "to

demonstrate in clear, visual terms successful results of policies, programmes, or technologies as applied to specific problems", according to an official of the UN's Centre for Housing, Building and Planning in New York. How this will work out is one of the more intriguing aspects of Confex. In the magazine Architectural Forum, Tom E. Morris recently spoke of the importance of finding ways of "monitoring human behaviour (because) crime, mental illness, welfare and other such basic data will better indicate whether a certain programme succeeds than whether a million people can be crammed into our downtowns in one hour".

Whatever form the Confex demonstration projects take, it will not be possible for all conference delegates let alone others who are interested—to visit the actual demonstration sites, which will be located all around the world. There is talk of organising a large scale (Confex is expected to attract as many people as Stockholm) tour of inspection—at least around the North American projects—and regional tours in other areas.

The subject matter of Confex '76 is critical. Strong stresses "the urgent need for practical solutions to one of the most compelling and pressing problems facing the human community ... within 30 years the human race will have crossed a fateful and astonishing historical watershed. Man will be living for the first time in a predominately urban planet." Some 3,500 million of a 6,500 million world population at the end of this century will live in communities of more than 20,000 people. They will be growing at twice the overall rate of population growth. Cities with populations of more than two million may be growing twice as fast again. "This Niagara of urban growth will require more new buildings in the next 25 years than have been built hitherto in the whole history of man.

"Another fateful change," Strong adds, "is that the majority of these

new settlements . . . will be in the poorer, still developing lands where the resources available for construction on such a scale are grossly and pitifully inadequate ... The changes that are looming could come with such speed and on such a scale that they threaten to overwhelm us-sometimes before we can even define their nature. The tide is rising. We have little time. We must set to work now before sheer scale and sheer speed have carried us into settlements constructed by chance and pressure, and set fast in unvielding concrete and steel, before we have time to know whether such settlements are really worthy of the name of a fully human environment."

The Royal Architectural Institute of Canada is an example of the interest already being shown by some private groups. It has established a special task force "to find ways and means of making an effective and positive contribution to the Vancouver Conference on behalf of the architectural profession. A member of this task force is Vancouver architect H. T. D. Tanner, who talks enthusiastically of the possibility of turning the whole of that onemillion population city into "a living workship" for Confex. RAIC has also invited the Council of the International Union of Architects to call an international conference of architects for Vancouver in June '76.

The "experts" included: Helena Benitez, former Philippines senator and president of the Women's University of Manila; Ingrid Jussil, architect and adviser to the Swedish Ministry of Civil Affairs; Gloria Knight, manager of the Jamaica Urban Development Corp; H. Peter Oberlander, former director of the School of Community and Regional Planning, at the University of British Columbia and currently secretary, Ministry of State for Urban Numan-Al-Jalili, Ottawa: Affairs. architect and planner, Director-General of Planning and Engineering, Ministry

continued on page 285

Squeezing the best out of water

Squeezing the best out of water

Like good wine at the marriage feast in Cana, agricultural productivity in Israel appears to know no limits: not quite yet anyway. A new technique in irrigation, devised at Technion—Israel's Institute of Technology—could lead, so its inventors claim, to harvests being bigger by 50 per cent or more for the same amounts of fertiliser and only 10 per cent more water. And since agriculture in Israel already uses more than 70 per cent of all the available water, any improvement in the use of water is bound to have far-reaching implications.

The Israel Government is already drawing up plans to reduce the amount of water piped to agricultural communities in order to meet the rapidly growing needs of industry and of an increasingly urbanised and expanding population. With less water available for agriculture the government was anticipating a 20 per cent fall in total agricultural productivity. Dr Benjamin Zur's "pulsed irrigation" could well turn that loss into profit.

"Controlled wetting is the key to plant growth," says Dr Zur, and he claims that none of the irrigation methods being used throughout the world today, not even such highly acclaimed methods as drip irrigation, achieve a wetting of the soil that most benefits the plant.

Israel is famous for its irrigation techniques such as the drip or sprinkler systems, and the best having been achieved one might be tempted to leave well alone. Yet when he calculated the theoretical maximum for plant growth based on a measure of photosynthetic efficiency he came up with figures that were three to four times the production levels of today, and Israel with its intense solar radiation should be one of the most productive areas of the world. Why then are our farmers producing only 20 to 30 per cent of that potential?

The reason, claims Dr Zur, is because the irrigation regimes are all wrong and he points out that the general principle used in modern irrigation is to space out the intervals between one sprinkling and the next. The rationale behind such regimes is to conserve water.

A typical experiment to determine the best irrigation regime for oranges, carried out at Beit Dagon, by the Ministry of Agriculture, indicated that alternate rows should be irrigated at 15-day intervals with a total seasonal application of 600 mm of water and every row should be irrigated at 21day intervals with a total application of about 700 mm of water.

"Instead of spacing the irrigations out" says Dr Zur, "the farmers should be irrigating continuously using small amounts of water." Yet the farmers have been led to believe that frequent irrigations are not only wasteful of water, but that they lead, when tried, to a drastic falling off in yields.

"Yet the reason for this falling off

is obvious. Air and water in the soil are in constant competition with each other, and excessive irrigation waterlogs the soil and pushes the air out. Without oxygen the plant cannot grow efficiently. A balance has to be achieved. Oxygen must be free to move through the pores in the soil and that it will only do when the pores are free of water. At the same time other pores must act as water channels. By controlled wetting we have managed to get the two systems going-the larger pores carrying water and the smaller ones oxygen. All that is necessary is a very low application rate. No more than 0.5 to 1 mm of water every hour."

To prove their case Dr Zur and his colleagues at the Technion added small quantities of water continuously to crops grown under rigorously controlled conditions in a greenhouse. They obtained amazing results. The yields of most crops were doubled and the yields of sunflower increased five-fold.

But how to reproduce such results in the field? Sprinklers turned down to their lowest could not deliver less than 3.5 to 4.0 mm per hour.



The soil scientists then hit upon the ingenious idea of pulsed irrigation whereby conventional sprinklers are only turned on for ten minutes out of every hour, a little black box automatically switching the valves on and off.

"The trick worked," says Dr Zur. "The soil responds as if the flow of water is continuous and 3 to 5 centimetres below the soil surface the pulses are not even seen, having been damped through the action of water viscosity. In fact we create a tropical environment and you can smell the hot humid smell of rotting leaves. Consequently, everyone predicted disaster from disease. We managed to prove them wrong."

The first out-of-door experiments were at Acre, on heavy soil, the crops being cotton, grapefruit and peanuts. The irrigation regime was four 10minute periods each day and Dr Zur and his colleagues found they could control the depth and degree of wetting very accurately. In addition less flushing was required to overcome salting, because the soil was always wet. In practice the winter rains were good enough to do the trick. Disease did not appear to be a problem.

Some of the most exciting results were at Beit Ha Emek—the best grapefruit growing area in Israel. That year the grapefruit harvest throughout Israel was superb, and on average 500 fruits were taken from each tree. At Beit Ha Emek the average from conventional irrigation methods was 900 grapefruits per tree. Pulsed irrigation increased the yields to 1,200 fruits per tree and the average weight of each fruit rose from 250 grams to 290 grams. Even in the best growing region the yields were therefore up by more than 30 per cent.

Having opened up entirely new possibilities for irrigation Dr Zur has now hit on another innovation which would do away with the sprinkler, the switch mechanism and even drip tubing. The innovation is a porous plastic tube which was designed for reverse osmosis in desalination by an-Israeli company called Hydronautics. The tubing did not work for osmosis but it had just the right characteristics for delivering the amounts of water required for controlled wetting of the soil. The "sweating line" works under a small pressure of water, the pressure being necessary to give an even flow over a changing topography. The tubing is now being tried on a golf course and on a water melon plot. Dr Zur is very hopeful of its success and Hydronautics Ltd is more than happy that its tubing has found an outlet.

And what about the application of Dr Zur's pulsed irrigation methods elsewhere in the world? Certainly his research raises all manner of questions about plant growth and potential yields. Even when the summers are cool and rainy it could be that Britain's soils are drying out too much and for too long. Controlled wetting during some of those dry spells and maybe Britain could go a long way towards feeding its own population.

Peter Bunyard

The built environment continued from page 283 of Municipalities, Iraq; Edmund Collein, Professor of Architecture at the Academy of Architecture and Construction, Berlin. GDR; Michel Colot, Ministère des Equipements et Amenagement de Territoires, France; J. W. S. de Graft-Johnson, Director of the Building and Road Research Institute, Ghana; R. Gonzalez, Director of Planning for the new city of Cuautitlan Izcalli, Mexico; John F. Keith, President, New York Regional Plan Association; Luis Lander, civil engineer, city and regional planner, Professor, Center for Development Studies, Caracas University, Venezuela: Ahmed Ali Mahmoud Misrati, geographer and

city planner, Libya, Lennart Mostertman, Director of International Courses for Hydraulic Engineering and Environmental Sciences, Delft, Netherlands, Rainer Piest, Ministry for Regional Planning, Housing and Town Planning, Federal Republic of Germany; Prabhaka Rao, Joint Secretary (Housing), Ministry of Works and Housing, India; Janos Szabo, First Deputy Minister Building and Urban Development, Budapest, Hungary, Ernest Weissman, Professor, Institute of Social Studies. the Hague, Netherlands; Kenzo Tange, Professor of Architecture, University of Tokyo and chief architect for Expo '70.

Patrick Hailstone

THE MATHEMATICAL THEORY OF THE DYNAMICS OF BIOLOGICAL POPULATIONS

edited by M. S. Bartlett and R. W. Hiorns

Department of Biomathematics University of Oxford, England

September 1973, approx., 355 pp., £7.50

This book contains a collection of papers delivered at a Joint Symposium of The Institute of Mathematics and Its Applications and The Institute of Biology at Oxford in 1972. Fundamentally, the contributors examine the mathematical theory of time-change in animal populations-whether these populations refer to land animals (including humans), fishes or insects, and whether they refer to actual migration in space or to changes in size and structure. This book should be of valuable assistance to researchers, as well as undergraduates, in mathematics and biology, who are interested in studying applications outside the traditional fields of their respective subjects.

Contents

Population Processes in Time. Population Processes in Space. Population Genetics. Estimation and Simulation Problems. Population Distribution and Community Structure. Author Index. Subject Index.



ACADEMIC PRESS LONDON AND NEW YORK

A Subsidiary of Harcourt Brace Jovanovich, Publishers

24-28 Oval Road, London NW1, England 111 Fifth Avenue, New York, NY 10003, USA



"Never mind the bloody edelweiss, Potterton ! "

Comment

Better pick the edelweiss !

The first prerequisite of good management, whether it be of a fish and chips shop or of the nation-state the size of Britain is to get one's priorities right. As problems appear they must be arranged in accordance with their importance and dealt with at the appropriate echelon of command.

A general (to continue the military analogy), who did the job of a lance corporal would not only probably do it very badly but he would not have time to do his own job—that of running the army, i.e. dealing with the generalities affecting the army as a whole rather than the particularities that effect but a small part of it.

The same principle guides the behaviour of all natural systems. The mechanism of perception for instance is so designed that an animal sees only those things that are relevant to its behaviour pattern—in fact it arranges the constituents of the environment according to their relevance, i.e. in such a way as to suscitate the most appropriate pattern of responses.

Now Britain is faced with a lot of problems, and if Mr Heath were a good manager he would begin by arranging them in order of priority, and would start off by dealing with the one that most affects Britain as a whole and over the longest period of time.

What is Britain's major problem? The answer is fairly obvious: We have developed a particular way of life that can only be sustained under very specific conditions. We must be able to import massive quantities of resources from abroad (about 95 per cent of our requirements), a considerable amount of food (about 50 per cent of our requirements), and manufacture finished products and export enough to provide us with the funds required to buy the resources and the food. Unfortunately conditions are becoming ever less favourable to the perpetuation of this process. The world is running out of resources. Producing nations are becoming less willing to part with them. There is a serious world food shortage with starvation in Asia and Africa.

There is likely to be a reduced demand for finished products from countries more willing to exchange food for resources (US corn for Russian natural gas) and vice-versa, and also as the industrialisation of the third world (which is, paradoxically, our avowed aim) proceeds these countries will be increasingly capable of producing their own finished products.

Mr Heath should be seriously considering one of two possibilities:

The first is to take all necessary measures to keep the ball rolling in the face of mounting difficulties. This would probably mean leaving the Common Market since its members are in very much the same position as we are, and linking up with Canada, Australia and New Zealand who have precisely those things that we are short of: space, mineral resources and food.

The second is to opt out—admit that our way of life is no longer viable and adopt a *Blueprint for Survival* type programme to achieve a more sustainable economy.

These problems do not appear to concern him at all. He does not look as if he has even considered them. So long as the goose goes on laying, he is satisfied that it must be in good health. He brandishes the golden eggs to the electorate with eager-beaver selfsatisfaction, as proof that "we have never had it so good". The balance of payments after all is excellent, the standard of living is high, therefore everything must be fine and our prospects excellent. There is no attempt to look at the long term forces involved, nor to examine to what extent these are the appropriate criteria for studying the welfare of a society. After all, they seem to be compatible with homelessness. delinquency and general demoralisation. These problems he does not appear concerned with. Much more important to him are such useless projects as Concorde, the Channel Tunnel and the third airport, in spite of the fact that even if they materialised they would be unlikely to be of much use to an increasingly energy-starved world.

One might ask whether they are but the toys of a self-indulgent Billy Bunter—or whether they are the pyramids of a technological age born of the convulsions of a dying society and of the fantasies of a latter-day Cheops?

Perhaps, in reality, they are but the

stereotyped responses of a man confronted with a terrible new problem that he is psychologically incapable of facing—a horrible ogre which has appeared from nowhere and which, he tries to persuade himself, might be induced to go away and leave him alone, if its presence were simply not acknowledged, or even better, if he purposefully indulged in the most frivolous activities possible, so as to emphasise his total indifference to the very possibility of its existence.

Edward Goldsmith

Growing market for military seizures

Should people be made to face facts or be left with their illusions? Most people would opt for the former course because they believe that knowledge is a good thing. The same people, however, would lift up their hands in pious and self-righteous horror if someone attempted to deprive them of some of their most cherished illusions-those on which they most depend for the maintenance of their mental equilibrium, i.e. in which they have the strongest psychological stake. However, in order to bring about those changes in public policy necessary to prevent the terrible calamities towards which our society is moving like a moth towards a light, some of the illusions of industrial man have got to be dispelled.

One of them is that industrial society can be maintained on its course during the next two or three decades without indulging in some pretty nasty warfare. We have recently seen how Britain has reacted to a resource shortage. Fish is getting scarce, the Icelanders are making it scarcer, at least to the British, so out goes the Royal Navy.

Precisely the same thing is happening in the Mediterranean. The Moroccans are threatening Spanish fish catches and the latter are threatening violence to ensure their supplies. Not long ago the

Subscribe to the Ecologist

To ensure that you receive each month's *Ecologist*, and the annual index, post free, send your name and address and £4 (US \$12) to Ecologist, 73 Molesworth Street, Wadebridge, Cornwall PL27 7DS. Israelis and the Jordanians nearly went to war for their water supplies. They were diverting the waters of the River Jordan for their requirements. Water, like fish, is also becoming a valuable resource. In Britain there is already talk of rationing it, and it is impossible to satisfy the US's ever increasing needs for water without importing it from Canada. Are the Canadians willing to see their lakes plundered for the benefit of American industry? There is already considerable opposition and it is likely to grow. If it becomes too powerful what will the Americans do? Allow the economy to collapse or invade Canada?

Energy is, as everybody knows, the key resource. Its use is proportionate to Gross National Product. If the latter does not increase from year to year, the result is unemployment and probably a stock exchange crash and even worse unemployment—a combination of events that no government can support.

A lot is written about alternative energy sources, nuclear power, coal, liquid hydrogen, geothermal power. None of these can begin to satisfy the requirements of our expanding industrial society in the next decades.

Energy is another word for oil, and so it will be for some time. This is one of the facts people have got to face. Now where does the oil come from? People talk of the North Sea. This represents no more than two or three years of world consumption. We also hear a lot about Alaska, but Alaskan oil is negligible when we are dealing with the quantities required to sustain industrial society. If energy equals oil then oil equals the Persian Gulf, because that is where the oil is. That is the only place we know of where there are really massive resources of oil. At the moment the Persian Gulf countries are selling us oil (albeit at an ever increasing price), but what happens if they decide to stop doing so? Are the Americans and the Japanese and the West Europeans going to sit back and allow their respective economies to collapse? So far people have preferred not to face this question. The idea that a handful of oil sheiks can cause the complete collapse of industrial society throughout the world is not one that people cherish, it makes complete nonsense of all our governmental policies which tend towards making all human

activities more and more dependent on oil.

It is refreshing to see someone facing facts at last. Senator William Fulbright, Chairman of the Senate Foreign Affairs Committee has stated in the Senate that American policy-makers "may come to the conclusion that military action is required" to protect American oil interests. Needless to say, there was an outcry. Highly cherished illusions were shattered. America, like Britain, likes to think it is a benign and peace-loving country whose sole preoccupation is the happiness and welfare of the people of the earth. Now we are told that she should actually go to war, and for what reason? Not to defend some great ideal like "the American way of life" against those wicked communists, but simply in the interests of commerce-for lolly.

Let us face it, if the Arabs withhold their oil they will be made to part with it by force and what is more with Britain's connivance. I say this with total conviction, as something so evident that it is almost embarrassing to have to say it.

What is more, Mr Heath and Mr Wilson or whoever has the doubtful pleasure of trying to govern this increasingly ungovernable country, may try to justify his action by appealing to all sorts of high-falutin' principles in order to satisfy his conscience and that of his electorate. But the fact is, he has no alternative, unless of course he opts out and adopts a policy on the lines of A Blueprint for Survival. Besides, Britain has more experience in this field than the US. After all, what was the Biafran war about? The perpetuation of the Hausa empire? Or General Gowan's beautiful brown eyes? No, it was to protect our local oil interests, which were nothing like as vital to us as Persian Gulf oil is today. It might be argued that the USSR will not allow America to interfere in the middle east; after all it was basically Russian pressure which put an abrupt end to the Suez enterprise. But times have changed. The USSR is now, and probably will remain, dependent on American corn (this year they imported 20 million tons of it). They also need American capital and know-how to exploit the massive untapped mineral resources of Siberia and the US can be paid for all its services with much needed natural gas. With an increasingly hostile China rapidly



teaming up with Japan one can foresee a very close alliance indeed which makes it more than likely that Russia will close its eyes to the little indiscretions of its new chum. Let us face it, the Arab Sheiks are too rich for their own good. Only the most naive can really believe that they will be allowed to sit for very long on their treasure hoard.

Edward Goldsmith

Can we feed the world?

Severe floods in the United States during the first half of 1973 make it likely that the US harvest will be much reduced. The FAO had hoped that a good North American harvest would replenish world grain stocks to provide short-term assistance for the areas of Central Africa and the Indian subcontinent where famine is widespread as a result of severe and prolonged drought. Such hopes are now dashed.

More extensive famine in these stressed areas seems unavoidable and we may expect food prices in Europe to rise again next winter.

No matter what the long-term theoretical possibilities may be it is time we admitted our failure to feed existing populations. Even if political constraints were removed, the world does not possess the food to permit more than token relief to stricken areas and US fuel shortages may cause transport difficulties. It is in this real-life context that we should discuss the implications of continued population growth.

Michael Allaby

Notebook

Beating swords into swords

The US Government is stuck with 2,338,900 gallons of Agent Orange, which it bought for \$16,540,000. Agent Orange is a military herbicide withdrawn from use in Vietnam after concern was raised about its teratogenic properties (i.e. its tendency to cause foetal deformities). It is very potent stuff. Some of it contains 28 times the maximum acceptable content of dioxin, one of the most dangerous teratogens known.

What is to be done with it? The answer is simple. Sell it to Brazil, Venezuela and Paraguay for agricultural use. Diluted, it can be sold to farmers at \$5 a gallon. "We're beating swords into ploughshares," boasted Jerome F. Harrington, president of the IRI Research Institute Inc., of New York, one of the promoters of the scheme. This, it seems, is what aid for development is all about.

Professor Samuel F. Epstein, a leading expert on environmental toxins, regards this as a "perfectly preposterous idea". "It is tantamount to the encouragement of chemical warfare. It is tacitly permitting the very, very critical possibility that in the hands of foreign countries it will be used the way it was used by the United States in Vietnam. ... I view the whole thing with horror".

One herbicide expert who has asked to remain anonymous pointed out that the Brazilian Government is currently carrying out what in his view amounts to "one of the largest paramilitary operations against an indigenous people anywhere in the world" in its effort to open up the Amazon Basin and relocate the native populations who live here. What could be more useful than Agent Orange?

Source: Science, Vol. 180, No. 4081.

Environmental impact statements lack impact

The most useful clause in the US National Environmental Policy Act of 1969 is Section 102 (2) (c), which instructs all federal agencies to file environmental impact statements in respect of proposed actions "significantly affecting the quality of the human environment". A study by Professor Frank Kreith, presented at the Environmental Law Seminar sponsored by the Colorado Association of District Attorneys in September, 1972, and published in *Environment*, 15, 1, reveals that this excellent law has been largely ineffectual.

The Council on Environmental Quality publishes a summary of all draft and final statements in its monthly 102 Monitor. In January, 1972, there were 1,300 draft and 1,100 final statements covering a total of nearly 2,400 actions subject to environmental appraisal under the Act. A random sample of 200 statements was analysed. "We studied these statements to see if any resulted in a proposed action being avoided or reversed. It turned out that all of the actions we investigated were approved and that in no case had adverse comments to an environmental impact draft statement resulted in the proposed project being abandoned, although most of them listed adverse environmental effects which they claimed could not be avoided. Of the 127 actions which listed adverse environmental effects, a total of 214 alternatives were listed, all of which were rejected: 130 were rejected for economic reasons, 47 were rejected for environmental reasons (that is, the alternative would do more harm than the proposed action) and 37 were rejected because of engineering problems. The EPA was requested to comment 56 times and approved all of the proposed actions. Indeed, in 24 instances the EPA made no comment at all or did not reply, and only in five instances did it make suggestions for improving the proposed action.

"After examining the above data it would appear that the impact statement process as it is now being implemented in government decision making is not a very effective tool in protecting the environment. Although two-thirds of the actions for which statements were prepared had adverse environmental effects, the actions proceeded essentially unchanged."

In many instances a project was too far advanced to be modified. A good draft statement, Prof. Kreith suggests, should already have examined all alternatives. Unfortunately, the reaction to environmental objections is often "simply one of ameliorating the feelings of the public or alleviating those factors that are visible and are the source of public controversy. For instance, when requests arise for cleaning stacks, industry may remove the stream which is visible, but disregard the more dangerous sulphur dioxide, which is invisible but much more difficult to remove from the exhaust. The natural reaction is always to deal with crisis events, whereas creeping, long-range actions, which are often potentially more harmful, receive less attention".

Energetic Chinese

Robert Rodale, publisher of Organic Gardening and Farming and Environment Action Bulletin, returned recently from a trip to China. China also has its pollution problems. Peking is becoming more polluted. Nevertheless, Rodale was impressed with many things, and in particular with the economic way in which the Chinese use energy.

"From an energy point of view, oriental wet-rice agriculture is the most productive, by far, of any farm system. One calorie of energy put into the system-largely in the form of food for the farmer-yields about 40 calories in rice. Best evidence of that productivity is the small amount of land needed by an average Chinese farm family living on fertile soil. We were told ... by Wu Hsueh-Yieu, vicedirector of a section of the Chinese Department of Agriculture, that a family of four people living on good bottom-land can support themselves on one-half acre of cultivated land.

"By contrast, the kind of highly mechanised, technological agriculture practised in the US requires a much larger input of calories than it yields. Of course, most of the calories are delivered into our agricultural system in the form of oil to power tractors or to make fertilisers and pesticides-not as food for the farmer-but still it is a system of agriculture that contains the environmental seeds of its own destruction. If the availability of oil were limited by war or shortages of any kind, we would get hungry mighty fast. (Even food distribution would be crippled.) China's agriculture would barely suffer at all under such restrictions, because oil is hardly one of its basic fuels.

"Another most interesting aspect of China's agriculture is the direct involvement of the land in the recycling of organic wastes. About 80 per cent of all fertiliser used is organic—either animal or human wastes, mulches or green manure crops. There is very little production here of that noxious fluid we call sewage. Small horse-drawn carts collect solid and liquid wastes and haul them out to the countryside, where they are composted and then spread on the land. This time of the year, most of the fields of northern China are dotted with small compost piles—soon to be spread.

"There is, of course, no prejudice against spreading such wastes on the soil in China. People have been doing it here for several thousand years. Intestinal parasites used to be a significant problem in China, but apparently they have been curbed by more careful composting methods, which Agriculture Department people here refer to as 'heat fermentation'".

The importance of being average

Maximum acceptable levels of pollutants likely to affect human health are determined by a kind of costbenefit analysis based on the probable exposure of a notional "average" human being and his supposed susceptibility. Of course, individuals vary both in susceptibility and in exposure, but it is "Mr. and Mrs. Average" against whom the costs and benefits are calculated.

This makes it rather important to be average. Departure from the norm in an upward direction with respect to exposure, or in downward direction with respect to susceptibility, may bring unpleasant consequences.

Unfortunately, there are groups of humans so perverse that they refuse to conform. Science News, Vol. 103, p.226, refers to a report by Tua Rahola and Jorma Miettinen, two radiochemists from the University of Helsinki, about the Lapps, those Mongolian nomads who have chosen to move ever farther north rather than settle down and get themselves jobs in the factories of Stockholm or Oslo. It seems they may now be paying the price of their eccentricity.

The Lapps eat large amounts of reindeer meat. Reindeer eat lichens. Lichens concentrate radio-isotopes, especially caesium 137. By involving themselves in such an original food chain, the Lapps expose themselves to 40 times more radiation than their southern neighbours, those sensible, average people whose level of exposure is said to be safe.

The number of non-average persons exposed in this way may be large. Roughly one million people live north of the Arctic Circle.

Oil down the drain

What happens to our waste oil? According to the EPA, 30 per cent of industrial oil and 50 per cent of automobile oil is neither burned directly nor consumed by use, but is disposed of as waste in various ways, each more dubious than the last.

"While the release of this quantity of oil is a problem in itself, the toxic materials which accompany the oil disposal are an even bigger worry. An estimated 3.4 million pounds of barium, 4.2 million pounds of zinc, 59 million pounds of lead and 21 million pounds of phosphorus compounds are dumped annually into our environment.

"Zinc from oil additives is finding its way into roadsides, poisoning earthworms and any birds which chance to eat them. Barium compounds used as smoke suppressants find their way into waste oil and ultimately spread throughout the environment. Lead is being dumped into the environment to the tune of about half a billion pounds a year, elevating lead content in air and dirt to disastrous levels, especially in congested cities.

"Phosphorus compounds in waste oil, either from gasoline additives or lubricating oil additives, are perhaps the biggest worry. In 1959 there were over 10,000 reported cases of paralysis in Morocco due to black marketeers adulterating cooking oil with surplus engine oil containing a phosphorus compound called tricresyl phosphate. The first known major epidemic of this 'TCP' poisoning occurred in the US in 1930 due to adulterated ginger extract from Jamaica, used largely in making moonshine. Minute amounts of this material are enough to cause 'ginger paralysis' or 'jake paralysis'.

"Smaller amounts of such toxic metals as nickel, boron, copper and cadmium are also found in waste oil.

"Though this is one environmental pollution source which is given little attention, people in EPA, parts of the Department of Health, Education and Welfare (HEW) and the Bureau of

Mines are becoming concerned. A billion gallons of waste oil don't just disappear. An Interior Department report in 1970 estimated that 15 per cent of the waste oil was re-refined. 15 per cent used as road oil, 32.5 per cent as fuel oil and 37.5 per cent was dumped. An American Petroleum Institute study in 1966-67 showed that 43 per cent of service station operators surveyed did not know the ultimate fate of their waste oil. Some portion is blended in regular heating oil and sold to unsuspecting customers. Most of it is simply dumped in the nearest convenient place.

"The drive to improve the quality of motor oil has resulted inadvertently in a massive deterioration of the environment. Currently used detergents and other oil additives render wastes extremely difficult to recycle by traditional procedures. The number of rerefiners has declined from 150 in 1960 to 49 a decade later. While our citizens are calling for more recycling, the oil re-refining capacity of this country has declined 50 per cent to about 150 million gallons a year."

Source: Environmental Action, 4, 17.

Drugs for foetuses

The thalidomide catastrophe has focused attention of the dangers of administering drugs to pregnant women. At a symposium on the subject in New York it was revealed that, excluding iron, drugs were prescribed for 82 per cent of 911 women in an Edinburgh survey. 65 per cent took non-prescription drugs, such as aspirin and antacids. Certain drugs, such as antibiotics, cough medicine and tranquillisers tended to be administered throughout pregnancy. Others-antiemetics. antihistamines, appetite supressants, bronchodilators and hormones were given mainly during the first month of pregnancy and antacids, analgesics, barbiturates, diuretics and hypnotics, late in pregnancy. Several doctors questioned the necessity for these drugs. It was admitted that little is known about the possible effects on the human foetus, but nevertheless it was suggested that the future lay in "foetal therapeutics".

With populations growing the way they are the pharmaceutical industry cannot afford to ignore such an obvious market.

Source: *Nature*, 1973, 242, p.367 and editorial comment.

The User's Guide to Ecology Films

The Environment Film Review is a discriminating reference work that provides you with:

critical reviews of more than 600 films selected from a field of several thousand
 subject index (multiple entry)
 industry index (multiple entry)
 index to sponsors
 alphabetical title listing
 star rating system
 cross referencing of reviews
 coverage of 21 major environmental areas from air pollution to wildlife, including population, energy, urban ecology, transportation, as well as common pollution categories
 names and addresses of distributors

.

Gives you the data you need:

- critical review of treatment critical review of ecological objectivity
- where films can be obtained
- ourchase or rental price
- length; color or black & white
- names of sponsor, producer, director
- T release data
- intended audience

a critical guide to 16 mm ecology films publicly available



Environment Information Centre, Inc.

c/o Ecologist, "Catesby", Molesworth Street, Wadebridge, Cornwall.

Please enter our order for _____ copies of The Environment Film Review (Library of Congress Card #72-89549).

Please enclose payment with order. (\$18 each) (No C.O.D.'s) Make cheque or money order payable to: "Ecologist"

Name					
Organization					
Address					
City	State	Zip			
Signature					

Just released!

Anyone using environmental films will find The Environment Film Review an invaluable reference tool that saves hours of searching, and avoids disappointment when your film arrives. The Environment Film Review cuts through the confusion created by vague catalog descriptions, answers your most important questions about ecology films. Thousands of manhours of selection, screening, indexing and editing have gone into this critical guide to the cinema of ecology. Order your copy now.

The Environment Film Review is a publication of Environment Information Center, Inc. publishers of Environment Information ACCESS and The Environment Index. For more information, write: Environment Information Center, Inc., 124 East 39th St., N.Y., N.Y. 10016.

The octopus that eats its own legs

by Norie Huddle and Michael Reich

"Japan is an octopus eating its own legs." These are the words of a fisherman arrested last Autumn for protesting a huge petrochemical complex planned for a lovely remote area of southern Kyushu. "Japan is a small country with very few mineral resources," he told us. "Our main wealth has always been in our oceans, rivers. good farmland, and in the spirit of our people. But just like the octopus, Japan has gone crazy. In a race for more and more economic growth, we are poisoning our soil, water, air, and ourselves." He made a quip that has recently gained popularity in the Media: "We are Number 3 in the world in Gross National Product, but we are Number 1 in Gross National Pollution."

What factors have led to the tragic environmental destruction of the oncebeautiful Japanese islands? First, let's examine Japan's spatial and historical characteristics.

A population of 105,000,000 Japanese (half of the total US population) live in a total area smaller than the State of California. Moreover, because about 80 per cent of the land is mountainous, people have been forced to concentrate in lowland and coastal areas. According to October, 1972, statistics, well over half of the total Japanese population lives in the narrow belt of prefectures that extend from Chiba Prefecture, slightly north of Tokyo, through northern Kyushu. At the same time, over 70 per cent of Japanese industrial production is located in the same belt, which is often referred to as "Japan's economic backbone". This concentration of people and industry in a very small area (26 per cent of Japan's total area) has contributed greatly to the rise of environmental problems.

Japan's rapid development, accomplished at an average annual growth rate of 11.3 per cent per year from 1959 to 1969, is a matter of pride for most Japanese. Twenty seven years ago, broken and defeated, Japan was cleaning mountains of rubble away from her war-torn cities. Then, during the early 1950s, American spending for the Korean war gave the Japanese economy a great boost. However, Prime Minister Ikeda's famous "Income Doubling Programme" of 1960 was perhaps the first official push for single-minded economic growth. Using GNP as a barometer for success, Ikeda aimed at improving people's welfare and enhancing Japan's international status.

Then, with the National Comprehensive Development Plan of 1962, 15 cities were designated as New Industrial Cities and factories were invited to move there. In an atmosphere generally permissive to industrial expansion, tax burdens were lightened for enterprises, and factory effluents were left virtually unchecked and untreated. During this period, anything not directly related to economic growth was considered superfluous. This is related to the so-called "bicycle operations" of Japanese corporations. Operating on a very high debt-equity ratio (by Western standards), Japanese corporations must grow rapidly to service interests on their loans. If not, they fall—as does a bicycle if the rider stops pedalling.

According to Dr Michitaka Kaino, Director of the Tokyo Metropolitan Pollution Research Institute, when Japanese industries began importing factory blueprints from abroad in the postwar period, they set their engineers to work to eliminate anything not directly related to production—such as waste treatment and pollution abatement equipment. Given corporate secrecy in Japan, it is difficult to determine how widespread this practice was; nevertheless, it is clear that pollution control was of very low priority.

Another major cause of environmental deterioration was the postwar shift in the type of production-from light industry to synthetics, petrochemical industries, and other manufacturing with high energy requirements. At the same time, hydroelectric energy sources, which in 1955 supplied 21.2 per cent of Japan's total energy needs, by 1965 supplied only 11.3 per cent, and by 1971, only 6.7 per cent. Petroleum generated energy, on the other hand, rose from 19.7 per cent in 1955 to 58.2 per cent in 1971. This has contributed greatly to air pollution as 84 per cent of Japan's petroleum is



The Nippon Kokan plant, Fukuyama: the world's largest steel factory

imported from the Middle East and has a very high sulphur content.

It is against this background that Japanese environmental problems have developed. Four important cases will now be looked at in detail to illustrate social and political processes characteristic of Japanese pollution.

Minamata mercury poisoning

Victims of this infamous case began appearing in 1953, in a small fishing town on the west coast of Kyushu. (By 21 March, 1973, officially recognised victims numbered 397, with 68 dead.)

Most of the victims were fishermen and their families, and the common element in their diets was fish and shellfish from Minamata Bay. At that time, the only major manufacturer in the area was the Chisso Minamata Factory, one of Japan's largest chemical industries, which had been discharging its untreated heavy metal and metaloid wastes into the shallow Minamata Bay for a long time. (It continued to do so, in fact, until Minamata Disease became a major social issue in 1959.)

Despite the relatively simple causeeffect relationship in this case, it took six years of intensive effort from the time the disease was discovered until the cause was determined. The main obstacle was Chisso's corporate secrecy —it refused to give out information or allow inspections of its production or waste facilities.

Another principle of Japanese pollution demonstrated by the Minamata case is the initial position taken by both the victims and the company. The victims, born into a tradition of respecting authority, at first humbly requested the factory to compensate them for the damaged fishing grounds and their health. Chisso initially refused to negotiate, claiming there was no relation between factory wastes and the disease. Later, totally frustrated, the fishermen's union stormed the factory. Thereupon the company offered several settlement proposals but continued to claim its wastes were harmless and to deny any responsibility. In late 1959, taking advantage of the fishermen's ignorance and desperate plight, Chisso paid a pittance to the victims and families of the dead.

Niigata mercury poisoning

For over five years the Minamata issue lay dormant, presumably settled. In 1965, however, the same strange disease appeared at the mouth of the Agano River in Niigata Prefecture. Like Chisso, the Showa Denko Company which owned the suspected source of pollution (an acetaldehyde factory upstream on the Agano River) refused to assume responsibility. In Niigata, however, victims filed a suit in June, 1967—the first large civil suit brought against a polluter in Japan's history.

In September, 1971, the final decision was announced in favour of the patients. The court, however, set the compensation fees at a very low level despite the irreversible damage and pain caused by the poisoning. As many members of the Japanese anti-pollution movement have told us, the Niigata case illustrates "the cheapness of human life in Japan". Two other points are notable: first, the slowness of the legal process (four years is actually on the short side in Japan) second, the fact that the victims, rather than the offender, had to shoulder the burden of proof. Both problems still exist.

The Niigata case, however, set the precedent for other pollution cases, including Minamata, where a suit was initiated against Chisso in June, 1968, and won by the patients in March of this year.

Today, in addition to official victims of mercury poisoning, there are many more unrecognised victims in Niigata and Minamata. And in Minamata, there is a strong possibility of many chronic cases appearing in the future.

Itai-Itai disease

This disease began to appear as early as 1920 around the alluvial plains on the lower reaches of the Jinzu River that runs through Toyama Prefecture. Since World War II, over 100 people have died of the disease, over 280 are afflicted with it, and more than 1,000 have been sufficiently exposed to make them potential victims.

The cause of the disease has been proven to be the runoff wastes from the slag mounds of the Mitsui mining and Smelting Company's Kamioka Mine located on the headwaters of the Jinzu River. This mine operated many years, pouring out its untreated cadmium, zinc, and lead wastes directly into the river water, which, in turn, was used for drinking and for irrigating rice paddies. As the cadmium passed up the food chain, it became more and more concentrated, leading (over a period of years) to the extremely painful disease where any slight pressure or shock causes the bones of the victims to fracture. ("Itai Itai" has usually been translated as "Ouch Ouch", but this is, in our opinion, completely inaccurate as it in no way expresses the pain conveyed by the Japanese words.)

Early research showing the disease was caused by mine runoffs was ignored or denied by the company. The prefecture appointed its own investigators who produced reports denying the relationship, another common occurrence in past pollution cases in Japan. In 1968, Itai Itai victims and their families brought a civil case against Mitsui Mining and Smelting Company. In 1972, they won compensation for damages (also cut substantially from their original demands) of US\$190,000, to be distributed among 31 plaintiffs. This was the first time in Japanese history that a citizen's group had won an environmental litigation brought against a corporation.

Despite the victory, vast areas of rice fields remain badly polluted by years of untreated mine runoff, and farmers in Toyama—like fishermen of Minamata and Niigata—have had their livelihoods destroyed. Cadmium poisoning victims have also been found in other parts of Japan where zinc is refined (Annaka, Kurobe, Bandai).

Yokkaichi asthma

Japan's first oil-refining and petrochemical complex was begun in the city of Yokkaichi on Ise Bay in central Japan in 1955. This was followed in 1960 by another petrochemical complex, and still a third in late 1963. Between 1953 and 1968, Yokkaichi's shipments of manufactured products increased over 200 per cent, overshadowing even the remarkable national growth rate of 70 per cent.

By 1959, however, air pollution had already become a serious problem, accompanied by a rapidly growing number of respiratory disease ("Yokkaichi asthma") victims. During the next year the situation significantly worsened to include a complete showcase of pollution problems common to all Japanese industrial complexes: sulphur oxides, nitrogen oxides, dust particles, noise, vibration, water pollution, and offensive odours. In September, 1967, stimulated by the suicides of two asthma victims, 9 patients brought a suit against the six companies of the first petrochemical complex (Showa Yokkaichi Oil Co. Ltd., Mitsubishi-Monsanto Chemical Co. Ltd., Chubu Electric Co. Ltd., and Ishihara Sangyo Kaisha Ltd.). In 1972, the decision was handed down in favour of the patients. If implemented, the decision requires the use of the world's most advanced pollution control equipment. Nevertheless, despite the legal victory, residents claim that in Yokkaichi there has been little real improvement of the air pollution, except when the trial decision was handed down.



Yokkaichi company representatives apologise to villagers

Rise of anti-pollution movements The Itai-Itai, Niigata, Minamata and Yokkaichi decisions, commonly called the "Big Four Court Cases", set important legal precedents and also provided a major impetus to antipollution movements throughout Japan. In 1971, the Pollution Problems Research Association listed over 450 such movements, with over 100 in Tokyo alone. These groups are attacking every type of environmental problem: thermal and nuclear electric power plants, noise pollution from automobiles, construction, Japan's super-fast trains, new buildings that block sunshine in cities, industrial pollution of air, water, land, etc.

Although the degree of success varies from group to group, local antipollution movements have been extremely successful in pressuring industry to install pollution abatement equipment. The movements have had to deal with industry's low sense of public responsibility and the many loopholes of Japan's pollution regulation and inspection systems. One example of the latter is a minor scandal that occurred in the Autumn of 1972, when the media discovered that the Chiba Prefectural government had informed factories, in advance, of a pollution inspection tour, to allow them time to make appropriate preparations. This is generally believed to be a common occurrence, resulting from the traditionally close connections between government and industry. One resident living near the huge industrial complex in Kashima, Ibaragi Prefecture, commented dryly, "The factories always seem to turn on their pollution control equipment when some VIP is coming to visit. What we need is someone to come every day."

In the past few years, citizen movements in Japan have undergone important changes. Many of the earlier movements, so-called "residents" movements" centring around pollution victims and the issue of compensation, have begun to broaden their base of active support, to include professors, doctors, lawyers, housewives, some students and in a few cases, organised labour. As a result of their new citizenbased structure, these movements have become more effective in their use of scientific and legal knowledge, more concerned with questions of representative government.

At the local level, governments used to bend over backwards to attract industry to their regions. Growing citizen opposition has changed this, making it increasingly difficult for electric power companies and heavy industries to find communities willing to let them construct production facilities or even expand existing ones. Citizens' movements have also initiated recall actions against political leaders who favoured development, as in the case of Abuta Town in Hokkaido, where the town leader was removed because he supported the construction of a thermal electric power plant in nearby Date City.

Throughout Japan, movements are girding themselves to oppose the new national development plan, proposed in 1972 by Prime Minister Tanaka. Tanaka's "Plan for Remodelling the Japanese Archipelago" calls for building new industrial cities of about 270,000 to redistribute the overpopulation and over-industrialised urban areas of today, while increasing the present GNP by a factor of four by 1985. Growth, Prime Minister Tanaka insists, is necessary to provide the capital for developing welfare programmes, for cleaning up the environment and for other social programmes. But, as many opponents to the plan point out, continued growth also means increasing aggravation of environmental pollution.

In anticipation of the development plan, industries (or their dummy real estate agencies) are now buying up land in every corner of Japan, driving prices so high that the average citizen can no longer afford to buy a plot of land to build his own home. This rage of land speculation has, in turn, increased criticism of the large Japanese trading companies and of Tanaka's development plan. Some Japanese observers feel that the land issue may eventually trigger the downfall of the Liberal Democratic Party, the conservative party which has ruled almost the entire postwar period.

Change in scale of pollution problems

In the past few years, the scale and complexity of pollution problems have grown so fast that local antipollution movements can no longer deal effectively with the widespread environmental disruptions of today. Photochemical smog has continued to increase annually since its appearance in 1970, when 43 girls at the Tokyo Rissho Senior High School succumbed to fits of coughing and difficulty in breathing. The smog is spreading from urban areas into the countryside, making it more difficult to escape from stinging eves and gasping throat. As one member of the Environment Agency explained, "With Japan's energy consumption per square kilometer sixty times the world average, what do you expect? Something's got to give."

Approaching Tokyo by ship through Tokyo Bay speaks for itself—a dark reddish haze completely shrouds the city's skyline. As for Tokyo Bay, even lobworms find it hard to live in the morass of industrial wastes, sewage and garbage at the bottom of the Bay. Ships' captains are hesitant to enter the Bay for fear of entangling their propellers with plastic floating in the water. Red tides have also become a major problem, as in many other areas where industries dump their wastes directly into the water. A shocking illustration of Tokyo Bay's unique collection of pollutants is a 1971 report stating that it is possible to develop film with Tokyo Bay water—with no additional chemicals.

New wealth in Japan has also led to new problems. With the rise of the "throw-away culture", created by mass production and mass consumption, problems of collecting and disposing of urban garbage have reached serious proportions in many cities. At present Tokyo uses its garbage to reclaim land Tokyo Bay, but the present in reclamation site is expected to be full in November, 1973. Although the Tokyo Metropolitan Government is earnestly grappling with the problem, their attempts to shift some of the burden to incinerators in each district have been foiled by opposition from local residents who have no desire to live in the vicinity of a polluting garbage incinerator, and by extraordinarily high land prices in the Tokyo area

The high percentage of plastic in Tokyo garbage (around 10 per cent) has also delayed an effective disposal scheme-when burned, it causes air pollution and destroys the interior of the smokestack, and because of its resistance to deterioration, it makes poor land-fill material. As for recycling, problems of collection, separation and recycling technology make widespread recycling unlikely until the late 1980s. In sum, the garbage problems are mountainous. Despite increased awareness, however, continued overwrapping and over-packing of goods, combined with the new consumer lifestyle, mean that garbage problems will probably get worse before they get better in Japan.

The garbage problem also extends to Japan's once-beautiful mountains and beaches, now beset by inconsiderate campers, hikers and vacationers. Many Japanese attribute this situation to the lack of a tradition of "public consciousness' in Japan, quoting the proverb: "On a trip, one knows no shame." Traditionally, each person kept his own area immaculately clean, but has felt no responsibility for places to which he is not personally connected. Although this attitude is slowly changing, much of it still remains and the vast majority of Japanese remain quite passive about their environmental problems.

The recent wave of affluence in



After the Yokkaichi trial, the six companies had to negotiate compensation with the plaintiffs, who denounced them publicly.

Japan, bringing with it a wide variety of consumer products, also serves to distract attention from social problems. There are many who feel that "pollution is the inevitable cost of wealth"-they view a clean environment and wealth (measured by variety of consumer products and the ability with which to buy them) as mutually exclusive, and they are not yet prepared to pay the price for a clean environment. Still others feel that little can be done within the present system to change the environmental situation. Although no one can really escape the publicity of magazines, newspapers, radio and television which focus daily Japan's severe environmental on problems and social crisis, many people avoid facing these issues directly, escaping into a selfish, materialistic lifestyle: "my home-ism" and "my car-ism".

The tide, however, is changing. Mass media are taking a strong antipollution stand; growing citizen movements are bringing pressure to bear on polluting industries; more and more progressive governments are being elected in polluted areas. Nevertheless, until fundamental changes are made in the attitudes of people towards the type of consumption, and until there is a major shift in government and industry priorities of growth and development, it will continue to be extremely difficult for Japan to substantially improve her polluted environment.

Four environment ministers talk to the Ecologist

Facing the future

by Vanya Walker-Leigh



Mr. Geoffrey Rippon.



Mr. Lopez Rodo.

Mr. Ingemund Bengtsson.

At the European Ministerial Conference on the Environment, held in Vienna from the 28th to 30th March, 1973, 23 ministers gathered to discuss the natural environment and to make recommendations to the Council of Europe.

Four of these ministers, The Rt. Hon. Geoffrey Rippon, British Secretary of State for the Environment, Mr Vonhoff, State Secretary at the Netherlands Ministry of Culture, Recreation and Social Welfare, Mr Lopez Rodo, Spanish Minister of Planning and Chairman of the Interministerial Committee on the Environment, and Mr Ingemund Bengtsson, Swedish Minister of Agriculture, replied to a series of questions asked by the Ecologist.

What do you think of *Limits to Growth*, and subsequent studies like the one just completed by the Sussex University Social Sciences Research Unit, refuting the Club of Rome's findings?

RIPPON: Well, that shows how many studies are going on and to some extent they duplicate each other, but I don't think that matters. What is, I think, encouraging is that such bodies are showing an understanding that is perhaps the most human problem of our generation.

VONHOFF: I think the Club of Rome report has been a shot in a sleeping wood. More copies of *Limits of Growth* were sold in Holland than in the rest of the world together. I won't disavow the Club of Rome but as they say, the model is greatly influenced by the data put into the computer. I think our society has great resilience and can solve the problem.

LOPEZ RODO: We cannot permit ourselves the luxury of establishing limits to economic growth, especially in Spain where we must satisfy the legitimate aspirations of the people to a higher standard of living. We must accelerate growth to the maximum. BENGTSSON: I read in a newspaper that some British university had applied the Club of Rome techniques to the situation as it was in 1850 and predicted collapse for 1970, but we are still here. There must be something wrong somewhere.

Are you in favour of Europe moving towards a stable economy, zero growth? RIPPON: Zero growth wouldn't do any good. It would probably mean more destruction of the natural environment. The stable economy concept doesn't mean anything. I want to see growth to enable us to provide everybody with a decent house. I don't believe this is incompatible with preserving wildlife and flora and fauna.

VONHOFF: I don't think it is possible. Our economy has to grow because people want more space, mobility, consumer goods, prosperity. The improvement of socio-cultural conditions, longer education, the youth problem, are all based on economic development.

LOPEZ RODO: I am totally against both concepts: They may be convenient theories but in fact they would deprive large sections of the population of better living standards.

BENGTSSON: The environmental problems of two-thirds of mankind stem from a lack of economic growth: only growth can help the third world. But of course, growth must not spoil the environment.

Are you in favour of planned obsolescence of consumer goods or do you think it should be checked by legislation?

RIPPON: In other words should we have growth? If you have planned growth you have planned improvement. Cars probably have longer lives than manufacturers say, but people do like a new car, and they emit less fumes. Old cars just get noisier and dirtier. From an economic and environmental point of view there is a case for renewal. If you want more durable materials you must spend more on technology, and so plan for growth. VONHOFF: As a former honorary secretary of the International Organisation of Consumer Unions and former Vice-President of the Dutch Consumers' Association I say we must further the situation: industry should deliver more durable and better goods. Consumers must be adult and aware of their responsibility. Legislation is not possible, it could never be effective. LOPEZ RODO: I am not in favour of industrialists withdrawing their products from the market when they are still useful, just to increase consumption. But if it is a case of natural obsolescence in consonance with the type of product concerned, it must be replaced. We have no plans for any legislation.

1

į,

BENGTSSON: I see no reason why we should manufacture products for a short time. But we are not prepared for "durability" legislation: however, we have passed a law banning goods that are dangerous for the environment and for the workers involved.

Do you foresee an exhaustion of natural resources, or need to plan their use, for instance, sharing them on an international basis?

RIPPON: Scrap metal for cars is not exhausted. Our stock is continually renewed. But one of the things Britain most strongly urged at the Paris EEC summit was a common approach to the problem

VONHOFF: It would be wise to plan their use, and investigate alternatives, but it's not a good thing to stop growth. I would be against a world resource sharing plan.

LOPEZ RODO: The exhaustion of petroleum is foreseen for AD2025 that of coal for AD 2300. That's far away. BENGTSSON: Not really.

What about the energy problem? Should petrol be rationed? Air travel too? Projects for new planes and airports scrapped?

RIPPON: The rate at which we are using up coal and oil is of great concern: perhaps petrol should be rationed on a world-wide basis before it's too late. Air travel is already rationed-many airports prohibit takeoff at night. Air travel only accounts for a marginal share in total petrol uses. Maplin Sands is an important environmental necessity for Britain: it was chosen for environmental reasons. Concorde is no different to the Trident. except that it is faster and safer, and, in the long run, quieter. These questions have nothing to do with the fuel shortage. The answer is to develop nuclear policies.

VONHOFF: I am very cautious about the end of energy. Some US professor said there was enough coal in the US for 600 years. We are in full swing looking for new sources of energy.

BENGTSSON: We have to distribute energy on a fair basis, and deal with it urgently. Look for other energy sources. You can't solve the problem by less air travel. Planes and cars are here and we must find fuel for them.

LOPEZ RODO: As I said, the energy problem seems far off, but we should seek other sources like nuclear fuel, so that human life, industrial activity is not restricted by lack of energy. By the time petrol does run out there will be other fuels, like nuclear energy for cars and planes.

The EEC, and Europe generally seem to be encouraging the trend towards concentration into even bigger units, which means getting people out of the rural areas. Do you feel this trend should be reversed?

RIPPON: The drift from the countryside has been far too great: villages should be allowed to expand naturally. We shall be introducing legislation on this subject. Also some areas should be kept free from tourists, to preserve the flora and fauna.

VONHOFF: In our second Physical Planning Note we try to control urban areas and check the trend towards concentration along the West coast. We are going to leave the "green heart" of Holland, and deconcentrate population elsewhere to make a balance between rural, recreation and urban areas.

BENGTSSON: It is difficult to reverse this trend. We tried in Sweden to deconcentrate population from the big cities.

LOPEZ RODO: You cannot check population concentration because it obeys the imperatives of economic growth, and those of external economies which big cities offer industry. There should be green residential zones separated from industrial zones to avoid noise pollution.

What do you think of the Council of Europe's proposal for a European convention to safeguard the individual citizen against environmental hazards? RIPPON: We support the resolution providing that consideration should be given to the possibility of a convention of this kind. In the UK, laws already deal with this to a certain extent: one can sue a neighbour who plays the piano too loud, and there are limitations on the distance from a house at which you are allowed to keep pigs. A convention may not really be necessary.

VONHOFF: This has to be introduced into the UN Declaration of Human Rights.

BENGTSSON: We have the UN Declaration on the Human Environment. It is up to different countries to give citizens that right in their basic laws.

LOPEZ RODO: It is most opportune. It is a fundamental human right. Our lives should not be endangered by health hazards.

Limits to growth?

In January, the Council of Europe held a meeting to discuss The Limits to Growth and its implications. Papers were presented by Mr John Maddox, who attacked the conclusions reached by The Limits to Growth, and by Dr Aurelio Peccei, Chairman of The Club of Rome, who defended them. In addition to these papers, the report contains a summary of the most common criticisms of the study, based on reviews by Mr Maddox, by the World Bank and others, with The Club of Rome's reply to them. It is this summary that is reproduced here, by permission of the Council of Europe.

The assumption of the model: Demography

Birth rates have been falling in almost all countries. (Maddox)

Death rates have been falling even more, in particular in the "developing" countries.

In the Western world a certain adjustment of birth rates to death rates is found ("demographic transition"); the "developing countries" will follow as they become wealthier (Maddox).

Available evidence shows that lowering infant mortality increases the population growth rate in the short term, with beneficial effects through lowering the fertility rate following only after several decades. There is doubt as to an increase in wealth in the underdeveloped world as fast as the increase used to be in the now industrialised countries. Moreover, decline in birth rates historically has followed industrialisation only after a substantial time lag.

Demographic transition in underdeveloped countries may be achieved independently of increase in wealth by special birth control measures.

There is no evidence to sustain such a thesis, considerable for the contrary. But if there were and if family size dropped precipitously in underdeveloped countries so that by around the year 2000 reproduction would reach replacement level (and no competent demographer thinks there is the remotest possibility of this occurring), the size of the population of a typical such country would be 2.5 times its present size when it eventually stopped growing. This is caused by the age structure: more than 40 per cent of the population is under 15 years of age.

Although the population is rising at an exponential rate, it has not as yet reached the globe's carrying capacity and there are mechanisms in the system which are not included in the model (as they were not operative during 1900-70 and thus not observable by Forrester-Meadows) which will cause the population to approach the carrying capacity asymptotically from below (World Bank).

It is rather risky to rely on the hope that "there are mechanisms" when there has been no evidence of them during the last 70 years. But more important, the "carrying capacity" of the planet is not known; it is at any rate not a fixed value but decreases with depletion of non-renewable resources and with increase of the consumption rate per capita; moreover it varies with cultural and behavioural factors. So if, as we all hope, the longterm carrying capacity of our planet has not yet been trespassed upon, reduction in population numbers and in average consumption would prolong the journey of mankind on this spaceship. Does not one use the brakes before hitting the obstacle, in particular when billions of other (if future) human beings are concerned?

Food

There is a food surplus in many regions of the world.

Yes. But about two-thirds of mankind is underfed, mainly affected by protein deficiency (UN Food and Agriculture Organisation).

Since the late 19th century we have multiplied the amount of irrigated land by four to five times, and will see another doubling before the end of the century.

True (perhaps). But despite these enormous accomplishments the amount of land man has turned into deserts by over-grazing and over-pressure is (perhaps) about five times greater than the amount we have irrigated. In India one-quarter of the entire acreage has such heavy erosion that the topsoil will be gone before the end of the century.

The "green revolution" is expected to produce a fairly rapid improvement in production of cereals.

"The drive for higher yields cannot continue for very much longer because of ultimate shortages of water and fertilisers. But there is a reasonable chance of managing it for the rest of the century. However, that is only under one assumption: that we move to strict population control now, in the 1970s. We have to, because we are already on the verge of the unmanageable." (Norman Borlaug, awarded Nobel Prize for his merits in the "green revolution") Besides this, the "green revolution" necessitates an efficiency and intensity of agricultural effort beyond the possibility of a peasant economy and thus gives rise to social difficulties, flow to the cities, etc. And the ecological consequences have not vet been fathomed.

What about food from the sea?

"The claims have been very exaggerated. The oceans look vast, but we

forget they contain large desert areas. We can perhaps double the world's catches and possibly treble them. It is questionable whether we can double the catches without gross over-fishing. But the most basic point about using the oceans to feed the hungry is what we do with these fish catches today. Approximately half of them go into the feeding troughs of Europe and North America for animal production, primarily broiler chickens, eggs, white meat and milk." (Borlaug). Furthermore, life itself in the oceans is in danger, and the situation is certain to become worse before it can be improved and uphold the hopes of harvesting large quantities of food from the hydrosphere.

What about synthetic food?

This is a possible, but not yet feasible way to ease the situation. It takes probably decades to develop and implement and the use of nonrenewable resources (fossil fuels?) as well as energy must be taken into account.

"We must stop thinking that there are easy solutions to these fearfully complex issues. People go around saying we have a solution in food from the seas, in synthetic food, in land reform, in irrigation. It is not like that. Let us be realistic about this; we are not going to remove all hunger. All we can do, if we are sensible, is to reduce it below a danger point. As it is now, it is moving rapidly to a very grave universal crisis." (Borgstrom)

Resources

The estimated confidence level of the US Bureau of Mines data (main information source of MIT) is relatively low: 80 per cent of the estimates have a confidence level of less than 65 per cent.

True. Better data are difficult to find. Therefore the values used have been arbitrarily chosen five times the presently known resources date (500year supply of all resources at 1970 usage rates).

Even five times increase of the reserves over the next 100 years seems unduly conservative in the light of recent finds and underwater sources (World Bank). This may be true for iron ore, aluminium, manganese, cobalt and other minerals. For copper the source cited by the critics gives estimates of twice the exploitable resources at 200 per cent cost increase for "conventional" origin and a 25 per cent reserve increase by sea-bed extraction. Nickel sea-bed resources would permit a production corresponding to three times the present Western hemisphere value. As to aluminium, a 200 per cent increase in price would make it possible to use clay which is virtually inexhaustible; however, this would entail the use of large quantities of electrical energy which may or may not be easy.

Lowering the demand growth rate from 4 per cent to 1.5 per cent would correspond to a lengthening of the "life" of the resources by a factor of 5. (World Bank.)

Lowering of resources input into industry (for equal output) by a factor of 4 has been assumed in several of the model runs.

We do not know the true extent of the resources that exist in, and can ultimately be recovered from the earth, nor will it be known in the next two years or ten years, (World Bank.)

Right. That is why the study had to work with assumptions, in order not to wait for another 10 years. More studies on resources are, of course, needed.

To argue that no amount of research or technological breakthroughs will extend the lifetime of resources indefinitely... is mere intellectual fantasy.

To argue that research or technological breakthroughs will extend the lifetime of resources indefinitely is mere intellectual fantasy. Technical progress could, however, in a number of cases extend the effective life of a number of critical materials considerably. The whole point of the report is to pinpoint the difficulties, in order that such research should begin now on a number of critical issues because the development process is very lengthy (upwards of 15 years) and the real question is: have we time?

Energy can be much more economically used. There is scope for smaller cars with weaker engines, public rather than private transport, increasing efficiency in burning fuels and in generating and distributing electricity, and improved design of aircraft engines and bodies. (World Bank.)

The study assumes unlimited availability of energy. But one must agree that there is scope for great economies in the use of energy and in the improvement of efficiency in energy production. Again it is a matter of beginning to look at these things seriously. The assumption of the study that energy is limitless is perhaps one of the weaker points of the report, especially in view of the probability of an energy crisis over the next 20 years owing to scarcity of petroleum and natural gas. The phasing-in of fast breeder reactors and massive utilisation of thermal, in particular high temperature reactors, is still terribly uncertain. The provision of sufficient energy is a quite critical point in relation to the use of technology to increase the time for manoeuvre.

It is not a question of expecting natural resources to accommodate forever our current patterns of growth, production and consumption; clearly they will not. But we are confident that natural resources will last long enough to allow us time to make deliberate adjustments in our manner of using natural resources in such a way that resource needs can be met indefinitely. (World Bank.)

Such problems have, unfortunately, up to now really been a matter of *confidence* not of enlightened judgment. Studies are therefore needed on the question of when adjustments are needed, how far-reaching they have to be, of what potential type, and what potential side-effects there might be. It has been one of the objectives of the report to attract new attention to the necessity of adjustments and in particular to the time element involved.

Resources are properly measured in economic, not physical, terms; new mineral resources can be created by investment in exploration and discovery.

This is the traditional economist's argument that economic forces create R & D and innovation. True, they do so, but often too late; moreover, no miracles should be believed in. "Our traditional reliance on research and programmes to increase our resource base will be of little avail, nor long lasting", (Russell Train, Chairman of the US Council on Environmental Quality). Finally, the assumption of resources corresponding to 500-year supply at 1970 usage rates, already takes considerable investment in exploration and discovery into account.

The weakness of the computer is characterised by the famous GIGO principle: garbage in, garbage out. A computer memory filled with garbage is easily cleared, not so, unfortunately, the brains of people. Some may even never have learned anything of importance and still rate happily along: nothing in garbage out (NIGO principle).

Pollution

If we were to continue to rely upon fossil fuel for energy production, severe environmental problems would arise (mostly, of a local or regional character), and pollution control would be costly. Eventually, the accumulation of atmospheric CO₂ might prove intolerable, and the further use of fossil fuels would have to be foregone altogether. If, instead, we were to alter the energy production process to rely mainly on nuclear power, we would encounter very large problems of plutonium management, radioactive waste disposal, and reactor safety. Construction of hydroelectric dams also causes severe environmental hazards. In these respects, there is merit in the argument that rapid growth can endanger clean environment unless appropriate long-run safeguards are adopted. By the same token, however, over a time span of decades, fusion power, solar power and the use of hydrogen-oxygen fuel as replacement to the internal combustion engine could drastically alter the pollution problems associated with energy production. (World Bank).

The very feasibility of fusion power is not yet proven, eventual economics utterly unknown. Some pollution and waste problems caused by fusion neutrons, uranium blankets and certainly from tritium would show up even with this technique. Fusion would be on the market well after the year 2000, if ever.

Solar energy cost is presently estimated (by its promoters) at 10 times the "conventional" value. There are space and storage problems as well as narrow climate limitations. At any rate solar energy cannot probably become of global energetical importance before the end of the century. As again it may be the time factor which could become decisive, an example for substitution delays in the energy field may be interesting: nuclear fission reactors were invented in 1939, proven feasible in 1942, first power use in 1953, commercial in 1966; now, 33 years after their invention, nuclear reactors produce about 3 per cent of electricity, 0.7 per cent of primary energy; it is hoped to produce about half of the electricity by nuclear means by 1990, but not more than 15 per cent of primary energy (50 years after the experimental demonstration of feasibility and with some hundred billion dollars spent on R & D, partly military).

Hydrogen may indeed be a good alternative for car engines and many other applications. Production with nuclear energy is possible, although today utterly uneconomic; production efficiency would be about 25 per cent using hypothetical processes under development as compared to about 90 per cent for production of refined products from fossil raw materials. At any rate fossil fuel substitution by hydrogen would constitute a considerable increase in nuclear energy use as primary source, with corresponding environmental problems of reactors, nuclear fuel cycle and waste storage.

The model assumes that there is a limit to the amount of pollution the world can absorb in a year and that this limit is four times the pollution now produced annually. There is absolutely no scientific evidence to support such a conclusion. Progressive pollution levels may destroy present concepts of living during the next 100 years, but the model builders marshall little scientific evidence to prove it will destroy life itself. (World Bank.)

At the present status of knowledge the assumption used could not be more than an "educated guess". The report makes clear that its consideration of the pollution aspects is fractional in that it concentrates exclusively on the accumulation of products which are non-biodegradable or decompose very slowly (e.g. DDT and mercury). Possibly the ecologists are just alarmists, although their fear of an overall deterioration of living conditions can point to quite a few tragic examples that have already occurred. We just do not know enough, and it is very necessary to undertake long-term research on these matters immediately so as to have some real facts as a basis for action and a means for rationalising hysterical anxiety.

Technology

A sufficiently large and exponential increase in technology will solve all food, resources and pollution problems. The answer is complex. Basic arguments against this thesis are already given in many of the above points. In general it may be said that the "optimistic" critique of modern variants of "Malthusian" arguments rests on the belief that the steady technical progress of the past century or two can be extrapolated into the future, and be directed towards new goals with equal efficiency, staving off potential catastrophes. However, this optimistic assumption may itself be vulnerable because of systematically diminishing returns to investment in science, technology and education, as indicated in the paper. Moreover, the net useful output of new industrial techniques will become relatively smaller with the need to devote an increasing part of the effort to remedying the unwanted consequences of primary techniques (pollution, degrading of nature, congestion of cities, fertiliser, and pesticide effects, etc.). With the limitations to the possibilities of technology, what is needed is not the haphazard, extemporary, if not military-oriented advances we experience now, but a set of science policies globally co-ordinated to attack the bottlenecks and weak points endangering our overall situation. But this rational use of our expanding knowledge is still a far cry. Technology's creations still obev private or sectoral interests, not the general one.

Imperfections of the model

The model has a very high level of aggregation. Averages of very dissimilar variables have been taken, a procedure which can give extremely misleading results. Also the number of feedback loops is rather low. (World Bank.)

It was acknowledged from the very beginning that the first study is of a "pilot" nature and that there would be inherent difficulties in interpreting the results in terms of real circumstances in different countries of different sub-assemblies of aggregated parameters. As to the fear of misleading results, detailed studies under way will show whether the way in which the "averaging" and aggregation has been done really affects the general conclusions. The feedback loop system will assuredly be perfected in later model generations. Critics and criticised alike should try to "de-bug" the tool.

At least a "two-world" model is needed in order to distinguish between the "developed" and the "undeveloped" parts of the world.

This belongs to the "second round" studies now under way as indicated in the paper. Lumping together so many different countries in one camp or the other would however be equally misleading. Further disaggregations must be made as soon as reliable statistics and other data are available.

A major flaw in the analysis lies in the total absence of adjustment mechanisms of any kind in the model. That is not how real social mechanisms work. Especially in the working of the economy adjustment mechanisms play a crucial role. The most important of these is price, (World Bank.)

Some adjustment mechanisms (like birth rate as a function of GNP) have been introduced but rather few. As indicated in the paper, real social mechanisms do adjust rather insufficiently, at any rate with a very long time lag which has turned out to be too long with respect to modern growth and change rates in research, technology, industrialisation and urbanisation, for instance. No adjustment mechanism has prevented the untenable situation in world nutrition, in private transportation, in the cancerous growth of metropolitan areas filled with misery, in the extreme disparity of wealth among countries and within countries. And price is no longer a valid regulator in many fields; it is often overruled by other factors.

In the case of industrial capital, the rate is defined as output less consumption, agricultural investment and services investments—in a sort of residual theory of investment which is not in accordance with any modern theories of investment. Moreover, the average lifetime of capital should not be constant but rather a function of level of development and the rate of growth. (World Bank.)

For a given output, considering investment in agriculture and services of vital importance, the freedom of choice was between consumption and industrial investment. In the model runs which assume no drastic change of policy and behaviour, the present propensity to invest industrially and average life-time of industrial capital stock have been considered. In some other runs, supposing different policies, the rates of investment and the stock lifetime have been modified to suit a more equilibriated behaviour of society (e.g. longer equipment and product lifetime). It is important to note that pollution abatement investments have to be made besides industry in the other categories as well: services (e.g. traffic, pollution), agriculture (e.g. fertiliser pollution), and consumption (e.g. household pollution from heating, detergents, etc.). However, more sophisticated investment and capital lifetime hypotheses will have no doubt to be applied in future investigations.

A fairly serious objection can be made about the question of reversibility ... Since virtually all of the relations of human behaviour with respect to income level have only been observed on the way up, the model is seriously in error to assume symmetric behaviour... Data shows that as income rises the birth rate falls, and this is incorporated directly in the Forrester model and indirectly in the Meadows one. One would expect, however, that on the way down with income the birth rate would not go back up the curve, but rather would remain at very low levels perhaps going up only when income reached low levels or when enough time had passed so that the

*** AGRICULTURAL EQUIPMENT**

* HEATING SYSTEMS

LOW IMPACT TECHNOLOGY LTD.

CONSULTANCY ON :

* SOLAR POWER

- * MICROBIAL SYSTEMS
- * BUILDING
- * WIND POWER * WATER POWER

MARKETING OF PROVEN EQUIPMENT I

- * CLIVUS AEROBIC WASTE HANDLER
- * SOIL-CEMENT BLOCKMAKING RAMS
- ***WATERPUMPING AND AEROGENERATOR WINDMILLS**
- *** WATERWHEELS AND TURBINES**

Write to us for advice and information

LOW IMPACT TECHNOLOGY LTD. 73 MOLESWORTH STREET, WADEBRIDGE, CORNWALL Wadebridge 2996

high income habits of low fertility had been forgotten, (World Bank.)

This is another field in which ameliorations are certainly worthwhile. A partial approach to this problem has already been realised in the original model using mechanisms of "third order" delays.

As to the example of birth rate as a function of income there is considerable evidence that factors such as instruction and habits are less important than the degree in which alternative modes of personal gratification exist which in modern societies are usually linked to income. The problem is thus not so much one of reversibility but of determining and qualifying psychologically relevant factors, which are insufficiently known as well as their influence on industrial and social behaviour.

A model is sensitive to changes such as the inclusion of small exponential rate in the discovery of natural resources and pollution abatement techniques, rather than using linear or step functions.

This is true. Such inclusions (with the same "time integrated content" as the linear or step functions, for a certain period of time) may in fact change model behaviour from "collapse" into a milder crisis. It should be investigated which of the two modes corresponds more to reality.

The level of detail in the different subsystems of the model is uneven.

Future disaggregation of the initial model and the replacement of major variables by distribution functions will show the relevance of this imperfection. This and other criticisms should be addressed to the body of information presently available on the problematique and attendant phenomena, rather than to the model of the MIT exercise.

The world is finite, thus it is impossible to expect the population of the world to be able to grow exponentially without stopping, or without something eventually preventing exponentiality. This is an obvious point. Malthus told us this in 1798; he did not need the MIT computer.

True (but arrogant). Comment: That Malthus did not need the MIT computer is irrelevant. He did not have it at his disposal. Would not he have liked to know more about the dynamics

of the "world system" and, about the relative importance and the interaction of various parameters?

Presumed remedial policies

One is not talking about something within the scope of human experience that millions of people will willingly accept a cut in their living standards. Many countries have in the past considerably reduced their standard of life. Social aspects were deliberately excluded from the first study and their consideration would in fact make the picture at once darker, but at the same time pave the way for acceptance of different value systems away from the merely material. It is not surprising that countries of both high industrial and population density have been more moved by the report than emptier areas of the world. Future studies, including some already begun in Japan, are concentrating on the social issues since it is fully appreciated that the attitude of individuals in societies will inevitably greatly influence demand for or rejection of the type of policy solutions suggested by the report.

It is difficult or even impossible to conceive of continued substantial economic growth in the poor countries in general taking place in a context of economic stagnation in the industrialised world. Within the present framework, it is impossible. We have to use our imagination, all our political will, all our energies to change that framework. If we are not able to change the framework one does not see how this world -underdeveloped and developedcan go on.

A cut in the standard of living even in an industrialised country, will mean severe hardship for the disadvantaged members of society.

Correct for a truly capitalist society. May one then ask whether a society with material profit as its main motivation can find a place in a homeostatic world, anyway? This does by no means imply that communist countries, as they exist today, could easily change direction versus an "equilibrium society".

Growth has been an essential attribute of capitalism since its conception in the late Middle Age, and it is questionable whether the liberties of individuals and business could be preserved in the

context of a no-growth world. (Leonard Silk).

It is. In the past, individual freedom has proved to be a good slogan to implement and maintain slavery and exploitation, giving every possibility to the strong, the reckless, and the privileged, leaving the handicapped, the morally inhibited and the underprivileged, open not only to arbitrariness but even to contempt. What of today? Equal freedom for all should be our goal. But optimum individual freedom for all cannot be but freedom limited by social responsibility, a limitation negative only in appearance.

"Profit" is the essential motivational force of man.

It gave rise to the Divina Commedia, the Ninth Symphony the Mona Lisa, and polio serum. It really did! Only the kind of profit in these cases has been essentially non-material satisfaction, the respective incentives being cultural, spiritual or social. The whole concept of "profit" must be revised, and its different kinds placed in a different order in the scale of social values.

If growth is "a substitute for economic equality," then stopping growth implies freezing the existing world distribution of income. (Wallich)

If growth is a substitute for economic equality, why not substitute the substitute by the real thing? The carrot swinging before the nose of man may prove to be more perturbing than Damocles' sword.

"Limits" predicts hell in 50 years. Hell is already present on Earth in places such as Calcutta.

No comment.

Note: This point and counterpoint analysis is largely unprofessional. The authors apologise if they have misinterpreted some of the critical observations listed here, or omitted more relevant ones or given irrelevant answers. Their purpose was not one of rebuttal. They wanted inter alia to show that controversy on details may be endless and sterile, and even offuscate, the vision of the drama and the stage in which man's fortunes are played out. And they hope that many of the critics will turn their talents to the constructive task of exploring what we all-the protagonists-should do to play our part right.

Progress in Water Technology

Volume 1 Applications of New Concepts of Physical-Chemical Wastewater Treatment

PERGAMON PRESS LTD

Edited by W. W. Eckenfelder and L. K. Cecil

CONTENTS: Municipal waste treatment by physical-chemical methods; Physicochemical systems for direct wastewater treatment; Advanced waste treatment at Alexandria, Virginia; Physicalchemical treatment design for Garland, Texas; Ultrahigh rate filtration of municipal wastewater; Interrelationships between biological treatment and physical-chemical treatment; Tertiary treatment the corner stone of water quality protection and water resources optimization; The effective utilization of physical-chemically treated effluents; Upgrading existing wastewater treatment plants; Some problems associated with the treatment of sewage by non-biological processes; The applicability of carbon adsorption in the treatment of petrochemical wastewaters; Treatment of wastes from metal finishing and engineering industries; Physical and biological interrelation-ships in carbon adsorption; Regeneration of activated carbon; Principles and practice of activated carbon; Automation and control of physical-chemical treatment for municipal wastewater; Recent studies of calcium phosphate precipitation in wastewaters; Logical removal of phosphorus; Phosphorus removal by chemical and biological mechanisms; Use of surface stirrers for ammonia desorption from ponds; Dewatering physical-chemical sludges; Disposal and recovery of sludges from physical-chemical processes; The role of freezing processes in wastewater treatment; Waste water treatment through electrochemistry; Ultrafiltration and microfiltration membrane processes for treatment and reclamation of pond effluents in Israel; Membrane equipment selection for the Must Hospital water recycle system; Comparative cost of tertiary treatment processes; Process selection and cost of advanced wastewater treatment in relation to the quality of secondary effluents and guality requirements for various uses; Interrelationships between fresh water and wastewater plants; How usable is present technology for removing nutrients from wastewater?

400 pages £7.00 hard cover March 1973

Volume 2 Phosphorus in Fresh Water and the Marine Environment

Edited by S. H. Jenkins and K. J. Ives

CONTENTS: Natural phosphate sources in relation to phosphate budgets: a contribution to the understanding of eutrophication; Significance of man-made sources of phosphorus: fertilizers and farming. The phosphorus involved in agricultural systems and possibilities of its movement into natural water; The significance of man-made sources of phosphorus: detergents and sewage; Phosphates in sewage and sewage treatment; Phosphorus in industrial water; Phosphorus in primary aquatic plants; Phosphorus in marine zooplankton; Role of phosphorus in eutrophication and diffuse source control; Significance of phosphorus in lakes and coastal water sediments and benthos; The acceleration of the hydrogeochemical cycling of phosphorus; Phosphorus in chemical and physical treatment processes; The role of phosphorus in the growth of *Cladophora*; Eutrophication and Lough Neagh; Stimulation of phytoplankton growth by mixtures of phosphate, nitrate and organic chelators; Soil and fertilizer phosphorus in the Irish ecosystem; Treatment in municipal plants: innovations for removal of phosphorus; Chemical pretreatment before biological treatment in sewage plants; A new method of removing phosphorus to produce a ready fertilizer; Experience with algal blooms and the removal of phosphorus from sewage; Environmental impact of detergent builders in California waters; An improved method of phosphorus analysis in sea water; Problems in the analysis of phosphorus compounds; Safety evaluation of substitutes for phosphates in detergents; Soluble phosphate removal in the activated sludge process; The microbiology of an activated sludge waste-water treatment plant chemically treated for phosphorus removal; Efficient biological waste-water purification is a precondition for chemical phosphate removal.

349 pages £8.00 hard cover Due Summer 1973

Volume 3

Water Quality: Management and Pollution Control Problems

Edited by S. H. Jenkins

CONTENTS (Partial): Legal and administrative problems; Training and education; Wastewater quality criteria; New analytical techniques; Virus problems in wastewater disposal; Problems of developing countries and arid zones; Low cost waste treatment systems; Municipal sewage treatment: Problems of design, operating and maintenance; Municipal sewage treatment; Problems of small communities: Packaged treatment; Industrial wastewater; Synthetic detergents environmental considerations; Renovation and reclamation of domestic and industrial waste waters; Ecological assessment of marine pollution.

368 pages £8.00 hard cover May 1973

Evolution and health

by Stephen Boyden

In our attempts to view the human situation in meaningful perspective, it is essential that we take account not only of our cultural background, but also of our biological history. For the human species evolved in an environment very different from that to which most of us are exposed today, and it was this evolutionary environment which determined, through natural selection, the innate characteristics of the species. While this fact has important implications for many of the major problems facing human societies today, this paper concentrates for the most part on a single aspect, namely, the biological history of Homo sapiens as it relates to problems of human health and well-being in the modern world. It concludes, however, by suggesting that this evolutionary approach to the health requirements of the human organism can lead to insights of relevance not only to public health, but also to the major social problems of our times, including the ecological predicament.

For the purposes of this article, I define "biological determinants of optimal health" as those various conditions which tend to promote or permit optimal physiological, mental and social performance in an animal in its "natural" or evolutionary environment. They may also be defined as those various conditions which tend to promote the kind of -functioning of mental and physiological processes most likely to ensure the survival and successful reproduction of the individual in the natural environment. Whereas, in the case of human beings, this degree of health is certainly not necessary for survival and reproduction under modern urban conditions, I contend that it is nevertheless a most desirable objective in terms of life enjoyment.

The Darwinian theory of evolution through natural selection assumes that populations of animals are heterogeneous, in the sense that there are inheritable differences between individuals, and that, because of these differences, in any given set of circumstances certain individuals are more likely than others to survive, reproduce and successfully rear young. The individuals which are better suited to the prevailing conditions tend to contribute more to the genetic constitution of subsequent generations than do those which are less well suited, so that eventually the population as a whole tends to become better suited to these conditions. From time to time, changes spontaneously occur in the genetic material (due to recombination, mutation, etc.). If an individual carrying such new genetic characteristics is, as a result of the change, less well suited to the prevailing conditions and consequently less likely to survive and reproduce, then the new genetic material will, before long, be eliminated from the population. If, on the other hand, the individual with the new genetic characteristics turns out to be better suited than its fellows to prevailing conditions, it will tend to contribute more offspring to the next generation, so that eventually the new characteristics will spread in the population, ultimately replacing the less advantageous characteristics. Thus, over many generations, populations tend to become better and better suited to the environment in which they live.

Phylogenetic maladjustment

The important corollary to Darwinian theory that I wish to stress has not been given a name, but I shall refer to it here as the "principle of phylogenetic maladjustment". According to this principle, if the conditions of life of an animal deviate from those which prevailed in the environment in which the species evolved, the likelihood is that the animal will be less well suited to the new conditions than to those to which it has become genetically adapted through natural selection and consequently some signs of maladjustment may be anticipated. Obvious though this principle is, and obvious though it's important, it is seldom referred to in the literature, and consequently its significance seems to have been largely overlooked. Although highly pertinent to the study of health and disease in mankind, I have not seen the principle mentioned in any of the standard textbooks of medicine. I have come across only two clear statements of the principle in the medical literature-one in the introduction to The Saccharine Disease by Cleave and Campbell (1966) and the other in Man's Presumptuous Brain by Simeons (1960).

The term "phylogenetic maladjustment",* then, specifically refers to disorders which represent the reactions of organisms to conditions of life which differ from those to which the species has become genetically adapted in evolution through the processes of natural selection. This principle relates not only to environmental changes of a physicochemical or material nature, such as changes in the quality of food or air, but also to various non-material environmental influences, such as certain social pressures which may affect behaviour. Furthermore, signs of phylogenetic maladjustment may be

* The maladjustment is *phylogenetic* because it represents a characteristic response of the *species* to the changed environmental circumstances. physiological, behavioural or both.

We can easily think of countless examples of the principles of phylogenetic maladjustment operating in Homo sapiens. The traditional "scourges" of mankind such as plague and typhus and the great deficiency diseases such as scurvy, beriberi, pellagra and kwashiorkor are all straightforward examples of the principle. An examination of reports on the reasons why patients visit their physicians in the most developed countries in Western society today (e.g. Logan and Cushion, 1958) shows clearly that the majority of the disorders of which they complain fit into this category, and are "diseases of civilisation", in the sense that they would have been rare or non-existent in primeval society (e.g. virus infections of the respiratory and alimentary tracts, peptic ulcer, cardiovascular diseases, obesity, diabetes and probably much psycho-neurosis).

Removal of "optimum health"

It is worth emphasising that one of the most significant influences of civilisation on the biology of mankind has been the removal of "optimal health" as a prerequisite for individual survival and reproductive success. In the evolutionary environment, survival and reproductive success were dependent on superb physical fitness, acuity of vision and hearing, absence of debilitating or painful illness, mental alertness, a good memory and a state of mind which permitted, when necessary, concentration, patience and a willingness to co-operate with others. None of these attributes is necessary for the individual's survival and reproduction the protective environment of in modern society, although, clearly, many of them are important in relation to life enjoyment. This molly-coddling influence of civilisation has been referred to as "pseudoadaptation" (Boyden, 1970; 1972a. & b.) because, while it mimics true adaptation by allowing the survival and multiplication of human populations under changed environmental conditions, it differs from true adaptation in that it does not involve any active response on the part of the

individual or of society, and consequently the forms of maladjustment are permitted to persist indefinitely.

Before proceeding further, it may be as well to refresh our memories on a few aspects of human evolution. It appears now that there were already beings on earth at least two million years ago conforming to Leakey's (1961) definition of "man" (i.e an animal that makes tools to a set and regular pattern). These people were, of course, rather different from ourselves in that their cranial capacity was about half that of modern man and there were other morphological, and no doubt behavioural, differences.

By 300,000 years ago, however, human culture was perpetuated by beings who differed only slightly from modern mankind in their physical characteristics, although the average size of their brains was still somewhat less than the modern average. But our ancestors of 60,000 years ago had a cranial capacity at least as big as ours, and they are classified as belonging not only to the same species as ourselves, but also to the same subspecies, namely *Homo sapiens sapiens*.

That was some 2,400 generations ago. It was not until about 400 generations ago that, in certain regions of the world some of our ancestors, reasons unknown to us now, gave up the nomadic hunter-gatherer way of life for a new kind of economy based on the domestication of plants and animals for food production and on a lot of hard work. This domestic transition was thus a very recent event in the biological history of mankind. Accordingly, we can safely infer that the innate phylogenetic or species characteristics of mankind were determined by the selection pressures operating in the primeval environment* and were already established by the time of the advent of civilisation. In the context of the present paper, the important point is that the innate biological determinants of human health were established under primeval conditions, and any innate needs that mankind may have for survival or well-being could be satisfied under those considerations. It follows from these considerations, and from the fact that Homo sapiens is no exception to the principle of phylogenetic maladjustment, that anv deviation that can be recognised from the primeval conditions of life must be suspect as a possible cause of

physiological or behavioural disorder. For this reason, knowledge of the biological conditions of life of primeval mankind is distinctly relevant to our concern for the health and well-being of mankind now and in the future.

Let us attempt, therefore, a very brief description of the biology of human beings in typical primeval society in much the same way as we might describe the biology of the jack rabbit, the mountain gorilla or any other animal species (except that, in the case of *Homo sapiens*, we do not have to make a special effort to resist the temptation to anthropomorphise).

The following description is written in the past tense, although many of the data on which it is based are derived from the work of anthropologists on existing (or until recently existing) hunter-gatherer societies.[†]

The biology of primeval mankind

Nutrition and feeding habits:

The energy required for growth, muscular work and basal metabolism was obtained from food of both animal and plant origin. The relative proportions of meat and vegetable matter varied according to circumstances, but usually the greater part of the diet was, by weight, of plant origin. Most of the food was brought back to the camp for eating.

Under favourable or typical conditions, activities aimed at the collection of food probably lasted for an average of two to three hours per day.

All hunting (except for small animals, such as lizards) was carried out by men, while the women, accompanied by some children, collected fruit, nuts, roots, etc. Men sometimes also took part in the gathering of vegetable food-stuffs.

Hunting was an occupation which was almost certainly enjoyed by the men. This sense of enjoyment in hunting may well be an innate characteristic of the species, of survival value in the evolutionary environment, and the product of natural selection. The same may well apply to food-gathering in women.

In the evolutionary environment, natural regulatory mechanisms operated to ensure that, under normal conditions, the intake of energy was directly related to the energy requirements of the body (Boyden, 1969). Much of the energy consumed was, in

^{* &}quot;Primeval" in this paper refers to the long hunter-gatherer period of human existence before domestic transition.

[†] The description is based partly on justifiable inferences derived from general biological principles and partly on data reported in the anthropological literature which was reviewed by Frances Barnes in her article "The Biology of Pre-Neolithic Man" (1970).

fact, utilised in the various activities associated with food-gathering itself, which involved periods of quite vigorous exercise each day.

Hunting combined the use of knowledge learned by experience and that transmitted by culture (relating to the environment, animal behaviour, etc.); it called for maximum use of intelligence; it involved the application of learned physical skills; it was characterised by co-operation between individuals; it was goal-directed (i.e. it had a built-in sense of immediate purpose); when successful it had a built-in sense of immediate reward-not only in the form of the satisfaction of hunger, but also in the form of praise and smiles from other members of the group, especially the women and children; it represented a challenge to the individual's mental and physical prowess and to his courage; it provided a daily outlet for aggressive feelings.

Rest and sleep:

In hunter-gatherer groups people tended to rest or sleep when they felt like it. Freedom to respond to feelings of sleepiness by going to sleep resulted in a polyphasic sleeping pattern, which typically included at least one nap during the daylight hours, usually around midday or slightly later.

Sexual behaviour:

Very little is known of the details of sexual behaviour in primeval societies.

Creative activity:

(a) Typically, most individuals in hunter-gatherer groups spent part of each day making and shaping things. This activity had the following characteristics: (i) it involved the exercise of learned manual skills; (ii) it was goaldirected, i.e. it had a built-in sense of purpose, as in the manufacture of weapons for hunting or defence, or utensils for preparing food or of ornaments to decorate the individual. It is noteworthy that the finished article frequently appears to be the product of more workmanship and effort than was necessary to render it functional, suggesting that some satisfaction may have been derived from bestowing an extra aesthetic quality on the object.

(b) Some individuals in huntergatherer groups specialised in such creative activities as story-telling or music making.

Social interaction:

Hunter-gatherer bands varied in size according to the nature of the terrain, and other factors. A typical band consisted of 30-40 individuals, including children. Bands might split up, come together again and exchange numbers according to circumstances (e.g. distribution of food supply, personality factors, etc.). Flexibility seems to have been the rule.

Much time was spent in conversation, discussing matters of mutual interest, exchanging information on aspects of the environment, sharing problems and anxieties, joking and story-telling.

Children were shown much affection by adults, and the attitudes towards them, especially small children, were generally permissive. While the parents, especially the mother, were expected to take main responsibility for their children, there was a good deal of communal co-operation with respect to the minding of children. For example, small children might be left with elderly members of the group at the camp when their mothers went off to gather food, and sometimes one woman would take care of several children other than her own for a considerable period.

In primeval societies there was little evidence of sharp "generation gaps", although the onset of puberty was often recognised as an important event. Young children tended to learn skills and to acquire knowledge from their older siblings or friends, who in turn learned from their older siblings and friends, and so on. Elderly people were, under favourable environmental conditions, treated with respect.

Strangers and strange groups were regarded with suspicion. However, open hostility between groups, involving physical violence, is not a feature of extant hunter-gatherer societies although this is not to say that such hostility never occurred in primeval times.

Visual environment:

It was an environment full of *interest* to the observer; it was characterised by a certain functional *harmony*, and it was *dynamic* in the sense that significant changes were occurring in it from day to day or from season to season

(i.e. it was never completely static—as, for example, a room in a modern home may be). Another point of relevance is that, if there are genetically-determined components to man's aesthetic sense (and I strongly suspect that there are), then these were determined through natural selection by pressures associated with the visual environment of the evolutionary period.

Health:

The mortality rates in primeval society were much higher than in modern Western society, and consequently the average age at death was much lower. The main factors contributing to illhealth and mortality were probably injury sustained in hunting and foodgathering activities (with subsequent infection of wounds) and attack by predators. Neither infectious disease due to bacteria and viruses nor malnutrition was a common cause of illhealth.

Biological determinants of optimal health

We have already noted that, if the conditions of life of an individual deviate from those to which the species has become genetically adapted through evolution, signs of phylogenetic maladjustment (physiological or behavioural) are likely to arise. With this principle of phylogenetic maladjustment in mind, I have utilised our knowledge of the conditions of life of mankind in his evolutionary environment to draw up a tentative list of some of the biological determinants of health of the human organism.

The list is not presented in any particular order, although I have tended to place the more easily definable "physicochemical" or "material" determinants of health first. There is inevitably overlap between some of the items on the list, particularly those concerned with behavioural and social aspects.

(1) An appropriate intake of calories neither in excess of, nor much less than the requirements for basal metabolism, growth (in children) and physical work performed.

(2) A well-balanced diet of a quality close to that of primeval mankind.

(3) Clean air.*

(4) Minimal contact with pathogenic microorganisms.

(5) Noise levels not much above or

^{*} The word "clean" in this list means "free of noxious agents and harmful products of technology".



The Man'Food Equation

A two day symposium on the relation between world population and food resources and the individual and his diet in health and

disease to be held at The Royal Institution, London

20/21 September 1973

WILL THE MAN'FOOD EQUATION BALANCE?

The disparity between the needs of increasing global population and decreasing food resources poses the most intractable problem mankind has ever faced.

What are the realities? Is the problem real or illusory? What are the limits to growth? There

are differing views of the impending crisis and probably an equal number of solutions to it. Will the Man/Food Equation balance?

Among the distinguished scientists who have already agreed to speak are:---

Professor D. P. Burkitt, FRS Professor N. W. Pirie, FRS Dr. S. J. Holt Professor G. W. Dimbleby Dr. M. A. Crawford Dr. R. Cracknell George Leslie Dr. Arthur Bourne Dr. M. Worgan Miss Mary Wheeler Dr. J. Williams Gerald Leach

Fallacies of Diet Potential Protein Sources Marine Fisheries and World Food Supplies The Impact of Man The Protein Myth Social Consequences of the Green Revolution Food Supplements - Natural or Synthetic? The Man/Food Equation Unconventional Food Sources Protein Requirements of Man The Ecology of Agriculture The Energy Cost of Agriculture

The registration fee for the Symposium is £10 including lunch and tea on both days. Students £3 excluding lunch.

Please register me as a delegate to the "Man/	Name
Food Equation".	Address
I enclose my cheque for £ as my	
registration tee.	

For full details write to Michael Van Straten, Symposium Secretary, Stratenport House, Tring, Hertfordshire, England. Telephone: Tring 4004

much below the range experienced in the natural environment.

(6) Minimal contact with noxious chemical compounds.

(7) Absence of accessible physiologically and psychologically harmful drugs.
(8) A visual environment which is interesting, which has aesthetic integrity, and in which a certain amount of change meaningful to the observer is taking place.

(9) Daily periods of physical exercise, at times vigorous, and with clear goaldirection.

(10) Conditions which allow natural outlets for the sexual drive, and a reasonable balance between levels of sexual stimulation and sexual satisfaction.

(11) Opportunities to rest and sleep in response to the urge to do so (by night or by day).

(12) Opportunities for spontaneous conversation with relatives and friends on matters of mutual concern and interest.

(13) Freedom to move at will from one social phase to another (i.e. from one small group to another or to and from a state of solitude).

(14) Opportunities for companionship and close friendship with other members of the in-group.

(15) Opportunities for mothers to leave young children on occasion in the care of others.

(16) Opportunities for frequent and unimpaired expressions of the universal behavioural tendencies of the species (e.g. tendency to seek approval, or esteem within the in-group, and to avoid ridicule, to compete with peers, to explore the unknown).*

(17) Opportunities and incentives for personal creative behaviour preferably with clear goal-direction, involving

* This whole question of the innate behavioural characteristics of the species is of critical significance in relation to the major problems facing human society. It is also a highly controversial subject (see Boyden, 1973).

[†]The range of the deviations in the conditions of life from the primeval pattern is extensive. A fairly comprehensive list of these deviations has been presented elsewhere (Boyden, 1972c.)

[‡] Lest I be accused too readily of Rousseauian romanticism, let me hasten to repeat that neither attack by predators nor serious injury sustained in hunting, which were common causes of death and suffering in the primeval situation, are features of life in modern urban communities, and that consequently the average age at death is much higher now than it was then. Moreover, infection of the tissues with microorganisms is far less likely to result in death today than was the case in the primeval environment.

§ The term parasite is used here in the general sense to include bacteria, fungi, viruses, protozoa, helminths, etc. potentially parasitic in the human species. especially the exercise of learned manual skills, or in story-telling, music making, etc.

(18) A considerable degree of emotional involvement and a sense of immediate purpose in the main activities of the day.

(19) Conditions which result in full awareness of a role of oneself in the in-group or community.

(20) A considerable degree of variety in daily experience and activity.

(21) General opportunities for selfexpression and self-fulfilment.

In essence, then, this is a list both of the main features of the conditions of life of *Homo sapiens* in the evolutionary environment of the species and of postulated biological determinants of optimal health in modern society.

Since it is clear that many of the conditions listed are not features of the pattern of life of the modern city dweller[†], the question arises, in the case of each deviation that can be recognised from the evolutionary pattern, whether or not the change is giving rise to phylogenetic maladjustment in any form, physiological or behavioural, severe or mild.[‡]

In some instances, of course, the connection has already been clearly established between certain environmental changes associated with civilisation and certain forms of phylogenetic maladjustment. For example, crowding in cities, in the absence of appropriate cultural adaptation involving the introduction of new standards of hygiene to suit the new conditions, results in alterations in host-parasite§ relationships so that item number four on our list-minimal contact with pathogenic microorganisms-is not satisfied and severe signs of phylogenetic maladjustment are manifest in the form of various contagious diseases.

Implications for modern society

While the modern urban environment in the developed countries satisfies the survival determinants for the average individual, it may not do so well with respect to the well-being determinants. The average man and woman are not, for example, involved each day, as were their ancestors, in personal creative activity; their levels of physical exercise are much diminished; their opportunities for resolving personal tensions by the reaction of mutual avoidance are restricted; and society imposes on them a monophasic sleeping pattern. Even more importantlythe average urban dweller is little involved emotionally in most of his daily activities. "The shining eye, ease of movement and quick heart beat which reflect the adaptation to enjoyable or emotionally inspired activity" (Minc, 1970) are rare sights in the modern city. This culturally-imposed divorce of the functions of the cerebral cortex and the limbic system deprive the individual of a sense of immediate purpose and of enjoyment in his daily routine. Moreover, it has been argued on neurohormonal grounds that this change may result in various forms of phylogenetic maladjustment, including cardiovascular disease and "minor morbid conditions which are so common today: headaches, lassitude, irritdepression and ability, possibly aggression" (Minc, 1970).

The arguments put forward here represent a development of the idea that an evolutionary approach to the study of mankind in the modern world can help us to view the human situation, and both the advantages and disadvantages of civilisation and technology, in meaningful perspective. By way of conclusion, it would be useful, I feel, to attempt a brief summary of the impact of technology on the biology of the human species:

(1) Modern technological society, by the protection it provides against the primeval causes of death, by making greatly increased quantities of food available and, more recently, by the protection it has afforded in more developed areas against the great lethal diseases of civilisation, has increased to an extraordinary degree the number of specimens of the human species that can exist on earth at any given point of time and also their average lifespan.

(2) Technology has increased to a remarkable degree the impact of the human species on the biosphere. An idea of the scale of human activity can be gained from the fact that, as a result both of the massive population increase and of the even more explosive spread and development of technology, the human species is now utilising energy at about the same rate as all other land animals and plants put together (Boyden, 1972c). The rate of energy utilisation, which is a fair measure of the impact of human society on the total environment, is increasing exponentially at about double the rate of population increase.* It is clear that, if civilisation is to survive, a state of equilibrium must be restored to the biosphere.

The solution to the problem, if there is one, must surely lie, not in further mindless intensification of technological and industrial effort, with increasing

* Part of the dilemma lies in the fact that ever-expanding industry and advancing technology, which are supposed to lead to an increased "standard of living", represent, in effect, a frantic effort on the part of society to continue to provide very simple and basic human needs (e.g. an adequate and balanced diet and freedom from pestilence). Ever-accelerating technological advance seems to be necessary in order to maintain the status quo in terms of the essential requirements of the human organism. A sophisticated food technology and an efficient transport and distribution system are essential if people in the great Western cities are to receive an adequate and balanced diet. The two automobiles per nuclear family, now common in some sections of Western society, provide the family with (a) some prestige, (b) the means by which the adult male can reach his place of work, (c) the means by which the female can visit relatives and friends and procure provisions, (d) the means by which the children can participate in group activities, (e) the means by which they can all visit the natural environment. It was possible for every one of these human "needs" to be adequately satisfied in bygone societies, even before the invention of the wheel, let alone the internal combustion engine.

GNP as the sole objective but rather in a re-organisation of society based on increased emphasis on the quality of individual lives and involving some fundamental changes in our value systems. The materialistic objectives of the Western world have been questioned by moralisers and philosophers for a long while, but the growing awareness of the threats to human survival in the ecological situation now adds a practical flavour to the problem. Questions such as "Where are we?", "Where are we going?", "Where do we want to go?" and "What is progress?" are taking on a new and urgent significance. It has been a theme of this paper that human biology can help us to see the relevance of these questions and can also contribute usefully to our attempts to answer them.

References

Barnes, F. (1970). "The Biology of Pre-Neolithic Man". In Symposium *The Impact of Civilisation on the Biology of Man.* (ed. S. V. Boyden), ANU Press, Canberra, pp. 1-18. Boyden, S. V. (1969). "The Impact of Civilisation on Human Biology". Aust. J. Exp. Biol. med. Sci., 47: 287-298.

med. Sci., **47**: 287-298. Boyden, S. V. (1970). "The Human Organism in a Changing Environment". In *Man and his Environment*, Octagon Lecture 1969 (ed. R. T. Appleyard) University of Western Australia Press, Perth, pp. 1-20.

Applevard) University of Western Australia Press, Perth, pp. 1-20. Boyden, S. V. (1972a). "Biological View of Problems of Urban Health". *Human Biology* in Oceania, Vol. 1, No. 3 (Feb. 1972), pp. 159-169.

Boyden, S. V. (1972b). "Biological Determinants of Optimum Health". In *The Human Biology of Environmental Change* (Proceedings of a Conference held in Blantyre, Malawi, April 5-12, 1972) (ed. D. J. M. Vorster), International Biological Programme, London, pp. 3-11.

Boyden, S. V. (1972c). "Ecology in Relation to Urban Population Structure". In Symposium *The Structure of Human Populations* (eds. G. A. Harrison and A. J. Boyce), Clarendon Press, Oxford, pp. 411-441. Boyden, S. V. (1973). "Human Behaviour as it

Boyden, S. V. (1973). "Human Behaviour as it Relates to the Ecological Problem". Submitted for publication.

Cleave, T. L. and Campbell, G. D. (1966). Diabetes, Coronary Thrombosis and the Saccharine Disease. John Wright, Bristol. Huxley, A. (1972). Island, Chatto & Windus, London.

Leakey, L. S. B. (1961). The Progress and Evolution of Man in Africa. Oxford University Press, London.

Logan, W. P. D. and Cushion, A. A. (1958). Morbidity Statistics from General Practices. General Register Office Studies on Medical and Population Subjects No. 14 (Great Britain), Her Majesty's Stationery Office, London.

Minc, S. (1970). "Civilised Man's Activities and his Automatic Underworld". *Med. J. Aust.*, (ii): 781.

Simeons, A. T. W. (1960). Man's Presumptuous Brain. Longmans, London.

Ecologist binders



Keep your copies of the Ecologist in a special binder

Each binder is in dark green library fabric, stamped in gold leaf on the spine

Binders for Volume 3 (1973) now available

Volume 2 is on order

Volume 1 is in stock

£1.20, inc. postage and packing

Order from the Ecologist, 73 Molesworth Street, Wadebridge, Cornwall

Asbestos and cancer

by Edward Goldsmith

Mr W P Howard, Secretary of The Asbestos Information Committee has written to us ("Asbestos and Cancer" the *Ecologist*, Vol. 3 No. 5) attempting to refute the statement made in the *Ecologist* Vol. 3 No. 1 to the effect that "low levels of asbestos in the air increase the risk of cancer to the general public".

A great deal is known on the effect of asbestos on human health. Thus, Merewether and Price in their extensive survey of asbestos workers in England found that 80 per cent of those who had worked 20 years or more in this field displayed symptoms of this disease. Similar evidence was found by Bohme in Germany. He showed that morbidity rates increased with length of exposure, reaching a 79 per cent rate for workers exposed for more than 10 years. Other studies have obtained similar results.

Another disease associated with asbestos pollution is the calcification of the pleura, the depositing of insoluble calcium salts in the lining of the lung. A Finnish study showed that this disease was observed in 499 of 6,312 people living near an asbestos mine. In about 7,101 people living elsewhere, no cases were recorded.

The most serious disease associated with asbestos is cancer. Merewether, the Chief Inspector of Factories in the UK in 1947, stated that out of 235 reported cases of men who had died of asbestosis between 1924/37, 31 had lung cancer—13.2 per cent.

Professor R. Doll has reached the conclusion that asbestos workers run a 10 times greater risk of contracting lung cancer than the general population. A massive study was undertaken by the Asbestos Workers' Union in New York and New Jersey which revealed a 60 per cent higher death rate than in the normal population. Deaths were caused by lung cancer, cancer of the pleura, cancer of the gastrointestinal tract and asbestosis. Another study of 17,800 workers in the US and Canada (between 1967/71) yielded similar results.

Very disturbing is the synergy between asbestos and cigarette smoke. It was estimated in the above study that asbestos workers who smoke have a 92 times greater risk of dying of lung cancer than men who neither work with asbestos nor smoke.

linked with Asbestos is also abdominal mesothelioma-also a form of cancer. This was established in 1960 in a study in South Africa. Studies in New Jersev reported high incidences of this disease in a community living in the vicinity of a large asbestos mill. Asbestos also appears to cause intestinal and uterine cancer and perhaps cancer of other organs. It was found in a recent study in Pittsburg that 98 per cent of lungs examined contained asbestos fibres. In New York 3,000 autopsies revealed 1.449 cases of lungs containing asbestos bodies. Pleural calcification has also been associated, in Finland, with non-occupational exposure to asbestos. In the US, legislation is beginning to appear to control the use of this very dangerous pollutant. Recently in Philadelphia, a court ruled that it was a criminal offence to spray asbestos at a building site. A city ordinance in Philadelphia now prohibits the spraying of asbestos-containing material at construction sites. The Environmental Protection Agency has recently proposed emission standards for asbestos from all mining, milling, spraying and manufacturing processes.

To understand the relevance of this information to human health today, we must realise that lung cancer is very much a disease of industrial society, in fact it appears to increase in direct proportion to industrialisation, and hence GNP. Thus, if we take a country like Ceylon with GNP per capita of 140 dollars, the lung cancer incidence among males is 5 per million. In Mauritius, with per capita GDP of 225 dollars, the incidence is 16 per million. In Portugal, a much richer country, with per capita GDP of 479 dollars, the incidence is 110 per million, and in the US where the average income is \$3,960 the incidence is 430 cases per million.

What are the features of industrialised society that make its members so vulnerable to this disease? I think that all those who have looked into the problem will agree that the main thing is that we are all exposed to well over half a million different chemicals of which the human organism has had no experience during the course of millions of years of evolution, and the number is increasing by three or four thousand every year. It is for this reason that cancer, diabetes, heart diseases etc., often referred to as the diseases of civilisation, are becoming known as the diseases of maladjustment. One of the most important facts that neither the government nor our establishment scientists have been willing to recognise is that the experimental method, consisting in examining the effects of each specific pollutant on laboratory animals, cannot possibly provide the necessary information to reduce the ever growing cancer rate. There are many reasons for this, all of which I cannot go into here. One is that different experiments reveal different results because the exact conditions under which they take place are never the same and also results invariably lend themselves to different interpretations. Another is the immense problem of logistics involved. There are simply not enough laboratories or laboratory technicians in the world to carry out all the necessary experiments.

The SCEP report makes this point very clearly. (Also see "So far so good" the Ecologist, Vol. 1 No. 16). "The significant aspect of human action is man's total impact on ecological systems, not the particular contributions that arise from specific pollutants. Interaction among pollutants is more often present than absent. Furthermore, the total effect of a large number of minor pollutants may be as great as that of one major pollutant. Thus, the total pollution burden may be impossible to estimate except by direct observation of its overall effect on ecosystems."

On the basis of this essential principle the case against asbestos is far stronger than it need be to justify the strictest possible controls on its manufacture and use, if not an outright ban.

Friends of the Earth

Scottish bonanza

As usual-and not a moment too soon -the gloss is wearing off the bonanza, and people are beginning to notice the fine print. For weeks the newspapers have echoed with one group after another uttering monitions about North Sea oil. The Scottish Nationalists were of course first in the field; but they have been joined by their fellows in the Scottish Liberal and Labour parties, and by numbers of Scots with no intention of running for office, and much more to lose. The alert was sounded, inadvertently, by the Scottish Development Office, when they published their report on sites which might be suitable for onshore oil-related industrial development. Suddenly people in communities all around the Scottish coast realized that the next American accent they heard might be their future landlord.

Our undertaking earlier this year (Ecologist, April 1973) re watchdogging the North Sea situation got well and truly rolling just about the time the S.D. sites were revealed and the populace bemused. On the last weekend in May Colin Blythe, Amory Lovins and your reporter journeyed to Dundee to meet with our colleagues in Scottish FOE groups, Conservation Society groups, and other environmental and amenity groups, and with the National Union of Students' environmental unit, to try for a collective viewpoint on oil and Scotland, We spent Saturday in vigorous discourse in a hall at the University of Dundee, in the company of associates from Aberdeen, Edinburgh, Glasgow and as far north as the Shetlands. Participants pooled their information concerning local oil-shenanigans, compared notes on defence-campaigns, past and current, swapped addresses and contacts and agreed that thenceforth it would be essential to keep open every available line of communication.

Terry Hegarty of the North Tayside Conservation Society agreed to act as Information Officer for the informal North Sea Oil Coalition which took shape. His address, 2 Tayside, West Ferry, Dundee, should be noted by all who have access to information which should be fed into the network—and indeed by those who may be about to find oil platforms in their backyard.

The participants at the Dundee meeting endorsed the following statement:

"We are concerned about the runaway expansion of oil-related developments, which may:

- (a) by-pass Scottish working people in favour of imported labour already possessing necessary skills;
- (b) lead to short term industrialisation, often under foreign ownership, in inappropriate locations;
- (c) give Scottish industry and commerce no opportunity to acquire the managerial and other experience needed to win a share of oil-related business;
- (d) overextend undersea technology to the point where accidents produce severe environmental damage;

(e) squander a precious resource. Uncontrolled, an oil explosion will cause irreparable harm. Let us open the valves with a bit more care."

It was agreed, in the light of information available, that FOE Ltd. should lodge a formal objection to support the villagers of Drumbuie, Ross and Cromarty, against plans to build concrete production platforms on the mainland opposite the Isle of Skye. The land in question is National Trust land; there is no unemployment problem in the area; the local people are opposed to the plan; the technology is still untried; and the companies in question have no guarantee that the site will even be used. As a test case it seems almost cut-and-dried. But when it comes to oil nothing-repeat NOTH-ING-is ever cut-and-dried.

Before we left Scotland we drove down the Fife coast to have a look at the Methil site where Redpath Dorman Long are building platforms. No one could reasonably deny that Methil is a good place to build platforms. Indeed, shortly after the Dundee meeting our colleagues went on record as applaudfurther platformplans for ing Burntisland, near construction at Methil. We have never doubted that the oil of the North Sea is and will be a valuable resource. But any resource is much more valuable when you know what you are doing with it.

Walt Patterson



NOW IN PAPERBACK

some comments on the first edition

Hugely readable, eminently sane and quite compelling ... an urbane, witty and stimulating book. It is full of facts and ideas. It illuminates the complex problems of preserving and enhancing liberty and leaves one in no doubt about the pressing reality of the problem of population growth. The Ecologist

... one of the most important of recent contributions to environmental thinking ... the author meticulously sorts out the facts and the issues, laying them before us with clarity and coherence ... presents the essential factors that any rational evaluation of the population situation must take into account. Before you accept any argument about populations read *Population versus Liberty*. You owe it to Humanity. Your Environment

Anyone who really wants to understand population problems should read this book. Bulletin of Environmental Education

A tremendous amount of valuable material ... the message is right and terribly urgent. TLS

This dilemma of the conflict of freedom is excellently summed up in *Population versus Liberty*. Donald Gould, *New Statesman*

Б

Down to earth

Composting for conservationists

All life depends for its energy on 5 per cent of the sunlight that falls on living leaves, for neither we, nor any other creature can eat nuclear energy, blowing wind or falling water. Directly or indirectly we need starches, sugars, oils and fats to drive the heat engines in our bodies. Even though we enlist the aid of digestive bacteria to include celluloses like grazing animals, or hemi-celluloses and lignins like termites, we still must live off Earth's green income-gatherers.

Thrust your hand in a heap of lawnmowings and you can feel some of that 5 per cent of sunlight escaping as bacteria attack the starches and sugars for their energy, breaking down proteins to supply nitrogen, phosphorus and trace elements to build their uncountable millions of ever increasing bodies. Quite soon the heap will go cold and become a black and slippery mess, because the bacteria will have exhausted their immediately available food and energy supply and polluted themselves out of their environment.

As they expand production on the fuel, mineral and food resources of the mowings, they produce acids which arrest further decay so the heap becomes silage, a vegetable "cheese" with its food value preserved by its own acidity. Farmers make it by excluding air and adding molasses.

Composting takes the process beyond the silage stage, with lime to correct the acidity, air to supply the oxygen for the air breathing bacteria and something to hold in the heat they produce so it kills weed seeds and the spores of disease. It uses almost all its starches and sugars, and even some cellulose to produce this heat, releasing minerals as food for plants and leaving behind the woody matter to become moisture-retaining humus and the energy supply for soil bacteria and fungi, earthworms and a whole ecosystem we cannot afford to starve and destroy.

Dig in straw or any other lasting

vegetable waste and the bacteria that increase to break it down will take up the nitrogen and phosporus they need at the expense of the crop that follows. Compost it and it is recycled so its plant foods are used again and again. Burn it and you convert its minerals to forms that wash quickly from the soil, and return its nitrogen to the air.

The traditional garden compost heap is built of $\frac{1}{2}$ - $\frac{3}{4}$ inch sawn boards and 2 in x 2 in timber, creosoted and then bitumen painted to last even 20 years. It should be about four feet high and shaped like a squared "U" with a loose board front at the open end. An essential is two double rows of bricks on edge with the ends of the rows protruding under the front boards, to let in the air from below for what is in effect a bacterial bonfire. The ready made types should sit on bricks and have air channels built under them, while the almost useless wire rat-trap kind should be lined with opened out cardboard cartons, to hold in the heat and moisture.

Start by covering the brick rows with stemmy material like hedge clippings, brussels sprout stems or even small pieces of wood laid across them to prevent blocking by fine material like mowings or soft weeds. Upright stakes thrust into the channels and withdrawn after building give extra air for heaps that are mainly mowings and weeds which should have as much soil as possible shaken off the roots.

The usual Indore system (invented at Indore Research Station in India, *not* made indoors) starts with an eight inch layer of garden rubbish, with a half inch thick one of animal manure, then another eight inches of rubbish, enough lime to whiten the surface, more rubbish, manure again and so on in a "layer cake" that can be six feet high.

There are many other activators and systems, with dabs of seaweed jelly or dried seaweed used by vegetarians, herbal preparations by some gardeners and chemical ones by others, but the principle is still the same. Perhaps the cheapest and simplest system is to stack the weeds outside the heap and to fork them on to cover the compost bucket contents emptied daily from under the sink, and tip on what is now known as "H.L.A.".

This is "Household Liquid Activator" made from one part of urine to two of water, which has three great advantages. It costs nothing, its nitrogen is in the form of ammonium carbonate which favours Hutchinson's spirogaete, an excellent breaker down of woody wastes, and it contains most of the potassium that leaves our bodies.

A heap made on this system, with dried poultry manure and Elsan bucket emptyings as well in 1972 held a temperature of over 150°F. for six days in summer, and over 140°F. in winter without smell or fly problems. Typhoid bacteria die in 30 minutes at 131°F., so do those of dysentery, salmonella, diphtheria and septicaemia. Brucellosis bacteria die at 142°F., those of tuberculosis at 151°F., but tapeworm eggs need 160°F. to kill them, which this heap achieved for two days, reaching a maximum of 165°F. with the help of the bacteria that set haystacks on fire. The Elsan fluid did not cause trouble, for this contains phenols which are also present in urine so there are bacteria specialised to break them down. Where human wastes are used in a compost heap, turning and adding lime to gain a second heating and make sure of complete breakdown is desirable.

An even better method for isolated cottages would be a methane gas generator, converting bucket emptyings, waste paper and weeds to free gas with compost as a by-product. This uses anaerobic bacteria needing no oxygen and reaching only 86-90°F. The spent charge still holds 60 per cent of the cellulose, 70 per cent of the hemi-cellulose and 80 per cent of the lignins, little less than normal compost, plus all the minerals, but unfortunately all the weed seeds, though the 14 days under anaerobic conditions destroys the pathogenic bacteria.

The mysterious man who runs a car on chicken manure can only extract about 50 per cent of the power he would get by burning the droppings, which is far less than there is in paper, straw or the wasteful garden bonfire, but some day we shall need that power badly, and it is then that research on methane gas generators will pay off.

Books

The seven lean years

THE STATE OF FOOD AND AGRI-CULTURE 1972. FAO, Rome.

It is a fair bet that the FAO Yearbook is the world's gloomiest annual. It chronicles the ecological crisis which large sections of the world are experiencing already. Usually it manages a note of optimism, but this year even this luke-warm comfort is hard to find. In his introduction, the Director-General, Mr A. H. Boerma, refers to the parable of the seven lean years. 1971 was clearly one in a series of lean years. We must hope the fat years really do lie ahead.

Food production, both in terms of total and per caput output, rose in all the developed regions, but in the developing regions the increases were not sufficient to produce per caput gains. The exception, and the only region which achieved an overall increase, was Africa, where a gain in total production of 4 per cent produced a per caput increase of 1 per cent. In Latin America, on the other hand, there was no increase in total production and per caput production fell by 3 per cent.

The areas of Asia sown to the new hybrid wheats and rices increased, but even here production was held back by bad weather, mainly experienced as lack of water, and disease. The rate of increase in fertiliser consumption slowed from 17 per cent to 8 per cent. Rural unemployment increased.

Mr Boerma points out bravely that revisions to preliminary FAO figures is frequently upward, but it would take a major, and global, computing error to turn 1971 into anything but a very bad year. Even the parable is of little comfort, for if long-term targets are to be met, one year that is below average must be followed by several years above average.

The annex tables for per caput calorie and protein availability by regions are missing from this edition of the Yearbook and the average dietary requirements have been reduced to 2,385 calories and 38.7 grams of protein for the world as a whole and 2,284 and 38.4 for the developing countries. That helps to improve the results but even then a large amount of malnutrition remains that cannot be "adjusted" away.

Michael Allaby

Trees of Exmoor

A HISTORY OF THE FOREST OF EXMOOR by Edward T. MacDermot, David and Charles Reprint, £6.50.

Robert Sellick has done a great service in preparing a new edition of this classic account of Exmoor Forest, first published in 1911. The author, Edward T. MacDermot, was by profession a lawyer: equipped to interpret the intricacies of forest law contained in a variety of documents held at the Public Record Office, and blest with the energy to pursue an arduous labour of love. The task was made all the harder by the fact that the Rolls of the Swainmote Court, which governed the affairs of the Forest, have utterly disappeared-destroyed it is feared after the extinction and sale of the Forest in 1819. None the less the result is an example of strict scholarship and comprehensiveness rarely equalled, nearly 500 pages long with appendices and index.

Mr Sellick has incorporated the author's own revisions, completed in 1939, and added further material gleaned from MacDermot's papers after the latter's death in 1950. He has also written a short informative introduction, including some interesting notes about MacDermot himself, who began his acquaintance with the district as a holiday visitor (renting part of the house at Yanworthy), and ending by settling permanently at Lillycombe. Eleven new photographs have been added, some of them familiar subjects, but not included in the 1911 edition. At £6.50 this is a very good investment, even for those who happen to own the original MacDermot, and-taken in conjunction with C. S. Orwin's The Reclamation of Exmoor Forest (recently re-issued and expanded under Mr Sellick's direction)-the reader has an expert and authentic account of this unique region from earliest times until the early years of the present century.

Lies, damned lies

THE NUMBERS GAME — The Bland Totalitarianism—By Harry Hopkins, Martin Secker and Warburg Limited. London 1973. £2.80p.

We hear so much these days of economic "growth points", the Gross National Product, the Growth Rates, economic and industrial indices and so on. Clothed in the precision of science, such statistical artefacts now increasingly dominate our times, even shape our lives. Progress, affluence and poverty are commonly presented to the public as functions of growth; that is, the GNP. A country is supposed to be rich or poor depending on her position on the Growth League Table.

The American economist Robert Heilbroner, in his book *The Great Economists*, written in 1951, noted that by 1950 despite rapid economic growth and a GNP per head twice that of 1939, one quarter of Americans were still living in poverty or on its edge. However, he concluded, by the 1970s income would have grown by another 40 per cent or so in real terms and "by shunting more of the gains from growth towards lower income brackets", the solution of the economic problem (which Keynes had looked to in the '20s) would be achieved.

The '70s have come, economic growth has been achieved, yet despite an aggregation of wealth unrivalled in history, the problem of mass poverty —of what has been lately called "the other America"—remains as apparently chronic and pressing as ever, and in New York alone one quarter of the population is classed as living in poverty.

In this fascinating book, the first comprehensive exploration of the rise and social impact of these intimidating numerical "signs and portents", Harry Hopkins finds the numbers bogus, the science dubious and our addiction dangerous, possibly fatal. As he chronicles the relentless inroads of what he calls "statistical imperialism". the author demonstrates the Laws of the Numbers Game now installed in the heart of the West. As the reader watches the gears of the Numbers Machine-the social sciences, the media, the compulsions of commerce -meshing together, he discovers a missing key to some of the most per-

Victor Bonham-Carter

plexing social problems of our time the "crisis of morals", the persistent industrial strife—and poverty—in affluence, to the mounting lack of conviction in democratic politics and our powerlessness to halt the rising tide of crime and violence.

Conventional economics has been a curiously disappointing science, which has not only failed to provide complete answers to many central economic and human questions, but has not really provided any answers at all. A society compulsorily dedicated, socially and individually to more, cannot entertain less, even if that less is better. Conventional economists are trapped within a process, "The Numbers Game". Behind all the high speed of statistical abracadabra, the probability is that with the weathermen, the most notable ability of such economic thinkers (or is it economic illiterates?) of the unthinkable will turn out to be to tell us it is wet when it is raining.

"Things fall apart; the centre cannot hold", wrote W. B. Yeats in 1922. Half a century later things fall apart yet more spectacularly-people are looking for a new life-style different from that of the centralised, atomised, computerised, technocratic mass society. A future that is going to be worth living is not going to be assembled from "bits" of the present, however ingeniously shuffled and reconstructed. And of the power of Numbers to maim there can be little doubt, for as Harry Hopkins points out we have been brought to the point where we are in danger of forgetting that, as the Brazilian social anthropologist Gilberto Freyre has put it, "What is human can only be explained humanely-one has to leave room for doubt, even mystery". The objection in short is not to availing ourselves of the high potential of technology and statistical science, but to their totalitarian extensions which leave no room for human ambiguity; for living space.

To seek to put back into democracy what the "numbers" have left out may seem to many a contradiction in terms, since democracy has come to be defined almost wholly in numbers, majority and minority etc. But we must free ourselves from it and rethink our basic philosophy of human society.

Mr Hopkins insists in this important book that if we are ever to liberate ourselves from our pathetic number-

314

watching dependency and inertia, we must restore ordinary—or extraordinary —human judgement to its proper place and role. And he suggests a few ways we might set about this uphill task. These include:—

(a) Placing the ordinary man at the centre and seeking to enable him to fulfil his possibilities. Concern should be with values rather than with quantities or prices.

(b) Giving priority to the human and social growth points. The need to locate, and build around the nodal points in our societies where technical requirements and human operations and community life critically interact. Nodal areas where a truly participatory democracy could expose the pseudodemocracy of the Numbers Game, such as real small-scale human communities, whether of work place, living space, places of education or leisure.

(c) The renewal of participatory democracy at grass roots level and the exclusion of large areas of society and its communications from unremitting commercial and industrial pressures.

Jimoh Omo-Fadaka

Dirty book

PAPER PROFITS: POLLUTION IN THE PULP AND PAPER IN-DUSTRY. xviii + 505 pp. 175 × 252mm. Published by The Council of Economic Priorities, New York. The MIT Press, 128 Buckingham Palace Road, London S.W.1.

This is an exposition of the existing situation regarding pollution in the

pulp and paper industry; what action can be taken, and what is being done by leading American firms. The authors mention that two of the largest companies were "notable for their lack of cooperation" (presumably they wished to keep processes secret from competitors) but it appears that CEP managed to obtain the information by indirect means, and one is left with the feeling that the aims of the authors are admirable, but their methods a little dictatorial.

The work is set on IBM machines in squat "typewriter" letters and is difficult to read in long lines spread over 523 pages. With condensed letters generally used with film or "hot-metal" setting the book could have been more legible, smaller in page size and comfortably within 350 pages, thus saving 40 per cent of the paper used.

The publication is stated to be printed on recycled paper trade named Oxford Earthtone but the percentage of the recycled element within this volume weighting over 3 lbs is not given and it is not included as a brand in the index of consumer brands in Appendix 4.

Nevertheless, it contains a vast amount of valuable information most of which has world-wide application, and it is praiseworthy that this nonprofit research group (CEP) should have undertaken such a formidable task and made the results available as a prime source of information on the subject.

Harvey Warren

Coming events

10-14 September—Residential week to begin Technology, Ecology and Conservation course for teachers at Trent Polytechnic followed by a series of day and evening sessions at Nottingham College of Education and a residential long week-end at Matlock College of Education 5-8 April 1974. Further information from the Secretary for Short Courses, School of Education, University of Nottingham, University Park, Nottingham NG7 2RD.

12–16 September—Conference on Landscape for People to be held in the grounds of The University of Birmingham. Further details from The Institute of Landscape Architects, 12 Carlton House Terrace, London SW1Y 5AH.

14-16 September—Countryside Interpretation Conference to be held at Southampton University. Further details from Mrs B. J. Dixon, 30 The Pastures, Kings Worthy, Winchester, Hants. **18–20** September—Conference on World Energy Supplies to be held at the Grosvenor House, London. Further details from The Financial Times Conference Department, 388 Strand, London WC2R 0LT.

20–21 September—A two day symposium on the relation between world population and food resources and the individual and his diet in health and disease, to be held at The Royal Institution, London. Further details from Michael Van Straten, Symposium Secretary, Stratenport House, Tring, Hertfordshire. Telephone Tring 4004.

Errata

In "Living off the sun", *Ecologist*, July, on p. 261 the values along the x and y axes of the figure should be multiplied by 232. P. 264, col. 2, line 3, 1.32 kWh should read 2.64 kWh.

Letters

Vapona

Sir,

I was indeed glad to see the comment in Gremlin on Vapona (dichlorvos) in the latest issue of *Ecologist*.

Ashwood-Smith *et al*, are not the only ones who have reported on genetic effects of dichlorvos; cf. enclosed references and comments.

The genetic effects of dichlorvos may indicate particularly a potential carcinogenic burden for our already troubled "inhalation organ".

With my best wishes Göran Löfroth Radiobiology Dept., University of Stockholm, Sweden.

Some recent publications on genetic and allied effects of dichlorvos:

- "Nachweis einer genetischen Wirkung von Organophosphor-Insektiziden." R. Fahrig Naturwissenschaften 60:1 (1973) 50-51.
- M. J. Ashwood-Smith *et al.* "Mutagenicity of dichlorvos." *Nature* 240 (1973) 418-20
- 3. H.S. Rosenkranz and S. Rosenkranz "Reaction of DNA with phosphoric acid esters: Gasoline additive and insecticides."

Experientia 28 (1972) 386-7

4. C.E. Voogd et al.

"On the mutagenic action of dichlorvos."

Mutation Research 16 (1972) 413-6 (Voogd et al.—bureaucrats in the Dutch administration—found that dichlorvos is mutagenic, but they conclude that it is not "dangerously mutagenic to man".

Has any Dutch bureaucrat ever said anything against Shell?)

5. Shell has bought a complete issue of Archiv fur Toxikologie (vol. 30, issue no. 1, 1972, pp. 1-85) where nine papers from Shell scientists have been lumped together. The papers related to genetic effects

are poor and deceiving.

Sir,

As one of the people concerned in the preparation of the Vapona report published by Friends of the Earth (Mid-Essex) last Autumn, I feel obliged to take up some of the points raised by Mr White of Shellstar Ltd. in the *Ecologist*'s letters column last December.

I agree that, if used properly, organophosphorus insecticides of low persistence are usually preferable to persistent organochlorine compounds. What I question is the need for preparations such as Vapona in domestic situations in this country at all. Where insects constitute a serious disease or hygiene risk, a case could, perhaps be made out for the use of such products in the home. In this country, where no such risks normally exist, the case is very tenuous indeed. In most homes, flies are, at worst, a nuisance and can be controlled with pyrethrin fly sprays which are only used when flies are actually present-for that matter, what's wrong with the old-fashioned fly-swatter?

It is known that continued exposure to Vapona produces a significant decrease in blood plasma cholinesterase. Although a decrease of this magnitude is not regarded as a symptom of intoxication, the wisdom of allowing the population in general, and the old or infirm in particular, to be exposed over a long period to an environmental contaminant which is known to produce such an effect, must surely be questioned. It is also interesting to note that of 17 common pesticides tested for mutagenic effects on bacteria in a recently published series of experiments (Nature 240, p. 419), only two of them, captan (a fungicide) and dichlorvos (the active principle of Vapona) proved positive. This does not, of course, mean that dichlorvos automatically produces cell mutations in Man, but nevertheless it does make one feel slightly uneasy.

As a result of FOE (mid-Essex)'s activities, Caters and Tesco in Chelms-

ford agreed to withdraw Vapona from sale pending their own tests, and a local Wimpy-Bar stopped displaying it on their premises.

A party from FOE did visit the Shell offices last September and, although the people we met were very helpful, we were not convinced that Vapona is as innocuous as is sometimes asserted. We maintain that the product should not have been marketed until multigenerational inhalation experiments had been performed to determine whether or not a risk of mutation exists, although we can appreciate, to some extent, the problem involved in testing a new product of this type. As far as I know, no results of any such experiments have yet been published. Yours faithfully,

Brian Price, Friends of the Earth (Bristol) Brunel House, St. George's Road, Bristol BS1 5UY.

Concorde

Sir.

Despite what Prof. Scorer supposes (*Ecologist*, May 1973) I have read much of what he has written about the "environmental crisis". Much of it I find admirable—and totally inconsistent with his support for Concorde.

May I answer briefly the major complaints he makes in his letter.

1. In denying any direct involvement in the Concorde project he is refuting a charge I did not make. I called him a supporter of the project.

2. "... you would have to have at least 1.000 Concordes to produce any perceptible effect. I do not believe 10,000 would cause any danger ... " As a dismissal of the ozone problem this is unsatisfactory. The consequences of a decrease in ozone were examined in a study sponsored jointly by the National Academy of Sciences and the National Academy of Engineering in the United States. The report observes: "In general, small decreases in the amount of atmospheric ozone would be expected to cause a relatively large increase in those wavelengths of solar UV radiation that are most biologically detrimental. This point is of utmost importance in considering the likely biological effects that might result from man-made changes in atmospheric ozone concentration."1 Thus by the time a decrease in ozone attributable to Concorde became perceptible

a proportionately greater increase in harmful radiation might already have occurred.

3. "... the world fuel crisis is too big for it to be affected by whatever happens to Concorde". Certainly, since the small number of first class passengers that would fly in Concorde is greatly outnumbered by those owning cars, the amount of fuel consumed by a few hundred Concordes would be small relative to that consumed by all the world's motorists. But a day trip in Concorde from London to New York and back would consume more fuel per passenger than it takes to run the average family car for one year. In times of national or global scarcity one does not encourage restraint and sacrifice on the part of the many by supporting the conspicuous consumption of a privileged few.

4. "The British and French people were in a mood to embark on this sort of proud enterprise " This unsupported assertion sits rather uncomfortably alongside his much more plausible assertion that Concorde is an example of "a decision arrived at without proper democratic control".

5. "Falsehoods about the stratosphere". It would be helpful if Prof. Scorer would be more specific about the identities of the authors of these falsehoods. In the view of two separate study groups sponsored by the Australian Academy of Sciences² and the National Academy of Sciences³, large scale stratospheric flying by SST's might destroy sufficient ozone to cause harmful increases in UV radiation. There is considerable dispute about the magnitude of the risk but both study groups concluded that much more evidence was needed before the risk could be confidently dismissed. Dr Priestly, the head of the Australian study group characterises Prof. Scorer's confident assertions as "a more extreme view".4 Counting heads is, of course, no way of getting at the truth in matters of scientific dispute, but until Prof. Scorer can convince more qualified experts the layman is entitled to assume there is a risk.

6. "The fury of the John Adams against a person who seeks to get the scientific truth understood . . ." Prof. Scorer suggests that I am "bending". the ozone issue to my anti-Concorde cause. Certainly I think there are other arguments to be made against Concorde. Because there is so much

controversy attached to the ozone question I do not think it is one of the stronger arguments at the present time, although it could, if the fears of the pessimists are confirmed, become an overriding argument. I hope Prof. Scorer's optimism is justified; I hope that man is not as capable as some fear of upsetting the balance of the stratosphere. But if pointing out that other scientists do not share his confidence is "bending" the issue, then I plead guilty.

Yours sincerely,

John G. U. Adams Dept. of Geography, University of London.

References

- Academy of Science and National 1. Academy of Engineering, National 1973, Biological Impacts of Increased Intensities of Solar Ultraviolet Radiation, p. 14.
- Australian Academy of Science, 19772 2. Atmospheric Effects of Supersonic Air-craft, October 1972, XXII no. 8, p. 2. C. H. B. Priestly, 1972, "Reply", Search, Vol. 3, No. 8, p. 298.

4.

Maplin

Sir.

Your article on the Maplin Manifesto in the April Ecologist makes excellent and frightening reading but your last few paragraphs on the energy crisis need more emphasis.

Building of motorways and airports encourage more and more people to use motor vehicles and aircraft where otherwise they would travel by train, a much more economical form of transport.

Consumption of oil products is escalating every year and by the time that Maplin is completed, sometime in the 80s, there is going to be a world wide shortage of oil, and its cost will make it prohibitive except for essential services.

Little progress has been made in finding a substitute for oil and it appears unlikely that any will be found before our oil wells finally dry up.

By the early years of the next century one can visualise not only Maplin but Heathrow, Gatwick and the rest in the same condition as the abandoned war time airfields whose broken concrete and rusting hangars disfigure so much of our land.

Yours faithfully,

Col P. A. Porteous, VC, Fund Raiser,

Countdown, 27/35 Mortimer Street, London W1A 4QW.

Flower pickers

Sir,

I must take issue with John Blackwood over his article "The flowers are not for us to pick" (June 1973). Let us by all means chop off the hands of any botanist who takes a rare specimen, and let us indeed do all we individually can to educate the public. Let us hammer home the iniquity of digging up wild flowers to transfer to gardens. Again let every parent and teacher and granny show every child they know that a little posy made from a few common hedgerow flowers-and a little imagination-can be as pretty to look at and as pleasing to the recipient as the "armfuls" of bluebells with drooping white stems that we all deplore.

Of course Mr Blackwood has a point. But the motorists' children, to whom in particular he cries "Hands off!" do not leap up mountainsides trampling on the rare saxifrage, and if they, like children from the beginning of time, pick a few wild flowers from the hedgerows, or from the edges of hav fields before the flower heads are mown down by mechanical grass cutters, can he say that they do more harm than the unenlightened cows who pause to drag at mouthfuls of the same as they wander down the lanes between their pastures and the milking parlour? I do not quarrel with the writer's concern, only with the areas he choses to attack in his passion to preserve our native flora. Would he ban the traditional decorating of the churches at Easter? an annual orgy of primrose picking enjoyed by all the children of the parish? Let him first campaign against the deadly weed killers that eradicate from arable fields the poppies and the cornflowers and the wind pansies that once grew there in profusion.

Finally I offer a practical suggestion. Let country children be taught how to preserve the seeds of their local wild flowers. Let these be harvested annually, packaged and labelled ready for replanting whence they came or for sending to areas where they are in danger of becoming lost. Let every country school adopt a city school to whom it can send its seeds for growing in pots and boxes, in corners of playgrounds, on wasteland and the corners of allotments. If even 3 per cent of the seed so saved grows to produce mature flowers they will replace for years the

little bouquest that the children pick, and if even a few establish species where none grew before there will be satisfaction indeed. Finally let all of us who care about the country seek to tell our children what they *can do* to preserve it, not what they must not do.

Yours etc; etc;

Ruth Lumley-Smith Lavethan, Blisland, Cornwall.

Sir,

John Blackwood's article emphasises the need for wild plant conservation with the slogan "Take only what you have put there", and quite rightly addresses most of his remarks to teachers. In this connection it is remarkable how neglected the school estate is as a teaching resource. With some knowledge of plant husbandry and ecology it is possible to devise features there that simulate natural habitats so that most native plants can be grown. For example an artificial marsh is easily made by digging a depression, lining it with polythene, and filling it with peat and loam. Plants are raised from seed and surplus plants can be planted on suitable wild sites. The pH can be raised by adding lime or lowered by adding peat.

At Alsager College of Education we have developed a number of features along these lines, and our 200 main course students are instructed in plant husbandry as well as in ecological principles and study techniques. We also run courses for teachers. In July there was a week's course on "The objectives of environmental education and methods of achieving them with the eight to 18 age group", and during the summer of 1974 there is a one-term course in Environmental Studies for Junior School teachers. Both these courses deal with a wide range of environmental problems and include the use of the school estate as a teaching resource. Interested teachers might like to write to me for further details.

Yours faithfully,

John Burton, Senior Lecturer in Environmental Studies, Alsager College of Education, Alsager, Cheshire ST7 2HL.

NEW INTERNATIONALIST

WARNING by the Publishers THIS MAGAZINE CAN DAMAGE YOUR IDEAS

The New Internationalist is a unique new monthly magazine about the people, the ideas and the action in the fight for world development. It is packed with clear, readable articles on the new political and social ideas from Africa, Asia and Latin America.

Using the best journalists, designers and photographers, the New Internationalist has published in-depth feature articles on *The World Health Scandal, The Chinese in Africa, Peron Rides Again, Ujamaa and African Socialism, The End of Cheap Food* and *Volunteers: Killing with Kindness?* Readers have seen exclusive interviews with President Kaunda and President Nyerere. Future issues will feature Indira Gandhi, Salvador Allende and King Hussein.

The magazine will continue to carry its campaign page on the injustices in the relationships between the rich and poor nations; photo-features from all over the world; news on action for development at home and abroad and the controversial "Myth Exploder".

The latest issue reports on -

•A big multinational company in Colombia which is overpricing essential drugs – by over 6,000%.

•The way the Chinese in Hopei Province are coping with a drought almost as bad as Maharashtra — and bringing in a record crop.

•The immigrants of Paris - and the notorious Bidonvilles.

You will certainly not agree with everything that is said in the NEW INTERNATIONALIST. Sometimes you might be shocked by it. It might even damage your ideas. But we believe that fundamentally you will welcome this magazine as attempting to set out clearly and honestly the most important social issues of our times.

FIRST ISSUE FREE

We are happy to send the first issue of the New Internationalist free to all people who subscribe on this form. The annual subscription in the U.K. is £3.00 post paid.

Name

Address

Cheques/P.O.'s payable to New Internationalist (RPS). Send this form with your cheque to R.P.S. Ltd., Dept. 17, Victoria Hall, FREEPOST, Fingal Street, London, SE10 8BP. No stamp is needed in the U.K.

Linguistic minorities

Sir,

The terms BRITISH, BRITAIN, etc., are merely a confidence trick vocabulary for assimilating the non-English indigenous people as rootless "New English" inhabitants of a Greater England. With upwards of 20 per cent native Celtic-speakers the Welsh would appear to have the greatest possibility of recovering from this cultural steam-rolling. Even though this percentage is healthy in a comparative Celtic context, looking at the downward curve of this percentage since the introduction of general education (exclusively in English) a hundred years ago it is apparent that another generation or so will see something like the 2 per cent of speakers of Scottish Gaelic, mentioned by Mr Tewdwr in your March edition.

If he could draw up a "reasonable" programme calculated to reverse the tide within a suitably short time span I am sure that the Welsh Language Society would be only too ready to consider it. Unless Mr Tewdwr can blueprint such a reasonable and feasible campaign there would seem to be every indication that a reliance on sweet reason would be a most unreasonable attitude for any Welsh people concerned about the survival of a distinctive Welsh ethos. I venture to suggest that their fellow Celts, together with many fairminded English people, will recognise that the Limited violence in defence of the Welsh language is in essence reactive. It is a reaction against the official violence to which Welsh nationality has been subjected since the Acts of Union of Henry VIII. Unfortunately English dominance has never been counter-balanced by an enlightened "conservationist" attitude towards the dominated.

Yours faithfully, *Pádraig Ó. Conchúir* 84 Pulleyns Avenue, East Ham, London E6 3LZ

Sir,

Yes, linguistic minorities do indeed have great difficulties in surviving. One of them is that there are people around like Mr H. Tewdwr, who says (March 1973) that Welshmen are "fascists and racialists" because they want "Welsh Only" areas and the reservation of jobs for Welshmen. I live in a town (if that's what you call our major megalopolis) which is an "English Only" area, and I find very few jobs open to people who can't speak English. But I don't shout "Racialists! Fascists!" So far as I know, no one in Wales wants to keep jobs for "racial" Welshmen: certainly it isn't the policy of the Welsh Language Society which is very happy to help Englishmen, Arabs or anybody else learn Welsh so that they can efficiently do their jobs in Welshspeaking Wales. If this is racialism, it is racialism of the same kind as that of English education authorities which teach immigrant children English, in order that they may be able to hold jobs in England.

Mr Tewdwr's letter does not explain the present language policy in Wales: a person speaking only English can obtain almost any job throughout Wales, even in areas which are 80 per cent or most Welsh-speaking; a person speaking only Welsh can get no job but the most menial (for example farm labouring and there aren't many such jobs now) even in the Welsh-speaking areas. There are a very few positions reserved for people who speak both languages; nearly all of these are lower government posts, where it is still felt to be an advantage to be able to talk to the "aborigines" in their own language. Because the present policy is long-estabished, Mr Tewdwr obviously regards it as the only reasonable policy. But this policy was originally introduced with the deliberate aim of getting rid of the Welsh language; and that result it is slowly but steadily achieving. It has a striking resemblance to some of the policies of the Nazi German government towards Polish, Czech and other Slav languages. Yet Mr Tewdwr calls those who oppose such policies "fascists"!

It is most regretable to read such smear words being used in the *Ecologist*, especially to describe a group of people who tend to agree with the *Ecologist's* policies. Yours sincerely, *Ifan Lloyd*, 73 Boileau Road, London W5 3AP

The future of the motor car

Sir,

"We are in the last decade of the motor industry as we know it", are we (Gerald Foley, February 1973 *Ecologist*)? So why is Robert Allen quibbling about routes for the M16 (January *Ecologist*)? If Gerald Foley's thesis, that oil shortages will lead to a fall in the number of cars, is correct, then the first item we shall be able to do without is roads, including the M16.

But is he correct? Won't rising prices make hitherto uneconomic reserves worth exploiting? And didn't I read somewhere that the oil shales in America are sufficient to meet the world's needs "indefinitely"—once they are worth exploiting? What about oil under the oceans, which might be within reach of the technology by then available?

But above all-why is the Government not doing something about a situation as serious as that portrayed by Mr Foley? Heath and Nixon discussed the prospect of an energy crisis. Until they settle something, are we to imagine them hanging on in the desperate hope that some solution such as those mentioned above will be found to make the problem go away? Or is the issue too hot politically for them to bring into the open? Meanwhile, they press on with their motorways and their airports and their concern to see that the motor industry is All Rightall for the sake of political expediency? That takes some believing, as does the theory that the Government believes the imminence of an oil shortage may be presumed not to exist until proved that it does exist.

The layman reading the Ecologist, even more the average man reading his daily paper, has to rely on expert evidence about such matters as oil reserves. The oil must run out one day, ves, but there is a great difference in this context between AD 2000 and AD 2100. Meanwhile, the layman can have no conception of the quantities involved, or the money, or the technology and so on; if one man says that we shall be short of oil by the 1990s and another that on the contrary the consequent price rises will add so many billions of barrels to the reserves, who is the layman to judge between them? The arguments put before him are always at the least incomplete, not to say one-sided; and he can dismiss the matter from his mind with the comforting thought that the Government must know it if the newspaper does. And yet ...

Of course, all this ignores the other objections to a high rate of oil consumption and to motorways and so on, but, if oil really is in short supply and really is irreplaceable, here is an argument so powerful that all the others must stand aside until it has been answered—if you can persuade anyone to believe it.

We know, Sir, where Mr Foley stands on these issues: his arguments will bring fervour to the breasts of the converted, but they will not augment their ranks. This letter is not trying to make a point: it is trying to obtain genuine answers to the questions posed in it from the gentlemen mentioned or others.

Yours faithfully, *Peter Eyres*, Westbrook House, East Hanney, Wantage, Berks.

Technology v. nature

Sir,

In your February issue Dr Skolimowski tells us that "what we must do is to shift our vision in a fundamental manner... away from modes of life directed towards further multiplication of material goods... and towards a new model for a symbiosis between man and nature. It should be crystal clear that this new vision cannot be maintained unless specific and appropriate changes are made in the social and economic structures of our society."

What is less than crystal clear is the kind of changes Dr Skolimowski is thinking of: It does not help much to say, that it would be better if things were changed without spelling out what to change and what to put in its place. Dr Skolimowski admits he cannot "provide a programme". But we do have a clue: He rules out Rousseau's "individual" and Marx's "social" solutions because they failed, the latter presumably because Marx turned out to have played the role of the sorcerer's apprentice, encouraging technology and industrialisation but offering no means to halt their growth. (He does not suggest a return to the ideal model, the Greek one, possibly because its social organisation was based on slavery and helotry.)

The clue to Dr Skolimowski's "third possibility...a new social utopia", the cloven hoof that betrays its essence, are his condemnation of "further growth of technology for the sake of personal profit", and his invitation to "specific and appropriate changes... in the social and economic structures of our society". His "third possibility" is therefore obviously intensified socialism of some sort, other than Marxism.

Aside from the fact that generally speaking, a change that would bring no personal profit to anybody seems hardly worth the trouble, the assertion that nowadays the growth of technology, the offshoot of science, is motivated by the pursuit of personal profit, is highly questionable. I cannot speak for the scientist and technologists themselves, but most of the costs, including those of technical education, amounting to hundreds of billions annually, are borne by governments, certainly not for the benefit of greedy capitalists, as Dr Skolimowski insinuates, but for the benefit of the workers, through the creation of jobs for the unemployed, and by reducing the damage caused by the constant pay rises by means of increased productivity-contradictory aims, it is true, but nevertheless solemnly proclaimed in the same breath in all government pronouncements, in the US at any rate. Neither were the huge plants which pour forth smoke, sulphur and mercurv, the twenty-storey hotels which disfigure beaches and mountain resorts and pollute the water with their sewage, built to satisfy the demands of the rich, few of the millions of cars belching carbon monoxide and bottling up the streets carry millionaires, nor did the mountains of empty bottles and cans contain champagne and caviar.

Reactionary as it may sound, the truth is that pollution-cum-degradation of the environment have gone hand in hand with socialism. Where are the snows of yesteryear? is the question I ask myself when I revisit the beauty spots of my youth. The aristocrats of the past built the parks and gardens of England, France and Italy and protected wildlife. They may have been selfish, but they were real "environmentalists". Today we have national parks and beaches with standing room only. The fact is that certain things are incompatible. If everybody must get first prize, nobody gets it. A crowd cannot enjoy the charm of privacy. If everybody has to have caviar nobody gets enough even to taste it. The criteria are debatable, but the necessity of selection-and limitation-is not. Besides, what most people actually love, is to be in a crowd, the mortal enemy of unspoilt environment. Look

at any beach. Even if it has a five mile frontage, only one of them will be packed. And as for pollution and litter! It's part of the sociable atmosphere.

Egalitarianism has already brought about a situation in which the early exhaustion of the earth's resources is a distinct possibility. What would it be like if everybody were to enjoy the standard of living of Americans, every one of whom consume over 20 times as much natural resources as the inhabitants of a laggard country! So maybe better unequal than dead. A considerable amount of socialism has undoubtedly come to stay, but it should be damned rather than encouraged, if we want to slow down technocracy. Socialism and nature cannot both have priority. It is a safe bet that, whether we like it or not, nature will come out on top. And the truth is that nature is not egalitarian and socialist, a fact Dr Skolimowski overlooks. The laws of nature are survival of the fittest, every one for himself and the devil take the hindmost, only the brave deserve the fair, vae victis!, and the lion's share, not sharing everything equally, whether provided by nature or by man.

F. C. Nano, Ca'n Vifor, Pollensa, Mallorca.

The fact that American consumption is too high to be enjoyed by everybody is surely not an argument against egalitarianism but against American consumption.

"Everyone for himself and the devil take the hindmost, only the brave deserve the fair", etc., are not "natural laws", and we know of no ecological theory which even approximates them.

That some resources would be destroyed by being shared simultaneously by large numbers of people is an argument against large numbers of people, or sharing simultaneously, not against simple sharing.

Editors

Population control

Sir,

Malthus has given us a theory of population summarised in the familiar concept "populations expand to fill the space available to them". He suggests that deprivation in living conditions or food supplies, contrary to expectation, tends to raise the birthrate although actual population may not increase since weakly individuals are selectively pruned out in the rigorous competition for survival. Experiments with mice/ rats/chimpanzees bred to overcrowding in confined spaces, confirm Malthus and indicate the way in which birth-rate reduction comes about. At a certain level of overcrowding a breakdown of the animal society structure occurs culminating in widespread loss of sexual drive and direction. Such a loss of sexual interest logically presages a radical drop in the birth-rate.

These points are raised to indicate the depth at which instinctive responses work to control population. The tendency to increased birth-rates in the face of hardship is not at all illogical when viewed in the light of genetic evolutionary functions. Evolution by selection can only proceed when there is freedom to produce large families. Individuals advantageously endowed for survival in a given environment, by mentality, physique etc., live longer to produce large families of similarly well endowed offspring. Such strains increase whilst less well endowed strains die out. If the two child family ever became the norm for humanity what then of genetic selection? (Particularly with welfare states committed to favouring the weak).

Against this background, Mr Rurlander's "personal story appeal" article



This photograph by John Stewart, was one of the winning entries in a competition organised by the Cambridge branch of the Conservation Society for Population Day.

seems more suited to the agony column of a woman's weekly than to the pages of the *Ecologist* and Mr Boulding's plausible licensing scheme appears simplistic in the extreme. The danger is that behind the arguments of both lies the assumption that the two child family should be taken as the norm the point at which to have a vasectomy, the rate at which to issue licences.

Environmentalists frequently find that the only way to control nature without causing ecological havoc, is to upgrade nature's own controls slightly. If Malthus is right then nature's control is space and where a high degree of spacial restriction already exists-in our cities-it seems that a breakdown of social structure, similar to that of the animals described above, is already well advanced and birth-rates already falling. I would suggest, therefore, that the way to control population, tilting nature's balance only slightly is to place huge, artificial restrictions on space. Totally prohibit migration of individuals from overpopulated to underpopulated areas and keep "space" continuously in the public eye through mass media. Nature would do the rest and genetic patterns would be undisturbed.

Perhaps we may hope to see in the *Ecologist*, shortly, a geneticist's views on genetically acceptable population control.

Yours faithfully, Miss Mary Nunan, 23 Lydalls Road, Didcot, Berks.

Classified advertisements

Classified rates

Display: £3 per single column inch.

Lineage: All classifications 6p per word-Minimum £3

Box numbers: 20p per insertion.

Series discount: 6 insertions 5%; 12 insertions 10% Copydate: 6th of the month.

Classified advertisements must be prepaid (cheques made out to INTERPRESS) and sent to Katie Thear, Ecologist Advertisement Department, 19 Anne Boleyns Walk, Cheam. Surrey. (Tel: 01-642.5826).

FOOD

Do you have real unpolluted organic food for sale? Tell us about it through this column.

CONFERENCES

20—21 September—A two day symposium on the relation between world population and food resources and the individual and his diet in health and disease, to be held at The Royal Institution, London. Further details from Michael Von Straten, Symposium Secretary, Stratenport House, Tring, Hertfordshire. Telephone Tring 4004.

HOLIDAYS

TRANQUILLITY - COMFORT - ELEGANCE in the wilds of the Cambrian Mountains. All double rooms with own bathrooms. Close to nature reserves. Llwynderw Hotel, Abergwesyn, Llanwrtyd Wells, Brecknockshire.

APPOINTMENTS

FOR recruitment of Research Assistants and Technicians in Ecological Studies and Environmental Sciences, advertise in *Ecologist*.

PERSONAL

WANTED. Young woman to help in family with four small children in rural Herefordshire. Beautiful environment, large organic garden. Must be domesticated, but an interest in arts or crafts an advantage. Au pair arrangements for hours and pay. Write Box No. PD9. COUPLE OR SINGLE PERSON interested organic farming, natural rearing, to run 20 acre smallholding Ashdown Forest, Sussex. Much experience unnecessary. Understanding animals, love of outdoor life essential. Possible combine writing or other activity. Accommodation available. Home produced food. Write, Wels, 13 Thomas More House, Barbican, London EC2Y 8BT.

Ph.D. PHYSICIST, bachelor, late thirties would like to hear from interested persons, either sex, any age, on what is the quality of life and where technology is failing. Also, does schooling pollute natural thinking (see Ivan Illich, Penguin)? How should children experience knowledge? Possible discussion group/ friendship. Write Box No. PD10.

What contribution did Gurdjieff make to our society? Was Ouspensky a theorist only, or did he have understanding?

Please address Box Number replies to the Advertisement Department.



See Nature's real nature in **Zambia**

Zambia's conservation policy is uncompromising. We have perhaps the richest and most varied wild life in the world – and we mean to keep it that way. So that arch-predator, homo sapiens, is strictly controlled : our reserves are reserves for their indigenous populations, not for Man's depredations. This makes Zambia the perfect place to study Nature in all its forms. We provide fine facilities and comfortable accommodation – for limited numbers. So come to Zambia – and re-read your chosen chapter of the Book of Nature complete and unabridged.

ZAMBIA NATIONAL TOURIST BUREAU 163 Piccadilly, London W1V 9DE. Telephone 01-493 5552 Bi-monthly authoritative facts and comment from international contributors —communicating special knowledge and experience in utilising the commercial values of urban and industrial waste and effluent

HERE IS A RANDOM SAMPLE OF PAST CONTRIBUTIONS

International Research Group on Refuse Disposal Prof.-Dr. O. Jaag, Zurich, Switzerland Research on Refuse and Garbage Composting in Kobe City, Japan Y. Kaibuchi, Sanitary Engineer, Kobe City Continuous Thermophilic Composting K. L. Schulze, Div. of Engineering Research, Mich. State Univ. Effect of Organic Matter on Soil Fertility—Part I Zenobius Stelmach Ecology and Junked Cars Peter J. Barrer Pollution or Solution, Which Will It Be? H. Dale Jordan Effect of Compost on Nutrient Quality of Food A. K. Pain, Berhampore, W. Bengal Composting by Artificial Aeration Dr. Eberhard Spohn A Simple Process for Composting Small Quantities of Community Wastes Rikard Lindstrom, Tyreso, Sweden Recycling Is the New Watchword Ruth C. Adams Sewage Disposal and Refuse Composting In Leicester, England John Leslie Beckett and Horace Roy Oakley How Refuse Is Processed In France L. C. Herbert Which Method for Rural Areas—Incineration or Composting? K. Wuhrmann, International Research Group on Refuse Disposal, Zurich, Switzerland

fill in and post this subscription order

form for your regular copy of



TO 'COMPOST SCIENCE' • 73 MOLESWORTH STREET • WADEBRIDGE • CORNWALL PL27 7DS

NAME			TITLE		
COMPANY		· · · · · · · · · · · · · · · ·			•••••
ADDRESS					
	Remittance	enclosed for	subscription as	ticked above	