

The

Ecologist

Man and the environment ■ The Quality of life ■ Pollution ■ Conservation

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May 1972

For a mess of motorways ■ The ecology of health and disease

A guide to courses in human ecology ■ Bugging the bugs



Rock-Bottom:

Nearing the Limits of Metal-Mining in Britain

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<i>Michael Allaby</i>	Editorial What is health?	3
	Feature articles	
<i>Friends of the Earth</i>	Rock-bottom: nearing the limits of Metal-mining in Britain	4
<i>Melvin A. Benarde</i>	The Ecology of Health and Disease	20
<i>Gerald Foley</i>	For a mess of motorways	24
	A Blueprint for Survival: Comments from Michael Tracy, Prof. Carroll L. Wilson, Paul Derrick, Ralph Coward, Mrs. G. R. Gardener	27
	Reports	
<i>P. F. Rogers</i>	A guide to courses in human ecology	30
	National Association for environmental education Newsletter	31
<i>Pamela Lewis</i>	Countdown; Family Planning's International Campaign	31
<i>Michael Allaby</i>	Bugging the bugs	32
<i>Doris Grant</i>	A recipe for survival	33
	Columns	
<i>Nicholas Gould</i>	Gulliver in Automobilia <i>The author discusses the conquest of air</i>	35
<i>Lawrence D. Hills</i>	Down to earth <i>The wind is free</i>	36
	Books	37
	Feedback	39
	Letters	40

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"Now Mr Lampsprocket, what did I say about leaving the window open?"

Editorial

Michael Allaby

What is health?

The time has come for a major reappraisal of medical research. There is a growing unease that under the prevailing system of priorities, time, talent and funds are being misapplied. The pursuit of technological advances is subject to diminishing returns on investment and as our general level of health continues to decline it may ignore the real needs of society. Should we concern ourselves rather less with disease and rather more with health?

The Soil Association has advanced this view for years and it has attracted support from some practising doctors who have recognised that the complaints they encounter from day to day are the product of the unsatisfactory environmental conditions within which their patients are required to live. There are children in most of our large cities who spend all of their formative years living beside, and in some cases beneath, motorways. They know no world other than that of the container lorries, the cars, the fumes, the noise and the drab streets and dank underside of the bridges and tunnels we compel them to inhabit in the interests of the mobility our affluence requires. When they visit their doctors to complain of respiratory illnesses, heart and circulation diseases, shattered nerves and ears, how is he to treat them? Their complaints are the inevitable consequence of the environment imposed on them. They are an extreme case, perhaps, but it does not end there. How else but with tranquillisers and antidepressants shall our medical practitioners deal with the victims of de-cultured, impersonal housing developments?

Even with this group, numerically large though it is, we barely scratch the surface. Dr. Geoffrey Taylor, who has made an extensive study of illness among old people, told a recent Soil Association meeting in Dorset that in one survey among elderly patients in

hospitals at Bromley, Sidcup, and Orpington, sixty per cent had dietary levels of vitamin C below those at which the first signs of scurvy had appeared among volunteers in an American study. Cleave, Campbell, *et al*, in their book *Diabetes, Coronary Thrombosis and the Saccharine Disease*, produced impressive epidemiological evidence to support their conclusion that a wide range of common diseases is caused by an environmental factor, in this case the overconsumption of refined carbohydrate foods. Many of these diseases are increasing and some, such as appendicitis, are relatively new. Cancer is increasing and its cause, too, is environmental.

Nor is the situation much better in the non-industrial countries, where the pattern of diseases is different, but where our efforts to control them by technology are often hazardous in the extreme. The March issue of *The Ecologist* (p. 38) quoted an *Environment* report on the death of 150,000 people in Ethiopia from a form of malaria that had caused no deaths while it was endemic and the population had an acquired immunity, but which proved lethal when it reappeared after a period during which it had been thought to be eradicated. There are fears that anti-malaria programmes in India may produce insecticide-resistant strains of the insects that transmit plague.

Yet the Soil Association doctors have been derided by their colleagues. Their concept of "health" is difficult to define. Their views have been dismissed as vague, unscientific, mystical.

The fact is that most, if not all, diseases have an environmental component in their cause and that this component has been largely ignored. Malaria was eradicated in Britain not by spraying DDT but by altering the habitat of the mosquitoes. Cholera and typhoid were eliminated not by antibiotics but by improved sanitation.

What has gone wrong? Any biological study may choose to concern itself either with the physiology of organisms or with their ecology. Medical research has been devoted, almost exclusively, to the study of human physiology. Thus we know a great deal about the human body and how it functions. Disorders can be diagnosed and treatment administered to restore the body to its previous, non-diseased state. Little attention has

been given to the total, ecological situation that produced the imbalance. If we concern ourselves with the relationship between disease and environment we must deal with whole communities and we must define the standard of health against which we measure deviations. Preventive medicine is more than prophylaxis, it calls for a positive definition of health.

High technology medicine has gone as far as it can go. It creates problems that should not exist at all. When it is possible for doctors and the public to find themselves debating the ethics of keeping alive individuals so severely damaged that they can never hope to regain consciousness, it is time to question the value of the technology. It is time, too, to rid ourselves of the naïve belief that surgery, or machines or miracle drugs will cure us of the ills caused by the way we live. As we reach for another cigarette we must not allow ourselves to believe that in twenty years' time, when we contract lung cancer, there will be a certain cure. We must reform now. The day will never dawn when heart transplants are free for all on the National Health.

Meanwhile, as we wait for the ambulance to take us to hospital for the removal of our stomach, our appendix or a lung, we may pause to reflect on the cost of it all. It is difficult to place a cash price on human misery, but those still wedded to the GNP may care to examine the statistics on working time lost through illness—around 400 million days a year. In 1970-71, the GNP included the £2,063,995,000 we spent in England, Wales and Scotland on the National "Health" Service as we sought in vain to undo the damage we ourselves had done.

It is time to think again, to revise our research priorities, to accept that further investment in transplants, intensive care units and all the sophisticated hardware of medical technology will contribute little if anything to the improvement of the quality of life of populations in general and that if this is our aim it will be achieved only by recognising that the study of health, as opposed to disease, is an integral part of the study of the environment as a whole. Painful though it may be, we must admit that once again the "cranks" have been proved right.



Rock-Bottom: nearing the limits of Metal-mining in Britain

"Yes, that's it," said the Hatter with a sigh: "it's always tea-time, and we've no time to wash the things between whiles."

"Then you keep moving round, I suppose?" said Alice.

"Exactly so," said the Hatter: "as the things get used up."

"But what happens when you come to the beginning again?" Alice ventured to ask.

"Suppose we change the subject," the March Hare interrupted, yawning.

—*Alice's Adventures in Wonderland*

Ten months ago, RTZ and six other mining companies actively prospecting in British wildlands announced that they had set up an "independent Commission on Mining and the Environment" chaired by Lord Zuckerman. This curiously named group (which is not a Royal Commission, and indeed has nothing at all to do with the Government) has since then been taking evidence in confidence from mining companies, trade and professional bodies, Government agencies, and private conservation groups. Its conclusions should be published soon.

In response to an invitation from Lord Zuckerman, Friends of the Earth submitted detailed evidence to the Commission. Agreeing with Kenneth Allsop that this evidence is "obligatory reading", *The Ecologist*

takes pleasure in reprinting it in full, brought up to date by minor revisions.

The evidence is organised thus:

0. Text of letter of transmittal
1. Terms of reference
 - 1.1. Resource depletion
 - 1.2. Wording
2. Exploration
 - 2.1. Exploration sites and land-use policy
 - 2.2. Exploration methods
 - 2.3. Exploration and planning law
 - 2.4. Exploration and the Government
3. Mining
 - 3.1. What does it cost the earth?
 - 3.2. What does it cost people?
4. Conclusions
5. Notes

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0. TEXT OF LETTER OF TRANSMITTAL

Dear Lord Zuckerman,

Thank you for your reply dated 23 December (received 3 January) to our inquiry about the terms on which you invited Friends of the Earth to submit evidence to your Commission [on Mining and the Environment].

We are sorry that you feel bound to prefer speed to the deliberation and balance that wider public participation could lend your debates. To produce your report as a *fait accompli*, as you propose, may give the public what the Skeffington Report warned against—a chance only to concur or object, not to discuss and contribute.

We also regret that you cannot at present undertake to make available to the public the evidence underlying your report. *Ex cathedra* conclusions, based partly on facts withheld from public discussion, are unconstructive contributions to the “wide public discussion” your report is supposed to stimulate. We hope you will reconsider your position and seek permission to make your evidence public promptly. We believe that expeditiousness and confidentiality—the principles you have hitherto adopted—are in neither your Commission’s nor the public’s interest.

We welcome your confirmation that “the evidence your Commission will accept will... be in geographically general terms designed to suggest ‘general principles and their future application to particular situations and cases’—without, however, treating in detail any specific schemes or proposals that would more properly be the subject of later Planning Inquiries.”

Your letter does not make clear why you cannot make our evidence available to the public. We take it that you are accepting some evidence in confidence, but you need not (and we hope you will not) treat ours in this way.

We take pleasure in submitting six copies of our evidence with this letter,

and we shall send you an advance copy of our book (the case-study of Gwynedd) as soon as we can. Please let us know if we can help your Commission further.

Yours sincerely,

Graham Searle, Executive Director,
FOE Ltd.

[Editor’s note: Friends of the Earth submitted their evidence to the Commission on 16 January 1972 and published it four days later.]

1. TERMS OF REFERENCE

1.0. Your terms of reference are¹:

In the light of current governmental measures to stimulate the fuller use of national mineral resources in Britain, the general concern for conservation and the environment and the need to establish the way in which these two objectives can be harmonised, to examine the relevant problems of exploration, mining, continuous rehabilitation and subsequent reconstruction of sites and to make recommendations designed to reconcile economic and technical considerations with other requirements of national policy, especially those concerning physical planning and the environment in terms of amenity, recreation and scientific and historical interest.

1.1. Resource Depletion

1.1.0. Before we address ourselves to the questions of mining and exploration technique raised by your terms of reference, we should like to explain why we think it essential that you construe “other requirements of national policy” to include the conservation of mineral resources. We do not see how your conclusions can be useful guides to national policy if you do not consider general arguments of resource depletion. If you were to do this, we agree that your already very hard task would become even harder; but we fear that your conclusions may otherwise be accepted without their underlying assumptions having been questioned. We therefore urge you to consider the following arguments, in order (if they seem cogent) either to study them yourselves, calling extra evidence and co-opting extra members as needed, or to include in your report a caveat urging proper consideration by a special Commission (preferably appointed after consultation, and not

by interested parties). Indeed, we feel there is much to be said for setting up such a Commission before you have reported, for its conclusions must be available before the Government make further decisions on domestic mining.

1.1.1. The rapidly increasing use of mined resources² is, on a finite planet, subject to limits set by diminishing social returns. The time has come for Governments—and mining companies—to consider whether these limits have been reached. As mining decreasingly rich ores becomes increasingly common and damaging, we become steadily more doubtful that public policy can justify further large-scale mining to support an economic growth that is not essential to, and is indeed often antagonistic to, growth in well-being³. The sensible alternative, which has not been examined seriously enough, is to use less profigately what we have already mined, and to devote as much effort to closing resource loops as we now devote (in the interest of private profit) to keeping them open⁴. This issue is especially urgent in Britain, an island-within-an-island whose rural habitats are notoriously fragile and whose population density exceeds that of India. As we shall argue in section 3.1, mining literally costs the earth; Britain, even more than most places, has no extra earth.

1.1.2. Your conclusions would be vitiated if you construed your terms of reference so as to beg the question whether large-scale domestic mining is in the national interest. Your terms at their face value (excluding the saving clause of “other requirements of national policy”) seem instead to say, Given that one must mine somewhere, how can one use cosmetic solutions to minimise the damage? This view—the assumption on which the extractive philosophy and economy rest—may well be held by the mining companies at whose unilateral initiative you were called together; but we believe it is also outmoded and does not deserve your support. We think history will show that this decade was the time not for cosmetic solutions but for basic alternatives; and we hope this decade will be recorded as the time when the implications of the round-earth theory (now nearly five centuries old) finally began to influence the policies of Governments.

1.1.3. We are not proposing a return

to agrarianism, and we are fully aware of the dependence of modern society upon continued supplies of minerals. We believe that this dependence lays upon Governments a *special duty to ensure these continued supplies* not merely for decades but for millenia, so far as it lies in human power to do so⁵. Governments that do not fulfil this obligation now will not be able to do so later, for physical law guarantees that our present short-sighted dispersion of concentrated resources is irreversible⁶. Lost time cannot be recycled either; and to encourage continued large-scale extraction, rather than to learn how to husband what we already have, is to perpetuate an ultimately disastrous waste⁷, not only of minerals but also of national time and energy that should be devoted to learning how we can survive for more than a few generations. "History teaches us," Abba Eban said recently, "that men and nations behave wisely once they have exhausted all other alternatives." If men and nations are to survive, they must start doing better than that.

1.1.4. Last May, Sir Val Duncan (Chairman of RTZ) wrote⁸, "Raw material demands...are entirely essential for rising living standards in a world enjoying [*sic*] a major population explosion." But the trouble with this argument is that there is no end to it. Sir Val did not explain when what he called⁸ our "growing demand" for metals will stop growing. If, as he said⁸, progress requires us to mine increasingly in "areas which we should prefer to avoid"—to sell to industry our last sanctuaries from industry—perhaps we should redefine "progress" so that it is better attuned to our real needs. Perhaps RTZ's capital and expertise, for example, should be devoted to meeting most of our "raw material demands" through recycling—a more appropriate form of progress than we have been getting lately. Such coming to terms with the capacities of our habitat seems to us an experiment especially well suited to Britain's small size, tight communications, and progressive tradition. It would mean abandoning the chimerical notion⁹ of an ever-rising standard of living, but that cannot be helped: the world is simply not big enough to support us in the style to which many of us are used.

1.1.5. A reasonable man, observing

the scarcity of many essential metals, would expect Governments to take stringent precautions to ensure the wise husbandry and unhurried use of mineral deposits. On the contrary, he would find that the tax structure of many countries encourages hasty exhaustion of resources. If mining companies get a "tax holiday" for the first few years of an operation, obviously they have an incentive to compress as much of their output as possible into those few years. Poorly planned depletion allowances may have the same effect. So can shamefully low royalties. (In Western Australia, for example, certain consortia are mining millions of tons of iron ore annually; under a "tax holiday" lasting until probably 1980, each ton yields a royalty of about 4.5 cents to the state government and a profit of over four dollars to the mining company¹⁰.) The pressure of the money market can produce a similar rush to depletion. For example, we know of a Canadian opencast mine¹¹ that was dug in order to extract a high-grade orebody. Had the company wanted to maximise total profit, they could have gone on to extract a far larger body of lower-grade ore all round, for the capital overheads were already paid; but since the pit was dug with vertical rather than sloping sides, this full use of the resource was and will remain prohibitively expensive. The company's motive was not to mine as much ore as possible, but only to turn over its capital quickly, make a large profit in a short time, declare a large dividend, and thus attract new investors. This example shows how the structure of existing financial incentives can preclude sensible planning.

1.1.6. A reasonable man would expect that the fullest possible use would be made of hard-won minerals, and that Governments would take care to prevent the loss or dispersal of essential metals (as was done during World War II). Yet he would find instead that industry is much more interested in mining afresh than in using what it has; and this preference is grounded on dubious economics. It is often said that recycling is hopelessly uneconomic—that recycled materials cost much more than newly mined ones. When this is true, it is invariably true for the wrong reasons. Most non-ferrous metals are now obtained from low-grade ores mined from hard-to-

find deposits in hostile environments in remote parts of the world. It is elementary that such a process is far more expensive in energy¹² (and hence in money) than reprocessing properly designed waste (of lower entropy than the ore) practically at the point of resale; just as, whatever an economist may say, thermodynamics insists, correctly, that it is cheaper to control air pollution at the chimney than to scrape it off the walls and wash it out of the clothes afterwards. In practical terms, scrap brass, as a copper ore, is two orders of magnitude richer than Welsh rock; therefore one needs two orders of magnitude less of it for the same yield; better yet, one knows where to find it, and collecting in cities is less awkward than mining and concentrating in Merioneth. It is thus a sad comment on short-sighted rapacity that all scrap contributed in 1965 only 19.7 per cent of the total UK consumption of copper (*cf.* 24.5 per cent in 1955)¹³. This pitifully small recycling rate, which is still declining, is much the lowest in industrial Europe—and only half of the 40 per cent recovery rate of both the EEC and the wasteful USA. Yet recycling would be especially appropriate in Britain because her per-capita domestic consumption (1965) of refined copper—11.8 kg/yr. highest of all the OECD nations—is 4x her export and 2.5x her domestic production; thus a lot of copper comes into the UK and most of it stays¹³.

1.1.7. The price advantage of new over recycled metal, where it exists, is entirely artificial, for three reasons: (a) the price of recycled metal is unnecessarily inflated because most modern wastes are intended not to be recycled, whilst the price of virgin metal reflects (b) neither its true social cost (e.g. in smelter pollution, indirect¹⁴ energy costs, loss of wildlands) nor (c) the irreversible depreciation of a fixed capital asset. In an economic fog that would never be tolerated in any field but resource management, all these three absurd conditions obtain almost universally. In theory, virgin copper whose price took proper account of depletion (i.e. of a running-down of the earth's capital) would be far dearer than it is. In practice, British imported copper would not be cheaper than British recycled copper if a small tariff on the former subsidised technology for the latter—at an im-

mense saving of hidden social costs. This sort of legislative change must obviously come as depletion restricts our options; the only question is when (para. 1.1.8.) and on how parochial a scale. We think it should come now, and preferably on an international scale, e.g. by a regulated world marketing pool or by stricter controls on the world refining rate. (Now, when copper warehouse stocks are the highest ever, many within the industry are calling for curtailed production, and CIPEC, the controlling body of the producing nations, may take action¹⁵ to ensure co-operative regulation of over-production.) It is idle to say that if people want this sort of change they must pay for it. In one way or another, people always pay¹⁶.

1.1.8. When will we run out of essential metals? Some people say never (given plenty of nuclear energy), or at least not for centuries. But in one section of an exceedingly important and impeccably reasoned report¹⁷, a Club of Rome research team headed by Professor Dennis Meadows of MIT has shown such beliefs to be false. The proof that energy-intensive solutions are impracticable rests partly on thermodynamic⁶ and partly on resource and capital arguments, and we cannot do justice to it in this space. The proof that depletion will occur unexpectedly soon if demand continues to grow exponentially is easier to sketch. Static reserve indices—how long the known world reserves will last at present rates of use—are generally computed from 1970 statistics of the US Bureau of Mines to be about 100 years for aluminium, 36 for copper, 240 for iron, 97 for manganese, 79 for molybdenum, 150 for nickel, 31 for petroleum, and so on¹⁷. (What we are supposed to do after that is seldom made clear.) But projecting probable rates of *growth* in consumption (typically 2 to 5 per cent per year), in accordance with recent estimates by the US Bureau of Mines, yields corrected indices of about 31, 21, 93, 46, 34, 53, and 20 years respectively.¹⁷ Most growth rates are themselves increasing, but at the present growth rate, discoveries *doubling* the known world reserves of petroleum will delay depletion by only about ten years! If we assume actual world reserves *five* times those now known, the exponential indices just listed become respectively 55, 48, 173, 94,

65, 96 and 50 years. The dynamics of resource depletion are of course more complex than this, and have been simulated by a detailed computer model¹⁸ that relates size of reserves, grades of ore, production costs, technological progress, consumer demand, and substitution by other resources. The simulation shows that so long as exponential growth in use continues, even if more slowly than now, depletion can typically be postponed for only a decade or two by very large improvements in the extent of known reserves, in mining technology, or in substitutability. Even complete recycling helps for only a few generations. A recent dynamic simulation by Professor Meadows's group suggests a practical copper lifetime of order 50 to 60 years *with* massive recycling, substitution, and ore discoveries. Thus there is no utopian haven from the rigour of the exponential processes built into economic growth. Growth in demand for basic raw materials will, unless drastically reduced, make most of these materials prohibitively expensive within a century¹⁷. This is not speculation but fact. The only remedy is major change in our economic structures and social priorities. A few generations from now we must have attained an equilibrium population and economy in which total demand does not increase at all. Sooner than that, however, we must prevent total demand from increasing exponentially. And whilst we are working to reduce growth rates, we shall need to institute far more complete recycling of essential metals, in order to buy the time required to overcome social inertia and make more fundamental changes.

1.1.9. The power of the theoretical argument for resource conservation (as distinguished from the very practical argument of impending depletion) becomes clearer if we use an analogy from biophysics. An open-loop economy uses energy to convert low-entropy matter (resources whose use constitutes depletion) into lower-entropy matter (commodities) plus high-entropy matter (pollution¹⁹), and a vigorous economy maximises the conversion²⁰. (Energy flow is similar: a source—a reservoir of low-entropy energy—is depleted in the manufacture of goods in which energy is bound, and waste heat—high-entropy energy—is simultaneously released to a sink.) This energy-consuming,

entropy-partitioning process is closely analogous to the metabolism of an organism converting food to tissue plus waste—except that metabolic rates regulate themselves rather than increasing until subject to drastic external constraints²¹! The point of the analogy is that in a real ecosystem, the interrelations of many different sorts of organisms²² **maximise the ratio of total biomass to energy input** by recycling every output of material into an input, every waste into a food; nature never wastes, and therefore never wants. Every potential food is eaten, every niche in a climax community is filled—precisely because nature is always looking for opportunities for cut-price metabolism, for ways to put idle energy sources to use. The result of this pressure to recycle everything is that a stable ecosystem has no waste. But without recycling, we have not an ecosystem but a monoculture, an organism or species in isolation; and it is a fundamental truth of ecology that monocultures do not last. The reason they do not last is that their maintenance needs more energy than the habitat can supply—i.e. that monocultures cannot compete with the more diverse, more stable, more efficient arrangements that need less energy. Thus the survival of monocultures is priced out of the energy market. And this “analogy” between ecological and economic monocultures is more than a conceptual coincidence: we and our works, and all things that live, are as much subject to physical law as are the simplest objects in the laboratory; thus the “analogy” is merely two contexts for expressing the same necessity, the same physical truth.

1.1.10. We believe there is a hard lesson to be learnt from the observed working principles of a world that for three billion years has been patiently designing stable energy-consuming systems in accordance with physical law. If there were a better way to do it, that way would already be here. It is not here because this is the way the world works. We must conform: we must evolve our systems and conduct our affairs within the constraints of the way the world works. Every organism that has overdrawn its accounts of energy and materials is now dead. It is one of nature's rules that those who won't play by the rules won't play at all.

1.2. Wording

1.2.0. Having suggested how you should interpret one phrase in your terms of reference, we want now to query and criticise other phrases.

1.2.1. Your formal terms of reference (para. 1.0) speak of "the need to establish the way in which [mining and conservation]... can be harmonised"; your task includes making "recommendations designed to reconcile economic and technical considerations with other requirements of national policy..." We fear that "economic and technical considerations" are in practice a euphemism for "what mining companies are willing to pay for". We presume it is common ground that there is generally a tradeoff between restoration and profit; and we are firmly committed to the principle that all costs of restoration should in each case be borne wholly by the company concerned—i.e. by the direct consumers of its products—and not (by way of an "amenity grant") by the general public²³. We think it likely that restorative schemes proposed for British mines will be very expensive and will cut deeply into corporate profits. Your terms of reference suggest that you ought to compromise—to seek beauty but (as Sir Val remarks⁸) beauty "in reasonably economic terms". This has already been done far too often. Your report would do a public disservice if, in keeping with the tone of your terms of reference, it merely strengthened the trend towards disastrous compromises between principle and profit.

1.2.2. It is not clear to us whether your terms of reference allow you to conclude, if you wish, that in some circumstances mining and conservation are fundamentally inimical and irreconcilable, or that the interests of mining and conservation in certain areas can in no way be served both at once. But this is what we shall argue. We submit that "to co-ordinate a national programme of mineral development with a national programme for safeguarding the environment"¹ is an egregious contradiction in terms, akin to proposing in one place simultaneous programmes of poaching and gamekeeping (both under the auspices of the poachers). We hope that if in certain cases you agree with us, your terms of reference will allow you to say so.

1.2.3. Though the context¹ of your terms of reference is "the fuller use of national mineral resources in Britain", the explicit terms apparently do not permit you to explore what happens to mineral concentrates after they leave the mine. Sir Val Duncan⁸ considers it "anomalous to say the least that no [copper-smelting]... complex exists in a highly industrialised country like Britain consuming as much copper as we do". We consider it a blessing, for we know that copper-smelters, with their huge outputs of SO₂, are among the worst of neighbours. Since RTZ have expressed interest in building a smelter "at some suitable location in this country" should they find domestic ore to feed into it—they are now reportedly seeking a smelter site at Swansea—and since domestic mining must inevitably entail domestic smelting if it is to pay, we think it your duty to ensure that the broad environmental issues of smelting various metals are properly explored, with appeal where needed to disinterested sources of scientific information. We trust this important gap in your terms of reference is inadvertent and that you will ask that it be corrected promptly.

1.2.4. A phrase in your Chairman's letter²⁴ puzzles us. He hopes you can "make balanced and fair recommendations designed to reconcile the interests of those concerned that the amenities of the countryside should not be spoilt, with the national economic interest". As we shall explain in para. 3.2.6. and elsewhere, it is one of our theses that these two interests already coincide and hence do not need to be reconciled.

1.2.5. We are also curious about the "modern methods of... continuous rehabilitation... and subsequent restoration of mining sites within areas of attractive landscape" about which you are to become informed²⁴. As far as we know, past large-scale mining in beautiful places has seldom if ever been subject to significant constraints of restoration. We therefore have the impression that the methods your Chairman describes are hypothetical only. We raise this point because his phrasing implies that these "modern methods" are well-known and have been thoroughly reduced to practice. On the contrary, we shall argue in para. 3.1.10 and elsewhere that (in

Britain at least) such methods probably cannot exist.

1.2.6. Your formal terms of reference seem to exclude Northern Ireland. This is strange and regrettable in view of (a) the use of "UK" rather than "Britain" in the preamble¹ to the terms; (b) the industry-designed exploration law recently passed in Ulster—a good case-study of how the balance of conflicting interests has been weighted even more firmly on the side of industry than in Britain (where miners must be content with compulsory-purchase powers, sometimes administered under a legal presumption that mining is in the national interest); (c) the extensive exploration now going on in wild parts of Northern Ireland, especially the Mountains of Mourne. We hope you will seek clarification of your geographical limits, and will investigate Ulster if possible.

1.2.7. It is all very well for RTZ to speak¹ of "facts, problems and issues... authoritatively reviewed by an independent body"; but we are sure you will agree that independence of view, in Commissions as in the judiciary, must not only exist in fact, but must also be seen to exist in theory. We fear your position before the public may be compromised by your having been appointed, without consultation, by a group of mining companies, and called by a name that wrongly suggests you have some connexion with the Government. We suspect it will be all too easy for uncharitable persons to claim that "their points of view" were not adequately "taken into consideration"; and we note that at least one prominent amenity group has already refused to submit evidence to you. We feel that the image of independence so essential to your pursuit of truth would have been better served had you been appointed and supported by disinterested parties, under a name appropriate to your unofficial status.

1.2.8. May we, finally, express our hope that your report will be written in plain words? It is alarmingly easy, as we have found out the hard way, to use vague gibberish out of caution or habit, until we succeed in concealing our meaning even from ourselves. "Amenity", "areas of attractive landscape", "the fuller use of national mineral resources", and the like phrases^{1,24} will not help people to

understand or accept your conclusions. Some words, such as "restoration", are downright misleading. Your report should be more than what Schlesinger called "the bland leading the bland". There has been too much woolly talk of "concern for the environment", too little clear talk of what this means in practice and why it matters. Thoreau put it well: "What's the use of a house if you haven't got a tolerable planet to put it on?"

2. EXPLORATION

2.0. Exploration and mining—which we submit (para. 2.2.0) are inseparable components of a single process—raise serious questions of land-use policy, planning law, and commercial policy.

2.1 Exploration sites and land-use policy

2.1.0. Sir Val Duncan has pointed out⁸ that Britain's wildlands are her most likely sites for deposits of non-ferrous metal ores. Having studied the nature and distribution of the eighty-odd UK sites²⁵ now being prospected by at least 28 companies, we agree that "mineralisation is most likely to occur in the more attractive and remote areas often designated as national parks..."⁸ The issues of land-use policy raised by present exploration seem to us most clearly pointed in the National Parks, to which we shall accordingly devote most of our attention. We hope, however, that you will give full weight to the similar and less publicised problems of Areas of Outstanding Natural Beauty, National Trust sites, Ancient Monuments and Scheduled Buildings, Country Parks, National Nature Reserves, and other designated areas, which, though smaller and less well-known than the National Parks, are more numerous and just as important. Their smallness and diffusion make them easier to erase than National Parks, and their lack of ecological inertia or buffer-zones makes them especially vulnerable to effects of development nearby or in the same watershed. We hope you will also share our concern for undesignated areas, such as certain wild tracts administered by the Countryside Commission for Scotland; for it is there that most of Britain's wildlands are found, and perhaps there that

Britain makes her closest approach to wilderness.

2.1.1. A common misconception of the purposes of National Parks seems, unfortunately, to be shared by some people in the mining industry. Sir Val Duncan has written⁸, for example, of "rocky and hilly country which is not suitable as a living area for a large population and much of it has therefore been set aside as National Parks". That is not the reason at all. National Parks are so designated because of "their natural beauty, and the opportunities they afford for open-air recreation, having regard both to their character and to their position in relation to centres of population"²⁶. Parliament did not feel that wildlands were wastelands, but instead that wildlands have a unique value worth conserving for the nation—a value great enough to justify setting aside in perpetuity 9 per cent of England and Wales²⁷.

2.1.2. It would be quite wrong to suppose that Parliament did not foresee conflicts between mining and the National Park idea—both the second-reading speakers in 1949 and the Hobhouse Committee were well aware of what might happen²⁸. We think it significant, therefore, that the Park boundaries were drawn to include regions known to be comparatively well mineralised, whilst there are also striking examples (such as in Snowdonia) of the deliberate exclusion of areas devastated by earlier mineral workings—even to the extent of omitting a tract that would otherwise be near the middle of the Park. It is a pity that when Sir Val Duncan mentioned that the Capel Hermon copper deposit is "not many miles from the traditional mining area of Blaenau Ffestiniog"⁸ he did not also point out that Blaenau, because it was so derelict, was excluded from the Park to which the hills of Capel Hermon contribute such beauty. The possibility that Capel Hermon—both land and people—may suffer the enormous man-made problems of Blaenau Ffestiniog is exactly what worries us.

2.1.3. In the second-reading debate in the Commons on the National Parks Bill, the then Minister for Town and Country Planning said that circumstances could conceivably arise in which mining in a Park might eventually have to be considered; but he laid down²⁹ these conditions:

...it must be demonstrated quite clearly [he said] that the exploitation of those minerals is absolutely necessary in the public interest. It must be clear beyond all doubt that there is no possible alternative source of supply, and if those two conditions are satisfied then the permission must be subject to the condition that restoration takes place at the earliest possible opportunity³⁰.

This lucid and reasonable statement of principle has been eroded by successive Governments until the first condition (echoing the Hobhouse Committee's "of vital national importance" and "of proved national necessity") has changed from "absolutely necessary" to what, "on balance, the national interest justifies"³¹ or what is merely economically desirable; the second condition has vanished utterly; and the third condition, as a sort of autopsy, remains for you. Even this condition has lost its spine: the present position, according to Lord Sandford³¹, is merely that "every care is taken to require whatever screening and restoration works are practicable". We trust you share our misgivings at "practicable": we observe that the Alkali Act's requirements of the "best practicable means [of abating air pollution]" used quite clearly to mean the best means technically available³², but now seems instead to mean the best means that the polluter is willing to pay for³³.

2.1.4. Recent Governments have apparently come to view National Parks as a holding action—a designation attached to land until a Minister decides he knows a better use for it. This gradual shift from the principle of Parks held in permanent public trust by the will of Parliament to the expediency of Parks existing by grace of Ministerial discretion is, we submit, a matter for national shame.

2.1.5. Parliament set up National Parks "for the purpose of preserving and enhancing the[ir] natural beauty... and... of promoting their enjoyment by the public"²⁶. Yet under present law, various Ministers are authorised to introduce into Parks massive developments clearly inconsistent with Parliament's expressed aims. We do not suppose anyone will argue that large-scale mining furthers those aims; we maintain, indeed, that it is hostile to them. We do not see what

right Ministers have to decide, or that they are competent or appropriate to decide, where the national interest in Parks lies. If Parliament no longer means what it said in 1949 and in the Countryside Act, 1968, it is odd that Parliament has not said so; and until Parliament says so, we must assume Parliament would agree that the National Parks, now becoming more overcrowded every year, are already inadequate to the nation's present and future needs, and must be not less stringently protected but more so. (More stringent protection would have the advantage, too, of helping to raise Britain's National Parks to the minimum standard required for inclusion in the United Nations List of National Parks and Equivalent Reserves.)

2.1.6. In short, we feel that under present or foreseeable conditions, any pretence that large-scale mining can be justified in a British National Park is a disgraceful evasion of the declared purposes of the National Parks Act. We think there are other excellent arguments against mining in the Parks, and we shall mention some below³⁴, but we believe that a civilised nation must first of all be bound by the intent of her own laws.

2.1.7. We also cannot understand how any Government can contemplate direct subsidies to the mining industry³⁵ to help it seek mineable deposits in National Parks. Neither allegations of some ill-defined "national interest" nor cries of "This is a development area!" can remove a basic inconsistency. With one hand the Government are giving public money to private corporations in the hope they will find ores in what are generally "white areas" for planning purposes; with the other hand the Government are spending more public money to protect the same areas from erosion by careless or too-numerous visitors and from unsuitable small-scale development by commercial exploiters. Are we to conclude that the bigger a development, the less unsuited it is to a National Park? To permit the substantial development of a "white area" (one in which there is a strong presumption against this) is deplorable; to encourage it seems gratuitous folly. We cannot help thinking that to a disinterested observer such behaviour must seem fundamentally insane; and this is not the way we think our country or our Government should look. If our

Government use our money to oppose the interests of our National Parks, we shall have to agree with Pogo that "We have met the enemy and they are us."

2.2. Exploration methods

2.2.0. Despite the organisational requirements of this evidence, we do not accept that mineral exploration—from preliminary surveys to, say, prospect drilling—is severable from extraction. Certain formal differences—e.g. that exploration is more likely to cause temporary nuisances than permanent devastation, and that its scale is altogether different than that of extraction—conceal the interdependence—logistic, economic and political—of the two processes. As Wool J. remarks³⁶, "There can be no subtle distinction...between the two halves of an umbrella."

2.2.1. Neither do we accept that scout and prospect drilling are innocuous. In a completely uninhabited area, properly conducted drilling might directly harm nobody—though in such an area the drillers are unlikely to be as good housekeepers as they must be when closely observed. But in a more typical setting in rural Britain, drilling may well be a substantial nuisance to many people. The view put forward by John Williams of RTZ³⁷ that scout drilling does not "lead to any substantial interference with the owner's enjoyment of his land" is in no way shared by the residents of Capel Hermon.

2.2.2. Even where one bore-hole is tolerable, the cumulative effect of dozens together may not be. If you have paid an unannounced call upon a drilling rig, we think you will agree that the noise is louder and more penetrating than that of a large bulldozer, let alone of a farm tractor (with which it is often compared); nor do tractors roar and whine continuously for twelve hours at a time. It is sometimes impossible for drillers to avoid diverting and polluting watercourses, blocking roads, cutting trees, or endangering livestock; and though the disturbance of drilling is far less severe and permanent than that of mining, we do not think it can be entirely written off. We are not happy about proposed legislation³⁸ that would give licensees power to explore (with scout drilling) throughout large tracts without landowners' permission. What may be

only a slight nuisance in one's back meadow may be intolerable in one's back garden, and the law must take account of such potential inequities.

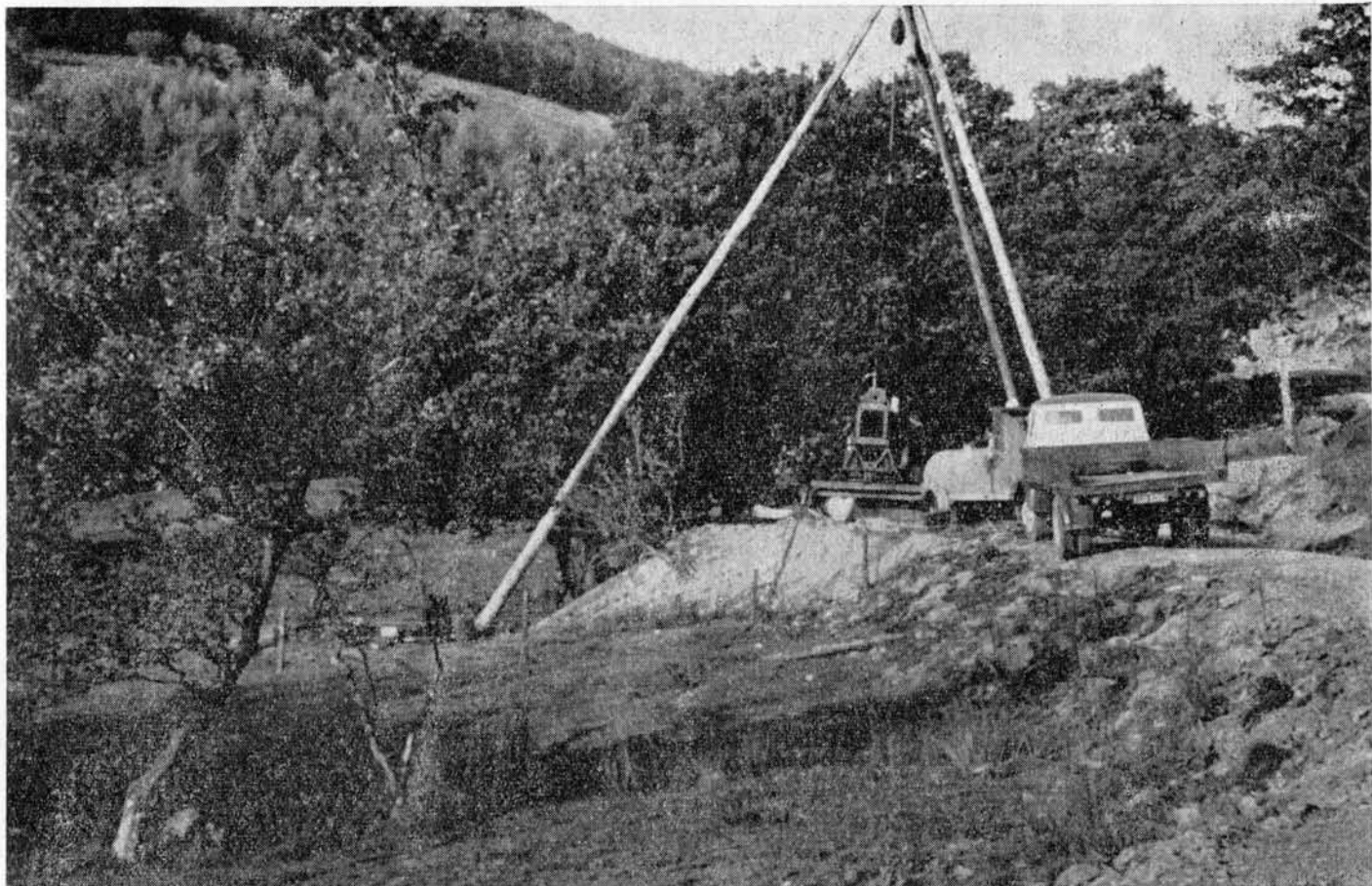
2.3. Exploration and planning law

2.3.0. The direct disturbance caused by mineral exploration, however intense at the time, is relatively localised and does not last for more than a year or two in a given area. The main danger of exploration, we think, lies instead in the piously maintained fiction of severability from consequent extraction, and hence in the tendency of planning authorities to creep from one grant of permission to another without giving anyone a chance to do much planning. (There is a presumption that this tendency may be aggravated by the Government's new direct incentive³⁵ to allow mining in order to be able to recover its exploration subsidies, which are only recoverable out of revenues from mining the sites explored.) Lord Sandford³¹ has laid great stress on the protection of National Parks by strict planning controls, but we have seen little evidence of strictness in recent years³⁹. We believe that the present system of planning controls will continue to be successful for permitting domestic mining (and indeed for patching-up after the wrong decisions have been made) but quite unsuccessful for enforcing the protection of the Parks—which are especially vulnerable because they suffer from government by chaos⁴⁰.

2.3.1. We believe that present planning procedures are fatally defective. Briefly, the main flaws are:

a) There is no ordinary mechanism for obtaining interlocutory advisory rulings on points of law; thus even on a point that seems perfectly clear, such as whether a programme of scout drilling requires planning permission, a mining company is free to take formally whatever view it pleases—perhaps under form of alleged vague legal advice⁴¹.

b) Developers can seek permission for large projects in discrete, artificially severed phases (e.g. preliminary exploration, intensive exploration, extraction, concentration, transport, smelting, refining) in such a way that the whole project can never be examined at once, even if fairly com-



plete plans have already matured and if each stage entails the other (*cf.* Shell's separate proceedings for the offshore moorings, onshore storage tanks, submarine pipelines, and overland pipelines for the proposed Amlwch oil terminal).

c) Planning authorities must take into account "any material considerations", but in practice have absolute discretion in deciding what is "material". This discretion has devolved on them because the courts are reluctant to determine what is "material" (since this might require a court to become a tribunal of fact). The result is frequent abuse of the option mentioned in (b).

d) Public Inquiries' formal terms of references are sometimes settled in advance by a private conference between applicant and authority. The industry's view of the value of this sort of cozy co-operation may be reflected by Sir Andrew Bryan's remark⁴² that many of the smaller planning applications probably ought not to go to an Inquiry at all. "That they do so is often the result of a failure of communications between the applicant and the local planning authority." What about communications with the public?

e) Prerogative remedies are in general not available if planning discretion is abused, e.g. if an authority errs on a point of law.

f) Legal standing to pursue the substituted statutory remedy is extremely restricted (by bad case-law).

g) No official transcript or tape-recording is normally made of planning Inquiries, even those of the greatest national importance.

h) There is no statutory requirement that Inspectors' reports to Ministers be published in certain sorts of Inquiries, e.g. non-statutory advisory ones.

i) The statutory requirements of public notice for Inquiries are loose enough to permit their intent to be easily evaded.

j) Despite common-law principles to the contrary, there is no legal obstacle to a developer's seeking planning permission to continue what he has already been doing unlawfully without it⁴³; nor can a planning authority be compelled to restrain (by an enforcement order or stop notice) a continuing breach of planning control within its sole jurisdiction.

k) Assurances given at Public Inquiries are not binding in law, and

apparently are not always considered binding in fact.⁴⁴

l) There appears to be no penalty for giving false information in a Public Inquiry.

m) Normal judicial procedures for eliciting evidence, e.g. discovery and subpoena, are not available even in those Public Inquiries that amount to adversary hearings, and Inspectors have considerable latitude in excluding evidence.

n) Applicants are free to withhold information that would contradict their own testimony; the burden is on private objectors to obtain it. Nobody is required to tell the truth, nor the whole truth, nor nothing but the truth.

o) In some sorts of Inquiries, the disclosure of the needed facts is illegal by statute or by order⁴⁵.

p) It is open to large corporations with permanent legal staff to exhaust the resources of private objectors through prolonged Inquiries, perhaps on a series of applications only trivially different.

q) The success of planning procedures depends not on equitable principles or on statutory requirements of justice, but on honesty and goodwill that are not always displayed.

r) The great discretion given to local executive authorities not subject to significant judicial review may tend to encourage corruption where permission for very large projects is being sought by non-statutory undertakers.

s) Poorly framed regulations make it possible for a planning authority to exclude the evidence of its own Planning Officer,⁴⁶ or indeed to act against the wishes of the entire constituency.

2.3.2. Planning Inquiries are often befuddled by the absurd argument that since mining is fixed by nature it must take precedence over all other forms of land-use—as though National Parks were not fixed by nature and could be put just anywhere. Many activities are fixed by nature, such as the dumping of high-level radioactive wastes in sea-trenches, but that has nothing to do with whether they are a good idea. Likewise, there is no logic in the argument that mining would increase national security. If copper, for example, is a strategic metal, then plainly squandering our domestic reserves of copper in peacetime would decrease national security⁴⁷.

2.4 Exploration and the Government

2.4.0. Apart from the planning issue of where exploration should be allowed, there is the basic question of who is to do the exploring. Those firms benefiting from the licences, concessions, and subsidies for mineral exploration offered by the previous and present Governments often point out that the geological knowledge thus gained will be a national asset. If one accepts this argument, we think one must then follow one's own logic by assigning the task of exploration to the appropriate research organisation, namely the Institute of Geological Sciences. When such an official body exists, we think it improper for its duties to be transferred to private corporations, which, under present arrangements for confidentiality, can then benefit enormously from five years' exclusive use of the information they have obtained with the help of funds raised by public taxation. (In opencast mining, when extraction must work quickly before the market falls⁴⁸, five years' lead is a long time.) Furthermore, this impropriety will be still greater if new legislation³⁸ allows

Ministers to license exclusive options for large areas. Were the IGS to get the £50 million that the Government are now making available to mining companies³⁵, the IGS would then be able to perform the functions for which it was set up. The public deserve an explanation of why the Government think it necessary for the private sector, which has often complained that the risks of domestic exploration are too high for commercial groups to undertake, to supplant the national agency set up for this very purpose. Exploration by the IGS alone would have a further advantage: since it has no commercial or competitive interest in the outcome, the IGS would be unlikely to arouse much local ill-will, and would have no reason to use the high-pressure salesmanship and distressing tactics sometimes employed by mining companies seeking options. A shift from commercial to academic exploration—if and where one wants any exploration at all—would benefit everyone.

3. MINING

3.0. In the past decade or two, the nature and the technique of base-metal mining have been completely transformed. New technology, and especially the development of huge semi-automated machinery, has made it possible for the first time to mine on a large enough scale to make low-grade ores highly profitable, as at Palabora⁴⁹; at the same time, as we scrape closer to the bottom of the barrel, low-grade ores are increasingly the only ones we have left. The trend toward larger-scale mining of leaner ores is illustrated by US data: the proportion of copper mined by opencast methods rose, between 1936 and 1964, from 45 per cent to 75 per cent of the total, while crude copper-ore production trebled and copper-metal production doubled⁵⁰.

3.1. What does it cost the earth?

3.1.0. Base-metal mining in Britain used to consist of following isolated rich veins or lodes, but these were few and soon exhausted. It is now possible to mine the much larger and poorer deposits remaining; and it is essential to realise that this mining will be *unlike any seen in Britain before*, and indeed of such a new sort that *traditional concepts of restoration are not applicable to it*. Britain has no Mesabi

Range; her ores are likely to be poor; her mines would therefore have to be large, and usually opencast. This new style of mining opens up wholly new possibilities for devastation: as Aldo Leopold wrote⁵¹, "The Lord giveth, and the Lord taketh away, but He is no longer the only one to do so."

3.1.1. We note Sir Val Duncan's assurance⁸ that "natural resource companies have special responsibility... not to destroy the environment." RTZ's Bougainville operation in New Guinea has removed 40 million tons of overburden (formerly supporting a jungle, which was removed with herbicides and high-lead logging) and dumped it in a neighbouring valley. Two-fifths of all material mined, i.e. over 400 million tons, will end there. The river gradient will go from 8 per cent to 1 per cent⁵². RTZ's Palabora operation in the Transvaal, after six years, has a pit 4,500 by 2,800 feet in size; eventually it will reach a total depth of 1,600 feet to remove more than 300 million tons of ore. Over 42 million tons of ore and waste are mined each year; 130,000 tons of ore are blasted free daily; every 40 seconds, day and night, a 65- or 100-ton truck dumps a load of ore into the crusher⁵³. If this is not destruction of the environment, it will do until the real thing comes along.

3.1.2. The scale of modern opencast mining renders the disturbance of land irreversible: the topography is completely changed, the drainage altered, the ecosystem obliterated, and the soil replaced by mineralised wastes (para. 3.1.10). As John Williams remarks³⁷, "...if open-pit methods were proposed, the economics might prevent the pit being filled in after the orebody had been exhausted." We would go further than "might": it seems a good approximation⁵⁴ that filling and regrading the pit would cost about as much as digging it, and we doubt whether a mining company would like its profits to be spent in this way⁵⁵. Williams suggests³⁷ that "in these circumstances the mining company would have to show an alternative use which paid due regard to the interests of amenity—for example, for water conservation, pump storage, a marina, or perhaps for tipping purposes."

3.1.3. This is a very curious use of "amenity"⁵⁶. "Water conservation"—

which we take to mean allowing the pit to fill with water and then (if the water is not poisonous) using it as a reservoir—is an alternative use, albeit an odd one in upland Britain, where there are already a great many natural lakes (more than 250 in Snowdonia, for example). But such a use does not seem to us to have much to do with either amenity or conservation. It is well-known that artificial alternatives to water retention by the natural ground cover (such as grassland or forest floor) accelerate leaching and erosion by altering runoff rates and storage times. “Pump storage” is again an alternative use—one so inconsistent with “amenity” that it is being fought right now in several parts of Britain; and we think there are attractive alternatives to this form of electrical storage. It is not clear that the use of a flooded (and land-locked) opencast working as a “marina” would succeed in competing with existing natural lakes or with the seacoast, far less that it would be more desirable than the recreational use made of the original habitat (with its greater diversity, resilience, and carrying capacity) destroyed by the mine. We note that flooded pits lack good circulation and drainage and often cannot support aquatic life; they therefore foul easily. Most British wildlands already have a very high density of natural lakes better suited to recreational use. Finally, we fail to see how even the most elastic imagination can stretch far enough to admit the use of a pit for rubbish-tipping as an example of “paying due regard to the interests of amenity”; and we think this idea is so impractical, and so out-of-place in wildlands far removed from the waste-producing cities, that it is simply not on. We can only conclude that Williams has at best a strange notion of “amenity” and at worst a tendency to careless thinking. He simply has no idea what to do with that big hole in the ground. Of course he would be willing to remove the buildings⁵⁷—they are worth money. But he cannot, alas, remove the hole as well.

3.1.4. Though we think the ecological and cultural effects of large-scale mining are more far-reaching than its local effect on beauty, we must share with you our misgivings at the use of such words as “rehabilitation” and “reconstruction” in reference to

hypothetical opencast mines in Britain. We believe that the scale such mines would have to assume, coupled with the toxicity of the spoil they would create, would make each site into a virtually permanent biological desert, as has happened at all the analogous smaller sites we know of in Britain. (We hope you have inspected Parys Mountain in Anglesey.) We have seen no evidence suggesting this desert-making would not happen, and we think the burden must be on those seeking leave to mine to prove very convincingly in advance that their methods of “restoration” will work. Such proof must be empirical, not merely theoretical.

3.1.5. The time-scale of mining makes it very hard to ensure that subsequent cosmetic works (required as, say, a condition of the grant of planning permission) will actually be carried out. The only prudent method appears to be the mandatory posting of a performance bond, though it is not clear whether there is any legal way of requiring this⁵⁸. Obviously one must guard against the independent company that goes bankrupt and is unable to meet its commitments; but in vertically integrated companies, mining may be carried out by a subsidiary that transfers its revenues to the prosperous parent company, folds its tents, and disappears, leaving a mess behind. Such shifting of corporate responsibility—for which there is at least one British precedent—is difficult to prevent without injustice, and we do not think the public interest is adequately protected by merely assuming that all companies will be anxious to comply with the spirit and letter of cosmetic requirements in order to safeguard their putative future UK mining interests. Experience with existing mineral dereliction in Britain suggests that cosmetic works are generally more costly than expected⁵⁹, and that, in fact, “restoration” is rarely done even when promised. In the West Riding, for example, planning permissions have been given for 12,000 acres of surface workings since 1947. Of this area 6,000 acres have been worked but only 500 to 600 acres satisfactorily restored and little landscaping done⁶⁰. 3.1.6. We are at the disadvantage of not having any specific mining proposals before us, though we should be glad to give our urgent attention to

studying any proposals that mining companies may care to submit to us. Meanwhile, all we can do without data is order-of-magnitude calculations. But even these suggest a scale altogether inconsistent with concealment, restoration, or tolerability. The essence of open cast mining is to move very large amounts of rock. A British opencast copper-mine, for example, would probably remove (on average) of order 20 to 30 million tons of rock a year for of order 15 to 20 years. This cannot be done quietly or discreetly; it is a brute-force operation. Simple sums suggest that such a mine cannot be expected to look nice afterwards, far less at the time: on a clear day it would be visible to the naked eye from a satellite more than 500 miles up.

3.1.7. If we make a generous allowance for the depth of overburden (which would normally be dumped in an adjacent valley) and for the degree of concentration, we find that our hypothetical mine must send thousands of tons of concentrate a day to the smelters. This is a substantial transport problem, and it is naïve to suppose it can be solved without disturbing a very large area extending far from the mine itself. We find that in an operation of this size it is inevitable that very harmful amounts of the powerful frothing and collecting agents used in selective flotation will escape from closed-loop concentrators into the watershed. (If closed loops are not technically possible, several hundred tons of reagents will escape annually.) Other forms of water pollution are likely as well—sulphides, silt, lime (used in quantities of thousands of tons a year), oil, and others; and crushing mills often produce air pollution. Mill tailings are very prone to escaping as an unpleasant airborne dust⁶¹.

3.1.8. We find also that despite the best precautions, and making optimistic assumptions about the forms in which metals are bound, the mobilisation of soluble metal ions is capable of sterilising large areas of watershed: as the Conwy oyster-bed disaster⁶² showed, heavy metals are exceedingly toxic to many organisms, are readily concentrated in food chains, and are easily leached by the heavy rainfall prevalent in upland Britain. This metal-mobilisation problem probably has no technical solution; it is bound

to happen if you dig up large amounts of mineralised rock and leave them lying in the rain or sitting in pit-water (which you then pump out into the watershed); and of course once the metal has been leached away you cannot control where it goes, either as surface- or as ground-water. We note that many of the areas now being explored for the more toxic heavy metals (such as zinc, copper, lead, and nickel⁶³) control large and fertile watersheds draining into important estuarial spawning grounds of e.g. shellfish and anadromous fish.

3.1.9. We are confident that you will not be influenced by artists' impressions of neat little mines surrounded by tall trees and happy tourists; the ecological effects of large-scale mining are extensive, complex, and disquieting, and deserve the closest attention of all of us. Sadly, mining companies are no more competent than we are to evaluate these problems, and may be reluctant to call your attention to them. You should therefore seek carefully researched evidence from appropriate statutory and academic bodies. This will take time, but we think it must be done if you are to meet the demands of your terms of reference. We must also ask you not to rely on bland oral assurances, as experience (e.g. with the Anglesey Aluminium Company⁴⁴) has shown that assurances sometimes cannot be honoured. The potential dangers of opencast mining to the ecology of large tracts of land and water justify your seeking the best impartial advice to be had—and acting conservatively upon it, since the effects of mistakes may be irreversible⁶⁴.

3.1.10. We hope you will also look very critically at any plans for revegetating mined land. Before mining, the soil has definite layers and horizons, with a stable physical, chemical, and microbiological composition evolved though aeons of weathering. After mining, the substituted wastes have no structure and are just unorganised masses—they are really not soil at all. The highly acidic mill-tailings and other by-products of ore-processing (as opposed to mere overburden) are by their chemical nature quite intractable. Acidic products cannot be neutralised except in a superficial surface layer, and the use of ammonia-based fertilizers usually remobilises metal ions that, at low pH,

would have remained bound. It is thus impossible to restore ecologically stable vegetation to a surface-mined area until most of the normal weathering has taken its very slow course—which no amount of scientific study will accelerate. More often it is impossible to restore anything at all because of the high concentrations of soluble metal ions, most of which are highly toxic to plants at concentrations of order 10^{-5} to 10^{-7} . Where mutant metal-loving strains of grass can be made to grow, there are still problems—as in the Carneddau, where it is said that though mutant grasses (adapted to lead-rich spoil) flourished, the grass poisoned both the sheep that ate it and the people that ate the sheep. Metals are conserved by nature if not by us. Finally, there is the very serious fundamental problem of stabilisation—a problem aggravated by heavy rainfall and by the difficulty of revegetating. A British opencast copper-mine can be expected to produce of order 200–500 tons of waste per ton of copper; and as Aberfan and Appalachia bear witness, storing this much waste material stably (rather than metastably) on steep hill-sides often proves impossible, no matter what technology is applied⁶⁵. In Appalachia, the Tennessee Valley Authority consider slopes steeper than 28° “unmineable” for coal for just this reason⁶⁶.

3.2. What does it cost people?

3.2.0. We take a broad view of “environment”; to us it is not just scenery, nor even land plus wildlife, but the whole complex of man in his surroundings—a much broader concept than those fond of cosmetic solutions would like to embrace. We are therefore concerned with the impact of mining not just on land but on people and cultures, which are often more fragile and less readily healed. This view is, we submit, wholly consistent with your terms of reference, which mention “other requirements of national policy”: for policy, like the economy, exists to serve people, not as an end in itself.

3.2.1. We believe Britain's rural cultures are an essential part of her diversity and add greatly to her strength. Most of these cultures are traditional, distinctive, tenacious, and economically marginal; most of our wildest areas are economically

depressed, mainly because the agricultural productivity of hill-farms with rough climate and topography cannot compete with that of mechanised lowland farms which, because of modern communications, sell into the same markets. By a peculiarity of bureaucratic thought, many of our “white areas” are also in or near “development areas”; yet history shows that the life of “white areas” is in units no larger than the village, and that any form of heavy industry is fatal to the village structure.

3.2.2. We are persuaded that extractive heavy industry is not the kiss of life for such regions, but on the contrary the *coup de grâce*. If the past history of the extractive sector in this country teaches us anything, it is that the boom-and-bust economy is in the long run disastrous to the rural economy; it destroys traditional livelihoods based on permanent resources, leaving behind embittered ghost-towns with a heavy welfare burden. This has happened too often and too consistently for us to suppose it is a coincidence. We think this sort of aftermath is inevitable, is inherent in the nature of the industry, and cannot be avoided by any novel features of a particular extractive scheme.

3.2.3. Especially worthy of your attention are the intricate and delicate interrelationships of man and land, economy and ecology, in hill-farming areas. We suggest you examine in detail (as we have done in a case-study to be published soon⁶⁷) what makes such areas work, with special reference to the nature of income, mobility and employment.

3.2.4. The temporary employment offered by large-scale mechanised mining is generally unsuitable for the sorts of unemployed persons found in rural Britain, unattractive to local school-leavers, and destructive of existing stable employment. Large-scale mining in such areas is also irreversibly antagonistic to the bases of the two most important sources of income that can be expected to last indefinitely (given proper nurture), namely agriculture and tourism. Certain rural areas of Britain in which mining is now being contemplated have nearly the highest per-capita tourist income in the world—and yet the potential for such income has barely been tapped. The mere existence and repute of large-scale mining there, even without its



drastic side-effects on scenery and ecology, would prejudice tourism over a much wider area than that of the immediate operation, since it is well-known that most visitors to such areas seek there the solitude, quiet, and integrity that cities lack. It is important to note, too, that these visitors are not generally the rich preservationists some people like to think; they are, on the contrary, mainly working-class and lower-middle-class people who cannot afford to go abroad.

3.2.5. Darling's illuminating example⁶⁸ of the sea-loch with a track on one side and a road on the other points up very clearly the vulnerability of rural cultures and rural

husbandry to contact with competitive cash-based urban economies, such as mining would import. We do not think it in the long-term interest of a country that cannot feed half her people to encourage the destruction of hill-farming. Sooner or later, as Ehrlich points out⁶⁹, the time will come when food for importation is no longer to be had abroad, and when that time comes Britain "will find... money rather indigestible". The traditional skills needed to run her domestic agriculture—and her hill-farms are among the most extensive and efficient components of it—must not be lost.

3.2.6. Thus we do not see how the

national interest in unspoilt countryside fails to coincide with its maintenance in roughly its present state, farmed by the same stable and individualistic people who live there now. It is important to remember that after decades of rural depopulation, most people who still live in such areas do so by choice, because they do not want to be in cities. We think their choice must be respected. And we think the national economic interest in rural land lies in its wholeness and its health. It is no good snatching a short-term mining profit at the expense of a permanent social debt—the debt, of course, to be the business of other generations; nor would this short/long-term dichotomy stand up to rigorous accounting of diseconomies. Britain has too little land left to be able to tear the fabric of any more; every such decrement reduces forever the patrimony of which we are stewards. History will judge us harshly if we, who inherited a living and regenerating land, pass it on diminished and despoiled, as an industrial site no longer able to heal itself or to support its people.

3.2.7. The argument⁸ that mining will "produce new wealth and employment for the country" is a dangerous fallacy. New wealth is created only at the expense of some form of new poverty elsewhere; wealth, like debt, is never created, only distributed. Thus "primary producer of raw materials" is a euphemism for "exploited country". The disintegration of a stable Melanesian culture, the physical destruction of its subsistence-base, and their replacement by alien ideas of economic expansion can hardly be construed as "contributing to the development of the economic and social fabric" or as "prosperity and welfare that should materially assist the Territory"⁵².

3.2.8. As for employment, any "brought" by mining is generally just that, bringing men from one job to another. To think large-scale mining can help the unemployment problems of rural Britain is to reveal complete ignorance of who is unemployed there and why—and to ignore the lessons taught by the history of every large civil-engineering project carried on there in recent years.

4. CONCLUSIONS

4.0. We hope you will introduce to

British planning a new and desperately needed approach—the practice of asking, when faced with a proposal for more high technology, not “How can we do this thing?” but instead “What if we simply didn’t?” If we have got along without the metals so long, why not forever? What would happen if they weren’t there? Are we as competent to weigh the wisdom of mining them as we are to discover them? Need we go to rock-bottom? What alternatives are there? If we will be forced to alternatives later, why not now? Once we begin to enumerate the positive advantages that flow from not doing (or rather from doing something wiser), once we count the blessings of renunciation in favour of conservation, we see more clearly the difference between what benefits the private economy and what benefits the nation. We see, to paraphrase Newton Drury, that Britain is neither rich enough to be able to sell her wildlands, nor poor enough to need to.

4.1. The Zuckerman Report on Mining and the Environment will be published in the centenary year of the National Park idea and the twenty-first year of Parks in Britain—and one year short of the centenary of the parent company of your principal sponsor. You have a grave duty. If your Report says that cosmetic solutions are what matter, you must bear much of the responsibility for the erosion not just of one National Park for a decade but of all British wildlands for all time; and we, mindful of what our children will say, should not like to bear such a burden. Yet since RTZ have said they will be bound by your Report, you also have it in your power to begin turning British mining companies towards a more far-sighted, constructive, and socially responsible view, towards an ethic more likely to encourage the continuing hospitality of the world that they (as well as you and we) must live on. You are called on to help decide whether Britain will have protected wildlands for ten more years, let alone for another hundred; and to the extent that you decide the time has come not to exploit but to conserve, to that extent Britain, and civilisation, will be the more likely to survive.

5. NOTES

1) “Mining Companies Set Up Independent Commission on UK

Mining and the Environment”: press release, The Rio Tinto-Zinc Corporation Ltd., 6 St James’s Square, London SW1; embargo date 22 July 1971, 1500 hr.

2) For example, it is estimated that by 1980 the total US consumption of minerals will double, with the use of aluminium and copper rising by factors of three and two-thirds respectively. *Proceedings of the Second Mineral Waste Utilisation Symposium*, Chicago, IIT Research Institute and US Bureau of Mines, 1970; pp 126, 216, and *passim*. The global growth rate of all mining is about 5 per cent per year, equivalent to about a 14-yr doubling time (*Man’s Impact on the Global Environment*, SCEP, MIT Press, 1970, p 117). Reference 17 thoroughly demolishes the notion that such growth rates are sustainable for more than a few decades at most.

3) This point is thoroughly discussed by Mishan, Boulding, Galbraith, *et al.*, and by H. V. Hodson in *The Diseconomics of Growth* (Earth Island Ltd., London, April 1972).

4) The symposium quoted in note 2 reported that automotive scrap in the US alone is accumulating at the rising rate of 1 million tons of ferrous and 0.5 million tons of non-ferrous metal a year—though it is said that industry has the capacity to accept all ferrous scrap produced. Evidently such capacities are not always used. In the US in 1968, according to the same source, 300,000 tons of aluminium were used in lids, caps, and cans, and none reclaimed. In New York City, 25,000 tons of tin are thrown away annually in the form of coatings on cans—the same amount salvaged from all secondary sources. Even the reactionary report cited in reference 64 concedes that “it seems unlikely that [continued] exponential growth in demand can continue to be met for all metals and minerals. An eventual reduction in the growth of supply of some therefore seems inevitable, whatever the demand. . . . [I]t is highly probable that economic and political pressures will lead to a need to mine large low-grade deposits in settled areas.” It is remarkable that even those expecting to be allowed to mine in “settled areas” still do not feel able to meet future demand. Evidently they accept that mining must eventually stop, but they would like to mine every possible site first.

5) It is customary and tempting to suppose technology will find substitutes for everything we run out of. To some extent this can be done, though it is difficult when one runs out of everything at once. (The present and projected growth rates of demand for aluminium—respectively 8.1 per cent per year and 6.4 per cent per year according to the preliminary and published drafts of reference 17—show the results of increasing substitution *now* of aluminium for iron and copper; but how long can this go on?) But for most non-structural applications (copper in electrics, platinum in catalysis, mercury in temperature/pressure control, and silver in photography are classic examples) it is unlikely in the extreme that satisfactory substitutes can be found; and this can be shown by fundamental arguments.

6) It is naïve to argue that since in theory any high-entropy state can be reduced to low entropy by a sufficient expenditure of energy, therefore in practice any ore can be used, however poor (cf. *Resources and Man*, W. H. Freeman & Co., San Francisco, 1969, at pp 122-3); just as it is naïve to suppose there is or can be any “clean” source of energy. We can evade the Second Law locally but not everywhere at once; it guarantees that all the energy we generate or use, no matter how, will end as heat in the biosphere. The heat now being released in this way can be expected, at anything close to present growth rates, to cause drastic instabilities in world climate in rather less than a century (Amory B. Lovins, “Thermal Limits to World Energy-Use”: *Nature*, 1972, to be published; also *Inadvertent Climate Modification*, SMIC, MIT Press, 1971). Furthermore, there are grave unsolved problems in nuclear fission technology—emergency core cooling and the isolation of high-level wastes—that are at best intractable and at worst may have no technical solutions. This is not the place for a paper on the subject, but we think you would be ill-advised to rely on any energy-intensive solutions now or in future. Future technology, however clever, cannot evade physical law.

7) Reference 17 cogently argues that continued mining of low-grade ores makes the eventual onset of depletion far more sudden, i.e. industry has perhaps a decade in which to learn to do without the material.

8) Speech to the Annual Meeting, RTZ, 19 May 1971. Text available from RTZ; also reproduced as an advertisement in *The Times*, 21 May 1971, p 23, and in other principal newspapers.

9) "Can We Afford To Be Rich?": first leader, *The Times*, 20 November 1971; and replying letters 25 November. The leader was based largely on the Rutherford Lecture by the Bishop of Kingston.

10) Simon Millar, personal communication, December 1971, referring to a book by Jeff Carter.

11) G. S. Headley, personal communication, October, 1971.

12) The direct energy input per metric ton of output from US copper-mines in 1965 was a staggering 3.8×10^7 BTU (about 11 MW-hr). This energy cost does not include overheads (e.g. machinery, research, exploration), yet is still roughly $1.9 \times$ the direct per-ton energy cost of smelting and refining, and $0.67 \times$ that of semi-manufacturing. Calculated from data on p 159, *Gaps in Technology: Non-ferrous Metals*, OECD, Paris, 1969; available from HMSO.

13) OECD, *op. cit.*, pp 50, 140, 146. Cf. *Annual Abstract of Statistics* 1971 (no. 108), HMSO, p 173.

14) "Indirect" means not what the mining company pays for e.g. a barrel of oil, but what the oil costs everyone else in depletion, marine spills, ugliness, air pollution, etc.

15) *Mining J* 22 October 1971, p 371.

16) This phrasing is due to Anthony Tucker: *The Toxic Metals*, Earth Island Ltd, London, March 1972.

17) D. H. Meadows, D. L. Meadows, J. Randers, and W. W. Behrens III, *The Limits to Growth*: Potomac Associates, Washington DC, and Earth Island Ltd, London, both March 1972.

18) W. W. Behrens III, "The Dynamics of Natural Resource Utilisation": *Proceedings*, 1971 Computer Simulation Conference, Boston, Mass.; also W. W. Behrens III and D. L. Meadows, personal communications, February 1972, and, by the same authors, "The Determinants of Long-Term Resource Availability", AAAS paper, January 1971, Philadelphia.

19) "Pollution" in the ecological rather than the anthropocentrically biological sense: the direct ecological effects of some "pollutants" may be

small, e.g. when they are chemically inert and are made from materials obtained from outside the biosphere.

20) For example, moderately complex petroleum molecules are converted, at an energy cost, into more highly ordered (lower-entropy) polymers plus highly disordered (high-entropy) by-products. The raw plastic is converted, at an energy cost, into a specially shaped (more highly ordered) toy plus fumes, scraps, etc. The toy is eventually discarded and, as a pollutant, increases the entropy of a pile of rubbish. It slowly decomposes—perhaps very slowly—and thus seeks the maximum entropy promised by the Second Law.

21) The cogently argued thesis of reference 17 is that human economies must seek equilibria, starting now, if they are to survive: it seems that nature (as usual) knows best.

22) Different because it is axiomatic that no organism can live by metabolising its own wastes; cf. the thermodynamic absurdity of the cat-rat farm.

23) Hansard, Commons (817) 128: "It is the view of the Government that the polluter must pay the costs [of restoration]."

24) Letter from Professor Lord Zuckerman to Graham Searle, FOE Ltd, 24 September 1971.

25) J. Bugler and R. Thomas, *The Observer*, 3 October 1971.

26) National Parks and Access to the Countryside Act, 1949, section 5 (12, 13, 14 Geo. 6, Ch. 97). The 1949 government accepted (Hansard, Lords (164) 881) the Dower Report's definition of National Parks, which specified that "for the nation's benefit and by appropriate national decision and action... the characteristic landscape beauty... [be] strictly preserved."

27) Mining in National Parks leads to a curious irony: the increased standard of material welfare that mining is supposed to produce will give more people more leisure, but the mining will give them fewer places to spend it in.

28) See the Hobhouse Report ("Report of the National Parks Committee (England and Wales)", 1947-7) and these far from exhaustive Hansard references: Commons (463), 1461, 1613, 1630, 1652; Lords (164) 881-2, 891-2, 899.

29) Hansard, Commons, (463) 1484,

31 March 1949. Cf. 1461, 1485-6, 1501-2, 1504-6: Sir Arthur Salter's prophecies are coming true.

30) Of course, the Minister's remarks about "restoration" must be interpreted in the light of the mining technology known or conceived in 1949. If there existed then, as there do now, power shovels capable of scooping up 220 cubic yards at a bite, and if the scale of opencast mining made it virtually impossible in 1949 (as it does now) to do effective restoration, one suspects the Minister would have phrased his requirement differently. To suppose otherwise is to imitate the Kentucky courts in their patently absurd construction of the broad-form mineral lease (*N. Y. Times*, section 6 (*Magazine*), pp 30+, 12 December 1971).

31) Letter from Lord Sandford to Michael Fidler MP on behalf of Mr D. S. Gibbs, 27 October 1971.

32) "Wherever it is technically possible complete elimination [of effluents] is required." Beaver Committee on Air Pollution, *Report* (1954), p 15.

33) "The problems of air pollution control are mainly economic. If money were no object there would be very few unresolved problems, for the technical solutions to prevention are almost all known.... The chief reason why we still tolerate a degree of pollution is economic...." Chief Inspector of Alkali, 1970, *106th Annual Report on Alkali, etc. Works* 1969, pp 5, 7.

34) See also our review in *The Ecologist*, June 1971, pp 4-8.

35) Mineral Exploration and Investment Grants Act, 1972. An interesting line of argument about the potential abuse of Government intervention in mining will be found in Hansard, Commons (825), 1073-4.

36) *Rex v. Haddock*: A. P. Herbert, *Uncommon Law*, Methuen, London, 1969, at p 419.

37) "Proposed Changes in Mineral Legislation in the United Kingdom" in *Trans Instn Min Metall (A)* 80:48 (1971).

38) Legislation proposing *inter alia* a shift from judicial to executive supervision of grants of compulsory rights, and in our view much reducing the protection of private landowners, is being prepared by the Department of Trade and Industry (in consultation with the mining industry) for introduction in Parliament in 1972 or 1973.

39) The more conspicuous examples of failure of planning controls include the approval of an early-warning system and of potash-mining in the North York Moors National Park, motorways in the Chilterns and in the Lake District National Park, china clay workings in and near the Dartmoor National Park, military exercises on Dartmoor, fluorspar and limestone quarrying in the Peak District National Park, a nuclear power station and mineral exploration in the Snowdonia National Park, oil refineries next to the Pembrokeshire National Park, and an aluminium smelter next to the Area of Outstanding Natural Beauty in Anglesey. This list is by no means exhaustive, and represents the response of several recent Governments.

40) Sir Jack Longland, "Report on the Administration of the National Parks", June 1971.

41) For example, RTZ have formally maintained the view that their drilling of 48 scout and prospect holes near Capel Hermon, over a period of 23 months, did not require planning permission (which it did not have). This view does not seem to be supported by the precedents, sources, and authorities (e.g. the Ministry of Technology) that RTZ have cited; is not shared by the Department of the Environment, the Welsh Office, the Merioneth County Council, or any of our Counsel; and is hard to reconcile with RTZ's actions, e.g. in requesting prior permission for shallower and less extensive drilling in the open country of the Mawddach Estuary.

42) *Trans Instn Min Metall* (A) 80: A70 (1971). Sir Andrew Bryan was the Mining Assessor who sat with the Inspector at the Public Inquiry (Dolgellau, 15-18 December 1970) into RTZ's application for permission to drill in Coed-y-Brenin and the Mawddach estuary.

43) Indeed, things have come to such a pass that Mr J. S. Sheppard, the Crown Estate Mineral Agent, felt impelled to express his admiration for John Williams of RTZ for admitting "that they [RTZ] had just about finished looking into one particular Crown area and would then like to take out a prospecting licence! He [Mr Sheppard] could not feel aggrieved about such a minor misdemeanour for he took the view that

if they found anything, then it was for the benefit of the community as a whole...." *Trans Instn Min Metall* (A) 80: A142 (1971).

44) The Holyhead smelter of the Anglesey Aluminium Company, for example, now emits several times the amount of fluoride promised at the Public Inquiry; *The Ecologist* (June 1971) raises some interesting points at pp 3, 9, 33.

45) For example, the Alkali Inspectorate follow a policy of non-disclosure; also cf. Rivers (Prevention of Pollution) Act, 1961, section 12 (9, 10 Eliz. 2 Ch. 50), and the Official Secrets Act. Under the former Act, together with sections 2, 7 of its 1951 predecessor (14, 15 Geo. 6 Ch. 64), the maximum first-offence penalty for polluting a river is a £200 fine—but for "disclosing any information" about who is putting what into a river, the penalty can be a £100 fine and three months' imprisonment!

46) Anglesey County Council did this in their Amlwch debate: *The Ecologist* (December 1971), p 5.

47) Kenneth Allsop, letter to *The Sunday Times*, 12 December 1971: "The varied approaches employed by mining companies... include spreading the impression that they are engaged upon a Government survey to chart the nation's 'strategic reserves' as provision against enemy attack.... [This] is twaddle. The mineral extraction now gathering momentum is a business deal of miniscule financial benefit to the nation, of none whatever to the locality but producing lovely profits for the companies." Mr Allsop obliquely raises an important question: in exactly what sort of notional national emergency would unmined reserves be useful if several years' preparation were needed before they could be mined?

48) "The time lapse between the beginning of stripping and actual production [of copper] may be quite long and could become a definite handicap if market conditions change for the worse during the development period.... Once exploitation is begun, a high rate of operation is needed to secure the most favourable unit costs." OECD, op. cit., at p 83. (Reference: 12.)

49) This huge RTZ opencast copper-mine produced in 1970 87,602 metric tons of anode copper from 18.9 million metric tons of milled ore. In 1968

alone, after-tax profits were £17.4 million; shareholders received dividends of £12.4 million on their investment of £38 million. Palabora Mining Co Ltd, 1969 *Annual Report and Accounts*; The Rio Tinto-Zinc Corporation Ltd, *Annual Report and Accounts*, 1970.

50) E. Pfeider, *Surface Mining*, Amer. Inst. Min. Metall. Petrol. Engineers, New York (1968), *passim*.

51) *A Sand County Almanac* (Sierra Club/Ballantine or Oxford University Press).

52) "Bougainville Copper... an Introduction": pamphlet by Bougainville Copper Pty Ltd, about 1969.

53) "Palabora Mining Company": brief undated pamphlet by PMC in English and Afrikaans.

54) In *Trans Instn Min Metall* 80: A 140, the oral report, Williams is reported as saying that opencast pits *are* (not might be) "uneconomic to fill".

55) The industry's position seems to be expressed in reference 50: "[Opencast mining] ideally... results in the exploitation of a mineral resource such that the optimum return on the investment to exploit it is attained compatible with maximum recovery of the contained economic metals."

56) It is suggestive that in Williams's rough draft, the clause "which [paid]... due regard to the interests of amenity" was apparently added as an afterthought.

57) Reference 37: "Positive undertakings could be given to remove the... buildings..."

58) House of Commons, Standing Committee B, Mineral Exploration, Etc. Bill, 7 December 1971, at 99-101, 109-10, 130-2.

59) According to reference 60, simple landscaping of Yorkshire dereliction costs £1,000 to £5,000 an acre, comparable to costs in the North Wales slate districts; cf. the Gilfach Goch project in Glamorgan, which will cost £2,650 an acre. According to reference 58 at 119, "It is impossible to predict the cost of any restoration measures, even 20 years ahead" (Sir John Eden, Minister for Industry); but the Ironstone Restoration Fund and others work on the assumption that it is possible.

60) B. F. Dixon, *Quarry Managers' J* 54: 220 (1970).

61) Reference 2 (*Proceedings*) at pp 128, 140.

62) Reference 16 gives an annotated

account of this leaching problem, which was caused by old and relatively small workings. Cf. *Marine Pollution Bull.* 2:3 (1971).

63) For these metals the estimated ratios of man-induced global mobilisation rate to rate of discharge in natural runoff are respectively 10.6, 11.9, 13.0, and 1.2. SCEP report (q.v. reference 2) at p 116.

64) However, M. J. Calahan's working party, reporting in *Trans Instn Min Metall (A)* 80:16, felt that "... in the long run the environment is renewable, whereas the mineral deposit is not. Possibly, therefore, conservation of minerals may be of greater ultimate significance than the conservation of the environment."

65) This is a huge problem. According to the symposium cited in reference 2, the US mineral industry is now producing over 1.6 billion (10⁹) tons of waste per year, 45 per cent more than in 1965.

66) See *N. Y. Times*, 7 December 1971, for details of new TVA waste regulations. The same source reported on 25 February 1972 that the 28° TVA slope limit is to be reduced to 24° and that the Federal Co-Chairman

of the Appalachian Regional Commission does not want spoil left on slopes steeper than 14°. How much of upland Britain is flatter than 14°? 67) A. B. Lovins and P. H. Evans, *Eryri, the Mountains of Longing*; introduction by Sir Charles Evans. A Friends of the Earth co-publication with Saturday Review Press (McCall), New York, 15 November 1971, and with George Allen and Unwin Ltd, London, late May 1972. The text, heavily illustrated with four-colour lithography of the highest standard, is an interpretation and case-study of the Snowdonia National Park and its problems.

68) *West Highland Survey* (Oxford University Press, 1955) at p 323: "We can think of a sea loch in the north-west Highlands where there is a road on one side and a track on the other. The living conditions in the townships on either side are different. Those on the road side are served by vans and are able to buy Glasgow bread (untouched by hand) and expensive packeted goods of all sorts. I have even seen tinned porridge on the vans during the thirties. The communities are heavily dependent on the vans which

come from as far as 70 miles away, and their standard of husbandry is low. On the other side of the loch more cows are kept; cheese and butter are made; home-made porridge and oat-cakes are the cereal staple rather than bought bread; the men fish more and the standard of husbandry is higher. The folk of the roadless side often join in the lament for a road, but what has the road done? It has brought the roadside townships into the commercial web of the east and south more completely than the roadless people have been brought in. But it has not so reorganised the habitat that the so-called higher standard of living can be paid for out of a larger quantity of produce exported. Indeed, quite apart from the loss of social health and skills, these people are in a worse economic plight [because they must support not only themselves but also the middle-men in the cities]. On the roadless side there is a self-reliance and self-sufficiency, competence, and a realisation that the croft must be well farmed."

69) P. R. Ehrlich, *The Population Bomb*, Ballantine/Friends of the Earth, London, 1971, paperback, at p 7.

THE ANTI-CONCORDE PROJECT

The stopping of the U.S. supersonic airliner last year is one of the major victories of the environment movement. The cancellation of Concorde would be another. The airlines are now being urged to place their orders. The next few months are crucial. The ANTI-CONCORDE PROJECT is part of a world movement opposing all supersonic airliners. We need funds to intensify our work of influencing governments, airlines and public opinion.

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are assembling a coalition of geologists, mining engineers, lawyers, and other experts to continue our intensive study of the implications of, and alternatives to, RTZ's possible opencast copper-mining at Capel Hermon in Merioneth.

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The Ecology of Health and Disease

by Melvin A. Benarde

Man's relationship with his environment is bilateral. Not only does he modify the world in which he lives, but his behaviour and his health are affected by environmental changes. As we learn more about the complex system of which man is a part we realise that frequently disease is a reaction to an environmental situation. The recognition of this relationship between health and the environment challenges accepted theories of the causation of disease and suggests that medical research should concern itself much more than it does with the study of man as an integral part of the biological system.

Not a day passes without a report by investigators in the US, or elsewhere around the world, concerning the effect of some aspect of the environment on human health. One in particular that is being studied in several countries for its possible contribution to chronic disease is water. A spate of reports have appeared that tend to correlate water softness with coronary heart disease. Thus far it is only a correlation; a cause-effect relationship remains to be established. Magnetism, and its effect on human physiological processes, long considered in the realm of quackery, is currently a respectable subject of investigation at several universities in the US. In the Netherlands, scientists are investigating the differing effects of the same drug therapy when administered at different hours of the day; there are indications that man's physiological processes are affected by the presence or absence of daylight, as are those of lower forms of life. At the University of Pennsylvania, scientists are studying arthritics who claim to be able to predict twenty-four to forty-eight hours in advance, impending changes in the weather. The researchers seek to discover how the body receives and uses weather signals.

An ecological view of life may lead to an acceptance of some theory such as holism* the idea that man is but one unit, a part of a comprehensive system of "dynamic interdependencies" which, in fact, is not merely the sum of its parts. Several formidable examples may serve to illustrate this concept.

An ecological upset that vividly portrayed the "dynamic interdependencies" and man's role as only one thread in the total tapestry of life was witnessed by the ornithologist Robert Cushman Murphy, who described it several years ago. It occurred along the coast of Peru in 1925.

Each year around Christmas, the dry desert regions along the northern coast are watered by rains brought by currents of warm air. These rains are so regular and so welcome in this otherwise arid land that they have come to be called *El Niño*, "the Christ child." These rains sustain life through the many months of drought.

Although *El Niño*'s arrival usually means periods of plenty (crops of

some of the finest cotton in the world are grown in the northern coastal areas of Peru), it can also mean disaster. Two or three times a century, *El Niño* makes its way too far south and does not quickly return to its usual area. This change in position disrupts the ecological balance on land and sea so drastically that even man does not escape the consequences.

In 1925, the warm current ranged far south, killing as it came the marine life adapted to the normally cold-water coast. Unable to outrace the warm current, fish in fantastic numbers perished and were cast up on the beaches. To the vast seabird population that frequented the coast, the death of the fish meant starvation. The bodies of countless dead and dying birds completely covered the beaches and blocked the harbours. The putrefaction was so great that hydrogen sulphide, a product of the microbial degradation of protein, was produced in quantities sufficient to blacken the paint on ships in the harbours. The pollution of the sea with the dead birds, which implies an overabundance of nitrate nitrogen, gave rise to blooms of a microscopic marine protozoa that actually turned the water blood-red.

On land, where rain fell for five months, the barren soil eroded, destroying the huts of the inhabitants. Without their supply of fish, the people began to starve. In the standing pools of water, mosquitoes began to breed in large numbers and malaria flourished. Contamination of the water supply with human fecal matter, as a result of seepage into wells, precipitated an outbreak of typhoid fever. The rat population, cut off from its normal food supply, began to die of plague, and, shortly thereafter, so did the natives.

* Holism is the term given by General Jan Christiaan Smuts to the concept of whole-making or the holistic tendency fundamental in nature, that links and binds both the living and non-living elements of the universe into a unified process.

This havoc resulted from a slight elevation of the temperature of the seawater. And it clearly shows the links that bind man, animals, and plants so closely together with the physical environment. Also, it underlines the necessity to know in advance what effects on water, on its flora and fauna, and on other forms of life dependent upon it may be expected from nuclear wastes or toxic chemicals disposed at sea. And the question arises: If the decision not to dispose at sea is made, what then will be the disposition of the waste?

Gambian sleeping sickness

Another example of the intimate weaving of the biological with the physical environment emerged as a result of the investigations concerning prevention and control of African or Gambian sleeping sickness.

In Central and East Africa, the agent associated with the clinical symptoms of sleeping sickness is a microscopic protozoan, *Trypanosoma gambiense*. This parasite was early found to be transmitted to the human population by the bite (injection) of the tsetse fly, *Glossina palpalis*, when taking a blood meal.

The natural habitat of *G. palpalis* is restricted to the dense tropical forests that border lakes and rivers. Its usual source of nourishment is the marshbuck, or Situtunga antelope, which is, in turn, the main dietary staple of leopards. Thus, there is an ecological relationship between the leopard population and the incidence of human sleeping sickness. In those years when leopards abound, the marshbuck is kept low, and as a consequence, the tsetse flies obtain few animal blood meals to sustain them between human blood meals.

Intensive, detective-like investigations aimed at controlling sleeping sickness uncovered a unique chain of events in the Rhodesias. Control now depends in large measure upon preventing the tsetse fly, in this instance a different species, *G. morsitans*, from reaching adulthood. To accomplish this, the natives in the area are prevented from burning off the grass in the treeless savannah regions.

It was found—after years of arduous searching—that grass fires destroyed the ants which fed on the tsetse fly pupa (the development stage between larva and adult). The heavy

mats of grass aided in increasing soil moisture, which in turn encouraged the growth of the ant population, which kept the tsetse fly population in check, which ultimately meant fewer transmissions of protozoan parasites and fewer cases of sleeping sickness.

S.E. Asian headache

From French Polynesia in the east, through New Caledonia, to the Philippines, Thailand, and China, eosinophilic meningitis is a widespread and well-known ailment that manifests itself in agonizing headaches. In January 1967, the final clue uncovering the ecological chain of events leading to the disease appeared to have been discovered.

The headache is caused by a microscopic flatworm that resides in the heart and blood vessels of rats, doing them no harm. These worms are regularly passed out in feces and are present in garden soil and other areas frequented by rats. In turn, the planarian worms are ingested by snails and slugs during their nocturnal maraudings in garden soil.

South Sea Islanders and Thais who eat raw or partially cooked snail and slugs are especially susceptible to the headache of eosinophilic meningitis. When the snails are eaten by the natives, the thread-like worms are liberated in the stomach and begin eating their way to the brain, where they initiate an infection that gives rise to the excruciating headache.

The infection can also be caused by eating fish and shrimp that have previously eaten worm-infested snails and slugs, or from eating improperly washed strawberries, salad greens, or tomatoes. Once the infection occurs, no medication can alter its course; relief can be effected only by spinal taps.

Charles Elton, an ecologist, described an illuminating example of the many inter-relations within a community which also showed that the balance of nature is not as neat an arrangement as some would have us believe. He stated that:

"In a year of mouse abundance, many animals change their feeding habits to feast royally on mice. Bears and wolverines do this. In 1905 Cabot says that the grazing was so much spoilt by the mice that the caribou left this part of Labrador in a body

to seek food elsewhere. In consequence of the absence of caribou, the Indians in the interior were compelled to subsist mainly upon fish, being also greatly handicapped for lack of deer skins from which to manufacture their clothes. In one area the annual crop of crowberries failed in some places, owing to the young shoots having been devoured by mice. According to Hutton, the shortage of empetrum fruit, the usual and almost the only berry food of the Eskimos, gave rise to a pandemic of a pustular skin disease, due apparently to the deficiency of some food factor contained in the crowberries."

An example closer to home may be useful. Lead encephalopathy—lead poisoning—takes its toll of thousands of children in Philadelphia, New York, and Chicago each year. The cases of lead poisoning begin their annual rise in the spring, reaching peak proportions in July and August. Apparently, after ingestion of a quantity of chips of lead-based paint, the higher temperature, combined with the active (ultraviolet) rays of the sun stimulate increased intestinal absorption of the lead. Thus the number of cases appears dependent upon season of the year.

The idea that physical factors exerted an influence on health is as old as man himself. Primitive peoples everywhere have reference in their language and traditions to the ill effects of certain winds, the changing of the seasons, the phases of the moon, and the influence of the sun and stars. While it is currently acknowledged that some such effects exist, much remains in the realm of speculation.

The germ theory

Until the 1860s physicians believed that health and disease were influenced by the external environment. During the 1860s however, Pasteur in France and Koch in Germany, were labouring on their investigations of human microbial diseases. The idea that a completely invisible living agent might be the cause of many highly fatal diseases of men and animals was considered utterly preposterous to most people. How could so small an entity kill a man?

Although it was in 1857 that

Pasteur published a paper describing the bacterial fermentation of grape sugar to wine—an historic event because it ascribed to germs, what was heretofore regarded as a purely chemical reaction—it was the year 1877 that was truly memorable: then, for the first time, a microbe was shown capable of causing an important human disease. “The Golden Age of Bacteriology” was thereby swiftly ushered in. For the next seventy years, microorganisms were believed to be responsible for all man’s ills; the germ theory of disease had ascended to centre stage, relegating the environment to the wings.

With the germ theory of disease, which states each disease is provoked by a specific microbe, with characteristic pathological effects, scientists acquired insight into an important and widespread mechanism of death and disease. Many leaders in medicine and public health were convinced that the germ theory explained fully the spectrum of disease and firmly believed that vaccines and antitoxins were the principal means for the protection of the health of the public. Unfortunately, too many still do.

Between 1930 and 1950 several new concepts were introduced into medicine, with far-reaching implications for public health. These were: *homeostasis*, *deprivation* and *stress*. Essentially, they implied that illness or disease could occur as a result of exposure to sudden or marked changes in the environment which subjected an individual to pressures in excess of his ability to tolerate them. Infectious living agents had no place in this scheme.

Beri-beri, pellagra, rickets, iron-deficiency anaemia, and hypothyroidism are several dramatic examples of deprivational disorders. However, a young child denied the care and affection of its mother can be seriously affected for the remainder of his life. This too, is an example of deprivation and stress.

Stress is a concept which is easier to appreciate than define; it may be considered as any force to which the body responds in order to maintain its economy and/or protect itself against injury. During a lifetime, stressful situations are encountered regularly: entrance to school, adolescence, acceptance into or rejection by college or university, selection of a mate, middle

life, working conditions, living conditions, income, availability of food. Each can impose a hazard upon people, and individuals respond in a variety of ways. The increasing number of hospital beds used for mental patients or for patients whose illnesses have a psychosomatic component attests to the severity of many of the stressful stimuli and the inability to deal with them without becoming ill.

In June, 1967, the *New England Journal of Medicine* carried a report by four physicians from Johns Hopkins Hospital. They concluded that family strife could stunt the growth of a child who was emotionally disturbed by a constant contact with the marital discord of his parents. They noted that “an adverse environment acting during the early critical years of childhood can be responsible for the growth retardation.” They went on to say that when the children they had studied were placed in a convalescent hospital they demonstrated remarkable growth acceleration. In fact, one boy grew seventeen inches after being abandoned by his parents. When the children were released and sent home, they stopped growing again.

A multitude of causes

Today, illness and disease are increasingly being studied not from the view of a single causative factor, but rather as the result of a multitude of causes. That is, it is now believed by a growing number of investigators that prevention and control may be given increased impetus by breaking one or several of the links in the chain of causation. This chain or web of causation implies that a series of events rather than a single event is necessary for illness to occur. It also suggests that a choice of “sites” is available for interdiction; that if one is not feasible or practicable, another may be. In this scheme, control and/or prevention is much more attainable.

For example, today the attempt to control typhoid fever is not directed solely to a search for a bacterium. Instead, there is concern about such factors as raw milk, inadequate sewage disposal and unprotected water supply systems, poor personal hygiene, low educational levels, inadequate community financial resources, lack of industrialisation and the historical development of the country.

It is not sufficient to isolate a microbe and simply plan its eradication. It has been found that in many instances people can harbor a microbe without showing clinical symptoms of illness. Some people are more resistant to the invasion of microbes than others. For example, all people who have tuberculosis are infected with *Mycobacterium tuberculosis*, the organism associated with TB. However, not all people from whom this organism can be recovered have tuberculosis. This is not contradictory. It implies a spectrum of resistance or susceptibility in the population. The microbe is a necessary but not sufficient cause of the disease. Something in addition to the microorganism is needed for the disease to occur. If all the factors predisposing to illness were known, prevention, control, and even eradication might be possible.

Considering the concept of multiple causation, programs to control or prevent lung cancer should consider the contribution of air pollutants, cigarette smoke (and cigarette advertising), entrenched habits, radioactive particles, the tobacco plant, environmental stress, and insecurity. Perhaps other considerations are more important, but what they may be has as yet not been ascertained.

Study of the environment as it relates to human health presents great obstacles. Scientists may not yet be ready or prepared for such an enormous task. For the most part, their research investigations are usually based on maintaining all but one factor constant while testing the effect or effects of a single variable on cats, dogs, fish, fowl, or humans. Only in special cases, have two variables been investigated. The fact that health depends on the inter-reactions of a multitude of variables which can be understood only as a whole system, rather than as separate parts, is a staggering realization to the researcher.

In a democratic society additional difficulties are imposed. For example, the association of cigarette smoking with lung cancer has received significant support from a multitude of different types of competent investigations. The evidence, albeit circumstantial, and the relationship appear highly valid, yet large segments of the population demand absolute direct proof before accepting preventive legislation. The only way to obtain

this type of evidence would be to gather together several thousand children about age ten, dividing them into two comparable groups of equal size, lock them in a stockade and observe them for several years, then start one group smoking while preventing the others from doing so. Since the effects of smoking are generally seen in the fifth or sixth decade of life, these two groups would be required to be under lock and key for at least forty years, under the scrutiny of scientists recording their every activity. Then and only then would absolute direct evidence of a cause-effect relationship be forthcoming. As this experiment is not possible, one can only wonder about the motives of those who clamor for "real" proof.

Currently, the US and most of the countries of Western Europe are experiencing a major epidemic of two infectious diseases, syphilis and gonorrhea. Gonorrhea was well known in Biblical times, but the bacterium associated with it was not isolated until 1879. The corkscrew-shaped bacterium that causes syphilis, a disease apparently unknown in Europe before the return of Columbus and his crews in

1493, was described in 1905. Both diseases are readily rendered impotent by the antibiotic penicillin. Yet we are experiencing a greater number of new cases of both venereal diseases than ever before. Knowledge of the microorganism is simply insufficient to control or prevent its incursions. Today, a total environmental or ecological offensive is needed. It is necessary to consider the psychology of promiscuity, prostitution, social mores, homosexuality, drug addiction, penicillin, the microbe, educational levels, and family life. Factors such as these are currently being used in the attempt to control the precipitous increases in cases in the fifteen-to-twenty-five age group, those with the highest incidence rates.

The day of the individual scientist working alone on an infinitesimal part of the whole may be passing. In its place may have to come an integrated team effort to arrive at an understanding of the cause-effect relationship between man and the world around him. So many different forces or stresses impinge upon us simultaneously during each hour of the day that to understand the contribution of

each, or the combined action of several acting in concert, will require experimental models not yet devised. Thus, statements purporting to incriminate some environmental factor as responsible for human illness, based on single variable studies, are of doubtful validity.

The investigation into man's interrelationships with his environment entails studying the whole man and studying him as a functioning unit. This will prove difficult, but the challenge is being taken up. New departments of community medicine and community health have been formed and are being formed in medical schools and schools of public health. These are dedicated to the idea that today's physician cannot merely treat the sick patient but must consider him as a member of society as well. It is therefore incumbent upon the physician to restore the patient to health and to prepare him to return to his place in the community. This calls for a greater knowledge of the many environmental problems that impinge upon an individual and can influence the pathogenesis, aggravation, and continuance of disease.

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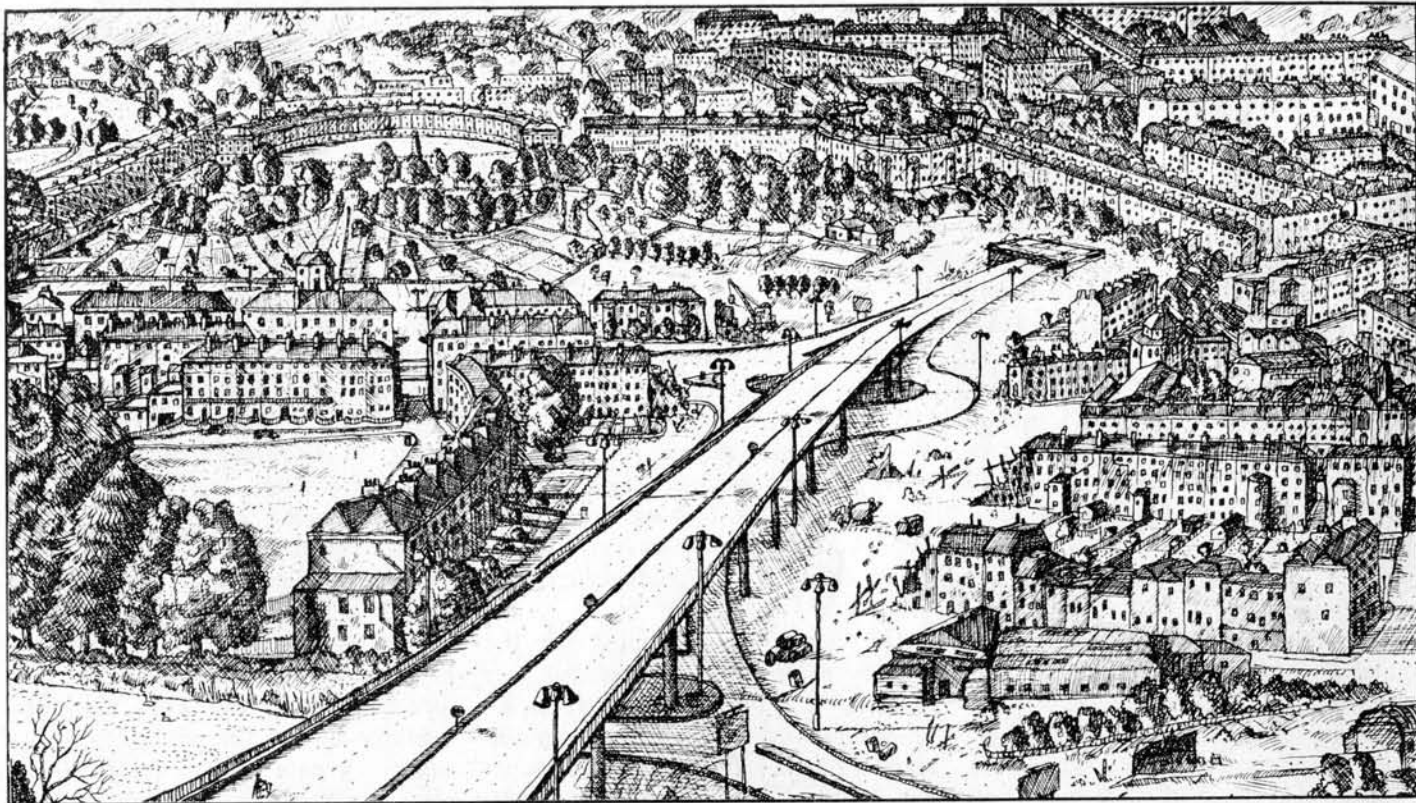
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For a Mess of Motorways

by Gerald Foley

Bath is a jewel of a city. Its honeyed grey stone buildings nestle on the steep hills above the curving Avon. About it there is a sense of totality. Compactness is its essence.

Like most places in Britain it has a traffic problem. Rather it has urban problems rooted in the use of the car and over-provision for it. Pavements are cracked and broken from parking on them, wrought iron railings are pushed over by vehicles, fumes hang heavy in the misty air of the valley, yellow lines, white lines, dotted lines, arrows, signs, bollards, the tatty plastic squalor of filling stations disfigure the elegance of 18th-century crescents, affront the dignity of huge and ancient plane trees.

Perhaps progress is coming a little later to Bath than to other places. The decay is not all pervasive. But there is a dreary familiarity in the sight of the urban fabric being shredded, teased apart, frayed and consumed by the automotive disease.

Professor Sir Colin Buchanan's solution for the problem is to drive a

four-lane urban motorway straight through the middle of it. The scheme he proposed in his 1965 report and which has been adopted by the Bath City Council is popularly known as the Tunnel because it features a tunnel under part of the city. And the tunnel is what the Bath City Department of Architecture and Planning and other publicists of the scheme insist on talking about.

But the tunnel is only a tiny part of the story. Before the motorway gets itself safely under ground it comes looping in along the banks of the Avon through the green fields on the east of the city. It smashes through the Walcot area, a slightly seedy agglomeration of small shops, houses and steep narrow alleys. Blight has already been at work and corroded the place almost beyond redemption, offering the planners an opportunity for redevelopment, a phrase beloved of the breed everywhere. Little gems like Ladymead House still hint at the possibilities in sensitive restoration; the nearby sanitised Council Georgian redevelopments in breeze blocks faced with ersatz Bath stone are proof of what is really in store.

Then comes the tunnel itself. After a quarter of a mile or so of it the road is back into the air again. It climbs on stilts and curves its way off to the west in the valley in front of the Royal Crescent. From the park in front of the Crescent the tourists will be able to watch the glittering beetle-hordes of vehicles emerging from and returning to their hole in the earth. The residents of Norfolk Crescent will have a much closer view: about thirty yards away and eye-level for those living on the second floor. There is some confusion about all this. There are different phases in the master plan; there is a semantic quibble whether the road should be known as an urban motorway or a high capacity trunk road; there is the problem of the model which the Council are having such difficulty in getting made. There is one model already on display which shows the tunnel. But one showing the roads has not yet emerged: a credible explanation was offered by one Bath councillor for this when he said showing the roads would be "likely to cause too much criticism."

But there is no doubt about the broad intentions, or the broad effects. But the

motorway is not all. Feeder roads wind and twist through the tightly-knit fabric of the town. A four-lane road with free-flow intersections must get its traffic from somewhere. One of the most idiotic propositions of current road mythology is that in some way roads eternally take traffic away from places leading it perhaps into some vast cosmic sponge for ever and ever absorbing. The function of roads is to create traffic not suppress it. That should be a platitude. But in the shattered cities of America and the rest of the world where the writ of the highwayman runs it is only now emerging with the clarity of newly revealed truth.

The whole Bath plan is bizarrely out of scale. It is equipped with all the paraphernalia of American road engineering, grade separations, braided interchanges, accessibility restrictions and the other ju-jus of traffic planning, all four miles of it. Bath is a tiny place, a population of only 80,000 and most of it compactly packed within the Georgian plan. But the concept of a "hierarchy" of roads is fundamental to Buchanan's thinking. And it always seems to demand a motorway at the top. As his Bath report says with "a network built to motorway standards, with adequate points of interchange then much more traffic can be accommodated and more safely than where the network is a mere improvisation based on the existing roads."

It is these concepts which are paramount. There must be more traffic, there must be a network, there must be a hierarchy, there must be a motorway. It is reality which is wrong. The cities are wrong.

When Buchanan produced *Traffic in Towns* he was riding a wave of current euphoria. It seemed the Americans had solved the problems of the car. It seemed also we were destined for an ever brightening future. "How bold can we afford to be?" he asked. "This is really a matter of faith in our own future as a nation. If we believe we have a great future then we must also believe that the standard of living will sweep steadily upward over-riding the ephemeral fluctuations of economic life". And it was with these heady words he entered into his public love affair with the car.

Love, besotted love—

Nothing but love, besotted love, can account for what he did then in *Traffic*

in *Towns* and subsequently in places like Edinburgh and Bath. He sees the problems all right and analyses them with force and clarity. He comes up with the right conclusions: high levels of traffic are incompatible with civilised notions of urbanity. But having done so he fails utterly to take the next step which his logic requires. Life is impossible with the beloved but he insists on making excuses or worse, attempting the impossible. Love must conquer and the car will find a way.

In *Traffic in Towns* he said it clearly: "the manner in which buildings and streets are put together is basically unsuitable for motor traffic." His hopeful answer was "traffic architecture" and "comprehensive redevelopment!" Even at virtual village level, Newbury with a population of 37,000 was his example, the answer was "to build the new *primary network* first." The face of Britain was to be renewed, reshaped to fit the car. High provision for car use is indeed incompatible with civilised urbanity. The answer to the problem is to choose civilised urbanity and restrict the car. Buchanan's way is to build Birmingham—everywhere.

In his Bath report he discusses in cogent detail the heritage of the city, its form, its architecture, its landscape. He explains how provision for the car destroys all these. He sees the choice that must be made. He says "no remedy lies in the banning of traffic." And that, the key sentence of the whole report, is nonsense. The remedy clearly lies there. With reduced traffic there is not a problem. Only the will to go that way is lacking. We can have whatever level of traffic we choose in our cities. Planners, Buchanan pre-eminent among them, have never even hinted that is so. In Bath, with the issue faced and dodged, the traffic option chosen, the rest of the way is downhill. The pernicious doctrines of the hierarchy of roads and the environmental areas begin to rule the argument. The hierarchy demands its motorway. Define the areas of special interest, architectural merit or whatever and along the lines where they join is the route of a road. Beyond them is the wasteland. "It is as bad that a child should be killed in Milsom Street as in some road in a remote housing area. But there is undoubtedly a double responsibility in the 'heritage areas' where it is not only a matter of

dealing with motor traffic but of preserving a physical fabric intact."

First and second class areas—

Here is the division of the city into first and second class areas. It is a failure to recognise the organic totality of a small city like Bath. A series of isolated urban museums lies behind that kind of thinking, "heritage areas" surrounded by roads and car-parks instead of the living continuity of a city where the bad and the mediocre sustain the good, where a run-down street is a possibility of existence for small shops, community, the multifarious activities of life and not an opportunity for redevelopment into a roundabout.

"We think it is highly desirable to keep the residential population at its present level in the central area both to retain 'life' in the area and to reduce journeys to work," the report remarks. And apart from surprise at the need felt to put "life" in inverted commas—is it such a strange idea to have it in a city—one cannot but agree. "We have shown, however, that this would not be possible with the particular floor space requirements under consideration for the maximum intermediate network study." It's tough on "life" in this kind of world.

Buchanan sees a "terrible dilemma" for Bath. Its heritage "comprised by its medieval centre, all the 18th-century development, the river and the landscape should be kept intact". This heritage is the result of the millions of years while nature carved and formed the river and the hills; the two thousand years of Bath as a Roman, medieval, Georgian, modern city. The car has been a significant factor in British life for about forty years, a problem for twenty. "It is unrealistic to think that this essential traffic can be made to disappear or be transferred to some other form of transport." Is it not possible, just barely possible, that what sustained Bath through its history might sustain it now if someone said it *was realistic* to restrain traffic to the level of say twenty years ago? From the Romans to the fifties is indicative of some staying power without all this "essential traffic" now shaking the place apart. And there is always Birmingham for those really hooked on exhaust fumes.

The Buchanan report for all its lip-service to the ideal, lacks a sense of historical perspective. It lacks also a

perspective beyond the turn of the century. Perhaps it should not be blamed too much for that. The rest of us until recently have been as blind as the professional planners to the implications in terms of fuel and other resources of a level of forty million vehicles on the roads of this country. There is just one hint of the need to consider the future as unknown in the report. Bath, it acknowledges, needs to achieve "wise control of development without tying the future into a rigid strait-jacket." There is nothing like a motorway for keeping your planning options open.

Pathetic and wrong—

But if Buchanan is eminent and wrong the Bath City Planning and Architectural Department is pathetic and wrong. Here one might have looked for a sense of the place, a defence of its integrity and value. But the whole Buchanan hocus-pocus is swallowed wholesale. Projected figures of traffic "demand" are taken as some kind of given-from-above reality. When traffic planners get into a spin about "demand" and the "need" for a

road does it never occur to them that if they build a road anywhere in a town and open it for traffic cars and lorries will use it? There is a "need" for a road through the Tower of London. Come to think of it with all that traffic coming up the Mall there is an even bigger "need" for one right through the middle of Buckingham Palace. Nor indeed should one forget the "demand" for parking space inside the National Gallery. Dr Stutchbury the City Planner and his colleagues have faced up to "the need for a new cross-city route to replace the existing A4."

They believe they have an approach which helps them to "remove guess-work" and "present methods of dealing with movement demands which are virtually certain to arise." They refuse to accept that Bath will only have the traffic for which they make provision. They confuse myth with reality, "demand" with actual traffic. For them "demand" is paramount and "cannot be expunged." They forget that traffic only goes where the roads are provided for it.

There is of course criticism of all this in Bath. The will to save the city is strong. And there are signs that those

who favour the motorway and its acolyte roads are falling into disarray.

The head of the Development Committee confessed recently that he and the City Architect and Planning Officer were annoyed by the criticisms they were receiving. He told the local evening paper "there comes a time when you blow your top and perhaps we have blown it." The result is that a series of advertisements has appeared in the *Bath and Wilts Evening Chronicle* in which is reproduced a telling leaflet being circulated in the city by the Bath Environment Campaign. In the advertisement the Council has written CENSORED across the leaflet and crossed out the words which offend it. Nothing could better have illustrated their insensitivity of mind or brought more clearly before the public the enormity of what they propose to do to the city in their care. Bath belongs to the world and fares badly in the hands of men like this.

But those who believe in the Roman gods will still find hope for Bath. Jupiter at least looks with favour on the city. Those he would destroy he first drives mad.

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A BLUEPRINT FOR SURVIVAL

Comments

From Michael Tracy

Sir,

I have found the *Blueprint for Survival* thought-provoking, and the following remarks are intended as constructive criticism.

I feel that the preoccupation with problems arising from yield increase in high-income countries—pollution, soil destruction—leads to an unnecessarily restrictive attitude concerning yield increase in developing countries. *The Ecologist* suggests (especially para. 224) that the latter are faced with a choice between increasing the use of the new high-yielding varieties, with associated inputs of chemical fertilisers and pesticides, thereby damaging soil structure and long-term fertility, or improving soil structure. It advocates the latter, without saying how this can be done. I think this neglects two important points. Firstly, use of chemicals in agriculture is so very low in developing countries that pollution can hardly be a serious concern for a long time to come. (The main use of DDT has been to control malaria, not to eliminate agricultural pests.) Secondly, the new wheat and rice varieties have started off a chain of events—technological, economic and social—involving among other things much *better* husbandry than was practised formerly. It is difficult to see how farming practices could be improved in backward agrarian societies without the impetus provided by the new varieties.

Appendix C, page 41, anticipates famines within the next 15 to 20 years. These would undoubtedly be precipitated if *The Ecologist's* approach were adopted! In fact, it is very difficult at the present time to make projections of food supply and demand, largely because the impact of the Green Revolution is too recent and uncertain. My own feeling is that this new technology offers a breathing-

space which may last for the next 15 to 20 years, and the major question-mark concerns the *subsequent* period, when population growth in the developing countries will continue and the yield increase available from the technology now available will have been used up.

Appendix C, page 40, states that food stocks in North America have been "allowed to run down", thus losing a useful "cushion". This is a misinterpretation. The USA and to some extent other major grain-exporting countries have been forced to control their production because outlets were not available. The USA food aid programme has been reduced because major recipients (especially India and Pakistan) have been enabled by the new technology to approach self-sufficiency in grains. North America now has substantial unused agricultural potential under present techniques.

The Ecologist advocates (para. 224) an "emergency food supply" to be created by the developed countries. (In para. 282(5) however it is said that this would be necessary until the year 2100.) This is misjudged, for a number of reasons. In the first place, as I have just indicated, unused potential already exists. In the second place, the proposal is inconsistent with *The Ecologist's* own aims, since the potential exists because of the intensive use of agricultural chemicals, and maintaining the potential to produce a surplus would imply continuing high applications of chemicals. In the third place, if developing countries are made to depend on food imports, their incentive to develop their own agriculture would be diminished: yet their own agricultural development is essential not only to increase their food supply but also to keep as much as possible of their population on the land and to prevent further overcrowding of their cities.

The Ecologist states (para. 133 and Appendix C, p. 40) that yields in the UK are beginning to decline. This is not true. In all the high-income countries, there have from time to time been setbacks for one crop or another, but so far the agricultural scientists have been able to keep ahead of disease and pest problems. Indeed almost every projection of yield so far made has proved too low. *The Ecologist* is entitled to criticise this

development on grounds of pollution, etc., but it must recognise the effectiveness of the techniques.

In paras. 251 to 254 *The Ecologist* discusses the need for stabilising the population, particularly in Britain, in terms of the "carrying capacity of the land". This is unfortunately much too vague a concept to justify the use made of it and the conclusion drawn—i.e. that Britain should have a population of only 30 million. The carrying capacity depends, among other things, on the pattern of food consumption. *The Ecologist* recognises that proteins come into the picture as well as calories, but the situation is much more complicated than that. The greater the proportion of livestock proteins, the greater the demands on land use. But a nutritionally adequate diet could be obtained with lower intake of animal protein than that now averaged in most high-income countries; the development of vegetable-based protein foods (especially from soybean) could also reduce land requirements.

Quite possibly Britain would be better off with a population of 30 million, but better arguments than this are needed. I would also question the assumption (para. 253) that Britain ought to be self-supporting in food. This would seem to imply that every food-importing country should reduce its population while food-exporting countries would be entitled to expand theirs. At the very least, Western Europe should surely be considered as a unit for the purpose, and international trade should not be totally neglected either.

If I might add one comment on a subject that is *not* my own field, I think that *The Ecologist* neglects the positive contribution of communications, which is a vital feature of modern society. Television, the telephone and so on are not significant sources of environmental disruption, to my knowledge; the press (including *The Ecologist*) unfortunately is, through the paper industry, but this drawback can perhaps be minimised. At any rate these modern facilities, together with the ease of travel (which admittedly usually *is* bad for the environment), make possible greater cohesion in human society, gradually extending across national boundaries. (Teilhard de Chardin's vision of a

progressive integration of humanity seems relevant in this respect.) This is not necessarily inconsistent with *The Ecologist's* advocacy of decentralised communities, but suggests that such communities should find their place in a much wider dimension.

Michael Tracy,

Head of OECD Agricultural Policies Division.

From Prof Carroll L. Wilson

Sir,

I recently received and more recently read the January issue of *The Ecologist* and wish to commend you for the most excellent piece of work you have done. As the Director of the SCEP and SMIC studies and a member of the Executive Committee of the Club of Rome and the System Dynamics Steering Committee at M.I.T., I have more than a passing interest in the subject matter.

It seems to me that you have not only considered the problem but also you had the courage to set forth some principles which might provide clues as to the pattern of an equilibrium society and, therefore, some of the routes by which one gets from here to there.

As you will see if you've not already seen it, the assessment of some of the characteristics of a stable society to be found in "The Limits to Growth" indicates that it could be a very agreeable and indeed in many ways much more attractive society than the growth-dominated, consumption-obsessed society we now have.

I am glad that SCEP provided such useful background material for your statement and assume that you have seen the follow-up in the workshop on global ecological problems of the Institute of Ecology at Wisconsin this past summer. This is entitled "Man in the Living Environment" and Fred Smith was one of the prime movers and as you will recall he was chairman of one of our critically important working groups in SCEP.

I hope that the focus of debate can shift in part at least to a consideration of the characteristics of a stable society. I believe that your point of decentralised decision-making, yet I would assume national and regional planning, suggests a direction in which I would hope our institutional changes might move.

Also, the notion of setting national

self-sufficiency in food with agricultural practices which can be long sustained does fix a reasonable kind of limit on the population which can be adequately supported.

It must have taken a great deal of intensive work by a dedicated team to produce this statement and the statements also going with the Proposal of a Movement.

Some time I trust that the story of how this was done will also be told. When I am next in London I would very much welcome the opportunity of meeting you and hearing more about this important project.

Sincerely,

Professor Carroll L. Wilson,
Massachusetts Institute of Technology,
Cambridge, Massachusetts 02139

From Paul Derrick

Sir,

The Ecologist is sponsoring a "Movement for Survival" which could develop into a political party; but though its aims may be urgent and revolutionary its programme does seem to be somewhat limited with regard to legislative and political implications.

You cheerfully recognise that your aims run somewhat counter to the trends of the times; but the reversal of those trends is a formidable task indeed. It will no doubt help to introduce taxes which will help to conserve raw materials and energy and which will help to encourage the production of high quality goods that will last—consumer durables that really are durable for example. But more than this will be needed to change the life style of a few hundred multinational corporations which, it is confidently predicted, are likely to be responsible for one half of production in the non-communist world within the next 20 years or so.

These multinational corporations are organisations of considerable irresponsible power that appear to be more interested in expansion and in profit and the more effective exploitation of labour and natural resources by capital intensive processes than in life cycles, a stable society or human survival. Any Movement for Survival will need to have ideas about what should be done about these huge organisations dedicated to unlimited growth. Some of them have a vested interest in the production of organo-

chlorines, plastics and other chemicals.

Again you lay much emphasis on the need for a dispersal of population and for mixed farming on a relatively small scale in place of the large scale monoculture associated with soil erosion. But populations in developing as well as industrialised countries continue to drift to the towns. The Common Market and other countries are encouraging farmers to leave the land and are planning to take land out of cultivation because of embarrassing food surpluses. There have been food surpluses in other countries too which the peoples of developing countries have not been able to afford to buy. At the same time the big corporations are moving into agriculture in the USA and elsewhere providing cheap food at the expense of posterity.

If the countryside is to be made more attractive to people and to light industry there will probably have to be some rather drastic changes in land tenure; but there is nothing about land tenure in your *Blueprint*. Land tenure arrangements would also be highly relevant to the more effective utilisation of marginal land.

The great and growing gap between the wealth of industrialised countries and that of developing countries is noted and deplored; but no specific suggestions are put forward about closing this gap. One of the reasons for the recent cut-back in aid by the USA was the US balance of payments deficit created partly by the export of capital by multinational corporations; but the free movement of capital seems to be favoured by many. There is hardly any mention of the intractable problem of inflation yet effective efforts to control pollution are going to add considerably to prices and inflationary pressure. There is little about tax or other measures to bring about a fairer distribution of wealth within nations; but there is already considerable poverty even in high technology cities like Seattle, likely to become worse if there is a sharp increase in food prices and appropriate measures are not taken. The report recognises that it will be extremely difficult to control population increases; and it could be more difficult if mechanical methods are favoured rather than biochemical methods which could have unexpected effects on life processes in the same kind of way as pesticides and chemical

fertilisers used on a massive scale before their side effects are fully understood. In any case the peoples of developing countries are likely to resent being lectured and told to control their numbers by people from industrialised countries with very much higher material standards of living. It is probable that the wealth of the world will have to be much more fairly distributed before the peoples of the poorer countries will be willing to accept a reduction in population growth on the ground that there is "not enough to go round".

There are plenty of references in your *Blueprint* to craftsmanship and rural communities; but no very clear indication as to how these are to be organised. It may be that changes in land tenure and corporation tax could encourage the return of small scale industry to the countryside; and it may be that industrial co-operatives or some form of guild would be a more appropriate vehicle for such developments than the limited liability company. Industrial capitalism has, in fact, been built upon the limited company and its structure may have something to do with the rapid exhaustion of natural resources during the last two centuries. Some of your readers may recall Robert Owen's hope of a new moral world created by the formation of more or less self-supporting rural communities based upon co-operative ideas. He showed at New Lanark that a sense of community and common purpose could be created in an industrial enterprise organised in the interests of the community; and his hope was that industry and agriculture could be integrated through the development of self-governing co-operative communities. A similar hope seems to be implicit in your *Blueprint* though it is not worked out in quite the same detail as Owen's "Report to the County of Lanark".

Yours faithfully,

Paul Derrick,

Secretary, Robert Owen Bi-Centenary Association,
11 Upper Grosvenor Street,
London, W.1.

From Ralph Coward

Sir,

I am writing to say that I have just read *Blueprint for Survival*. I must confess that I am not a subscriber to

The Ecologist, but I now want to say how much I appreciate the *Blueprint*.

I like the way it deals with chemicals and re-cycling; I can enthuse about "local-economy", and so on. I am not happy about abortion, however.

As far as I can see there is no problem about "population" if we resort to murder and suicide. In war we do not call the taking of the life of the enemy murder, but I think we do now regard war, pestilence and all that follows, as evil and wrong and try to rule it out, for our own comfort at least. If taking life is wrong I cannot decide where we must draw the line about abortion. The main feature of ecology—the vital relationships—is finding the right way to live and I'm not sure that abortion can be brought into that. You might say that in nature we do not see all this fuss about life and death, but we are asking man to behave as a responsible being. Can he be allowed abortion and get away with it?

In fact I think the whole question of "freedom" must come into the study. We now know that we cannot be "free" to consume the earth finally, to chuck out our rubbish into the environment; understanding, respect, discipline, obedience seem to be called for rather than "freedom". If we are allowed "freedom" in one vital relationship can we be called to order in others? I do not believe that we can train ourselves to good order in the vital relationships if we are "free" in one of the most attractive.

This is very difficult—so is it all—we have great power and "power without responsibility...!!!" I cannot decide where we should draw the line.

The other thing which struck me is the way that "economics" is referred to. I always make a point of differentiating between "economy" and "finance". For example, a squirrel must study economy but is not bothered with finance. Agricultural land is bought at a rate which makes the rent £15 to £20 per acre; this means that the occupier must get that amount out of the land. This is not (agricultural) economy, it is finance acting as a destructive force. Great 100,000 acre plots of land in Scotland are planted in solid blocks with trees, not for forestry reasons: the people who "do" it have no interest whatever in trees or their effects, they just want

investment for their money. This kind of block afforestation is often bad ecology. I think there should have been a clearer indication of the destructive power that "money" often is. Most things were covered fairly well; I find it unfortunate that this was left out.

But—I wish *The Ecologist* success.

Yours sincerely,

Ralph Coward,

Lower Berrycourt Farm,
Donhead St Mary,
Shaftesbury, Dorset.

From Mrs G. R. Gardner

Sir,

I am writing to express my admiration and gratitude for your *Blueprint for Survival*, a masterly document which should be a turning-point in the struggle to protect the environment.

I very much hope that having enunciated your principles so clearly you will be successful in getting them applied in practice. You must certainly be aware of "the Strategic Plan for the South-East" to which official blessing has been given. This provides, amongst other things, for major industrial growth in South Hampshire, including the linking of Southampton and Portsmouth into a chain of "development areas", the compulsory purchase of large areas of agricultural land for industrial and residential purposes and the accommodation of 60,000 "overspill" from London. The details will become available when the South Hampshire Structure Plan is published in a few months' time.

This industrialisation of South Hampshire (which will inevitably spell the end of all rural Hampshire) as a deliberate act of Government policy, seems precisely the very thing which your *Blueprint* is warning us against.

It is very difficult as an individual to fight such a development, but if your movement were to bring all its influence and pressure to bear in killing this "Strategic Plan for the South East" before the Government is too heavily committed to it, it would be a major triumph for the environment and would earn the gratitude of present and future generations.

Yours faithfully,

Mrs G. R. Gardner,

91 Bedford Gardens, London W8.

Reports

A guide to courses in human ecology

There is now a wide range of courses available for those who intend to study some aspect of ecology to degree level. Ecology is included in all degree courses in the biological sciences and is also playing an increasingly important role in many geography courses. Of the older universities, Aberdeen, Bangor, Durham, London (Imperial College and University College) and Oxford are all well known as centres for the study of ecology and of the newer universities, Lancaster, the New University of Ulster and York are also acquiring reputations in this field. In the Polytechnics ecology is a particularly prominent feature of degree courses at Hatfield, Liverpool and Plymouth.

Edinburgh University offers a full honours degree course in ecological science within which there are four honours schools, these being in ecology, forestry, resource management and wildlife and fisheries management.

In addition to these more traditional courses, a number of particularly interesting courses are now under development which are frequently interdisciplinary in nature and are concerned with the study of man's relationship with his environment. The following guide lists the major developments in the field and unless otherwise stated the courses are already in operation.

Aston in Birmingham

In the three year course leading to a BSc Combined Honours Degree (UCCA 3800 Comb Hons), The Biology of Man and His Environment may be taken as a one year Part 1 subject (together with two other sciences) or may be continued as one of the two subjects in the Part 2 course lasting two years. This Part 2 course is designed so that emphasis is placed on those aspects of biology which have particular relevance to the study of man and his environment, including population genetics, ecology, behaviour, nutrition, parasitology and social biology.

Birmingham

A three year course leading to BSc Joint Honours in Biological Sciences and Geography (UCCA 85CU Biol Sc/Geog) is offered which aims to provide a broad training in ecology and environmental sciences in the broadest sense including their application to problems of conservation.

East Anglia

The BSc Honours in the School of Environmental Sciences (UCCA 85CU Biol Sc/Geog) is offered which aims to provide "an appreciation of the whole range of the environment in its physical chemical and biological aspects and of man's role within the environment." After a Preliminary Programme occupying the first two terms of the three year course, students commence the Honours Programme in which they are able to select from a wide range of options their future course of study. Options currently available include Applied Earth Science, Ecology and Palaeobiology, Economic Geography and Location Analysis, Oceanography, Tropical Resources and Development, Soil Science and Urban and Regional Planning.

Keele

The BA Honours at Keele can be taken in Biology and Economics (UCCA 85CS), this being one of a wide variety of combinations available at Keele. As the Biology component can include an advanced course in Ecology and Evolution it is possible to study both ecology and economics in this degree programme.

Lancaster

The BA Honours course in Environmental Sciences (UCCA 3630 Env) does not have ecology as a major component, but courses available in the third year do include such subjects as pollution and water resources management.

London—Wye College

The BSc Honours in Rural Environmental Studies (UCCA 5220 Rural Env) course is "suited to students with an interest in the interaction between man and his environment, particularly in its rural aspect. It is designed to meet the growing concern with environmental deterioration and with the often detrimental impact of man on our scarce resources of land."

Oxford

The Honours School of Human

Sciences (UCCA 3900 Hum/Sci) aims to provide an integrated pattern of education in the biological and social aspects of the study of man. Courses taken include human genetics, animal behaviour, ethnology, population studies, physical and social anthropology, human ecology, social psychology, sociology and urban geography.

Salford

For those with an interest in engineering, the BSc Honours in Environmental Sciences (UCCA 3600 Env Sci) may prove attractive. The course is offered jointly by the Department of Civil Engineering and the Department of Sociology, Government and Administration. It is designed to provide a study of those aspects of the environment, especially the urban environment, in which there lie hazards to the health, safety and welfare of society, and of the legal and administrative means by which such hazards may be controlled.

Southampton

The new BSc Honours in Environmental Sciences (UCCA 3600) includes appropriate courses from Botany, Geology, Geography, Oceanography and Zoology.

Stirling

The university offers the BSc Honours course in Technological Economics (Biology) (UCCA 1900 Tech Ec) in which both economic studies and biology are studied to degree level. The biology component includes a course in human ecology.

New University of Ulster (Coleraine)

NUU offers the only degree course in Human Ecology (UCCA 8500 Hum Ec) in Britain at the present time. The course is prepared and presented by a panel of teachers specialising in biology, geography and social organisation and aims to provide a study of "the complex of interrelationships whereby human populations co-exist with other species in the physical context of nature."

Huddersfield Polytechnic

A new Honours Degree (CNAA) course in Human Ecology is under development and is planned to start in 1973. The principal area of study in this course will be taken from the fields of Ecology, Human Biology, Behavioural Science, Economics and Geography.

Plymouth

A new CNAA degree course in Applied

Reports

Ecology is in an advanced state of development and may commence in October 1972. The course is likely to place particular emphasis on pollution studies and resource management.

P. F. Rogers

Will readers please advise us of any courses we have left out. They will be listed in future issues.—Ed.

Dr Rogers works in the Biology section of Huddersfield Polytechnic.

National Association for Environmental Education NEWSLETTER

Environmental education involves those disciplines which contribute to an understanding of man in his environment. There is an increasing recognition that the ecological understanding of the bio-physical environment is an important factor for the survival of man. There is a deep concern about the quality of life and the problems of human society in the built environment.

The National Association for Environmental Education is the association of teachers, lecturers and others concerned with education and the environment.

Its members work in all types of schools, colleges, polytechnics and universities. They include representatives of all the disciplines involved in environmental education, both from the sciences and the humanities.

The Association presents the ideas of its members and continually promotes environmental education in discussions and constructive activities.

National Conferences and International Courses are held regularly. To these come educationists and leading speakers on national and world wide environmental problems.

Study Conferences are designed to produce solutions to specific educational problems.

Working committees carry out research, construction examination syllabuses and outline possible courses and useful activities.

The Association publishes the results of its work, newsletters and an Annual Journal.

In addition, the Association continually presses for financial and other facilities for environmental education in schools and colleges through the Department of Education and Science and local authorities. It is also very concerned to encourage a considerable extension of teacher training in this field.

The Association presents the needs of schools to outside bodies and encourages them to help in their specialist provision.

The Association takes part in the work for the Council for Environmental Education.

The next N.A.E.E. Conference will be held at Crewe College of Education 1 to 3 September 1972. On this occasion all those interested in environmental education have an opportunity of meeting one another and airing their views.

One of the most recent pieces of work sponsored by the N.A.E.E. has been the production of a report identifying present trends in school courses contributing to environmental education and to make recommendations to colleges of education to give some thought to this aspect of education in planning new courses. The document has been put together by a group of people representing DES, LEA advisers, college lecturers and teachers. The group has also been assisted by representatives from the Council for Environmental Education and the Schools Council. The meetings were chaired by Patrick Shallard, Chief Education Officer, Bedfordshire. This piece of work has been designed to promote a dialogue between all those working in the field of environmental education. By giving your support to the N.A.E.E. you can help to ensure tomorrow's society has the ability to Survive.

Countdown

Family Planning's International Campaign

The problem of overpopulation has fast become too big for governments to tackle alone, particularly the poorer nations of the world. Just as voluntary relief organisations play a vital part when disasters occur, so voluntary family planning associations all over the world have come together to tackle this serious threat to the human race.

Under the banner of the International

Planned Parenthood Federation the family planning associations of 79 countries are working together to make the world's population predicament more widely known. It is also developing and expanding its family planning services wherever possible all over the world.

Britain's Family Planning Association is taking a leading part in this work and has sponsored its Family Planning International Campaign, COUNTDOWN, with the aim of raising £1 million as quickly as possible. Simply stated, the objectives of COUNTDOWN are to enlist financial support for the work of the International Planned Parenthood Federation and the work of the Family Planning Association in this country. Sixty per cent of the money raised will go to the IPPF and 40 per cent will go to the FPA to set up regional training centres and expansion of its educational work. The theme of the campaign is the need to help people all over the world to ensure that for humanity's sake every child born is a wanted one.

Some examples of how the money will be spent and an idea of the costs involved are given in the COUNTDOWN leaflet; £10 will buy a year's supply of oral contraceptives for 10 women in Peru; £500 will cover the salaries of a part-time doctor and nurses for a family planning clinic in Okinawa for a year, and nearer home, £10,000 will enable the FPA to set up a regional training centre in Britain to teach doctors, nurses and social workers the techniques of family planning.

A campaign office, under the directorship of Caspar Brook, has been set up within the FPA to co-ordinate the day-to-day administration of COUNTDOWN. The support and help of FPA workers in branches and clinics is being vigorously enlisted to ensure the maximum impact of the appeal in all parts of the country.

COUNTDOWN was launched nationally at Winchester, the old capital of England, on Monday 20 March. Almost simultaneously posters appeared in all the principal rail and bus stations throughout Britain bearing the message—"Overpopulation has reached crisis point today... in your own interest and humanity's—help". Thousands of leaflets and car stickers carrying the same message are being distributed, hard-hitting advertisements

Reports

are to appear in the Press and up and down the country people are being asked to do something for COUNTDOWN either by fund raising efforts such as running garden fetes, car rallies and jumble sales, or simply giving money.

While public attitudes towards the problem of overpopulation have certainly changed in recent years, the aim of COUNTDOWN is to get individuals to do something positive about it and take active participation in stabilising world population.

For further information:

Mrs Pamela Lewis

ARTHUR WAREHAM

ASSOCIATES LTD,

20 Bride Lane, Fleet Street,

London EC4 8DX.

Tel 01-353 4691.

Bugging the bugs

To hear them talk you might think that pesticides are a thing of the past. There was an air of acceptance, not only of the desirability of biological control, but of its immediate practicability as well. Of course, there were one or two dissenters, the rebels who persist in the belief that pesticides are efficient, but even among them there was no nonsense about persistent organochlorines—they must go—nor did they doubt the importance of phasing in alternatives as soon as possible. Pesticides can cause pest problems quite apart from their other, better known side effects. This is a fact and no one questioned it.

The occasion explains the high level of agreement: it was a symposium on "Increasing the biological contribution to the control of pests and diseases", organised by the British Ecological Society, the Association of Applied Biologists and the Society of Chemical Industry (Pesticides Group)—looking for ways to put themselves out of business?—and it was held at Oxford from the 4th to the 7th January.

There is much more to biological control than the introduction of predators and the artificial sterilisation of male pests, which are the two techniques that have been publicised most.

Dr J. P. Dempster, of the Nature Conservancy, presented a paper describing his own work in using "weeds" to keep down pests. The removal of weeds may rob potential pests of all their food supplies except for the crop. This is one of the problems with herbicides that are too efficient. A field without weeds may be a field full of pests, and vice versa. Ask a farmer which he would prefer and you will get a dusty answer, but what if the weeds are grown in such a way that they do not compete with the crop? Dr Dempster undersowed brussels sprouts with clover and found the survival rate of insect pests was reduced. When the crop was harvested the damage from cabbage root fly, the brassica-grower's worst enemy, was much reduced and the yield was significantly higher than that of the control crop, which had been kept weed-free. The experiment was transferred from the Conservancy's experimental station at Monks Wood to Cambridge and repeated with cauliflowers and brussels sprouts. This time the difference in infestation was even more marked, but the yield was low because they used red clover instead of white and it grew so fast that it choked the crop. Nevertheless, the theoretical aim, which is to increase species diversity, is clearly correct.

It is the trend toward monoculture that creates many of our pest problems and chemical control methods do not attack this fundamental cause. The point was made by Dr G. A. Wheatley, of the National Vegetable Research Station. He told delegates that a very large part of all the celery eaten in this country is grown in one part of Cambridgeshire, and that most of our carrots come from a small area in Hertfordshire. Between 1964 and 1969 the number of holdings under 20 acres in size fell from 30 to 20 per cent of the total for the country as a whole—a drop of 50 per cent. During the same period the total number of holdings fell by one-third. The movement is to monopolistic monoculture! Hundreds of acres of one crop offer unlimited food supplies to a pest species and the problem is more acute than with cereals, because not only do vegetables offer a larger leaf area for some pests, but their production is so planned that at any time during the season there are plants at every stage from seed to harvest.

Some of the most interesting work is being done at the Glasshouse Crops

Research Institute. It was described by Dr I. J. Wyatt. The situation inside a glasshouse is different from that found in other forms of horticulture and, on the face of it, this is the place where you would expect biological control to be least popular. Space is expensive and plants are crowded more densely than they would be outside. The environment is controlled and plants of the same species are grown continuously—there is not even a winter to relieve the monoculture. There is no opportunity for predators or pest-parasites to enter from outside, nor can the pests themselves leave the crop should they try to migrate. Pests are carried with the crop all over the country and since plants are moved from house to house at different stages of growth, pests are distributed all over a holding. Because of the high value of the crop, growers have tended to spray very thoroughly.

However, the environmental conditions work in two ways. Although pest populations may be high, they are also unstable. When the insects, especially the red spider mite, became resistant to most insecticides, an alternative control was sought in another mite which eats the red spider mite at all the stages in its life cycle. This has proved so effective that the technique recommended for the commercial grower is to plant a crop, then introduce the pest, allow its population to increase and then introduce the predator. The pest will be brought under control very quickly and all that is required thereafter is a periodic reintroduction of the pest, to keep the predator from starving. Some chemicals are still used at the GCRI, particularly fungicides, but nowadays they are all screened to ensure that they will not interfere with the biological control programme. Dr Wyatt is so confident of this that he looks forward to the day when entire nurseries may be pest-free.

Can it be that the campaigns of the whole-fooders and the conservationists, who have been urging pesticides bans for years, have been overtaken by events? Not quite, for these were the ecologists, many of them conservationists themselves. There are other conferences at which the advantages of pesticides are enthused over but, all the same, we have come a long way since *Silent Spring*. One day pesticides will be abandoned altogether. One speaker at Oxford gave them another 15 to 20 years. There is some hope that by then

Reports

we may have developed alternatives that form part of a new farming system which places biological stability as one of its main objectives.

Michael Allaby

A recipe for survival

Introducing the Bran-Plus Loaf

This loaf was first suggested by T. L. Cleave in his food guide in **DIABETES, CORONARY THROMBOSIS AND THE SACCHARINE DISEASE** by himself and two co-authors, published by John Wright. The rationale behind it is as follows:

A 100 per cent wheat loaf is the perfect answer in a perfect, that is, a natural, environment. But in the unnatural nutritional environment of modern-day Britain and of other Westernized countries, so much fibre is lost in the manufacture of sugar, and other foods, that the bran-plus loaf is a particularly suitable vehicle for returning some of this lost fibre. Such a loaf not only has extra aperient qualities, but also, though its calorific value is less, it satisfies the appetite more, and is therefore excellent in cases of overweight. I am happy to write that production of this loaf has already begun. It is being produced in the bakery of the well-known Cranks' Restaurant in Central London and is being increasingly sought-after there.

The Bran-plus loaf

(Based on the recipe for the "Grant Loaf")

Sufficient for two loaves

2 lbs of English stone-ground, whole-wheat flour

3 ounces of fresh, unprocessed bran.

28 ounces of water at blood heat (Just under 1½ pints.)

1 Teaspoonful of Barbados sugar, black treacle or honey.

1 ounce of fresh yeast (Dried yeast can be used successfully.)

Method: Mix salt with flour. In very cold weather warm the flour sufficiently to take off the chill.

Mix yeast and sugar together in a small bowl and add half a teacupful of the water. Leave for ten minutes or so to froth up. Pour yeasty water into the

flour and add the rest of the water. Mix well—first with a spoon and then by hand—until the dough feels elastic. Divide the dough, which should be slippery but not wet, into two "two-pint" bread tins which have been warmed and greased with vegetable oil or saltless butter. Place the tins in a warm place to allow the dough to rise until it is within half an inch of the top of the tins. (To give the loaves a professional finish and to enhance their aroma when baked, sprinkle the tops with 81 per cent flour, obtainable at Health Food Shops.) Then place the tins in the bread oven—(near the top)—which has been heated to 400°F or the equivalent. Bake for about 40 minutes, or until the loaves are a golden brown all over. The loaf should have a well-built appearance, with a nicely rounded top. If properly made, it can be easily cut in sandwich-thin slices. If the texture is crumbly and difficult to cut, the dough has been allowed to rise too high, or the yeast has been allowed to ferment too long with the sugar and water.

If there is no suitable or convenient warm place in which to rise the dough, the tins can be placed in the bread oven which has been set at the lowest possible temperature. Let the dough rise until it is within a good inch of the top of the tins; it should not be allowed to rise as high as for the above method. When sufficiently risen, make three diagonal scores across the dough with a sharp knife, turn the heat to 400°F (between 6 and 7 Regulo), and bake as above, but allow approximately five or ten minutes extra baking time; if the bread tins are very solid ones, allow even longer baking time

The quantity of water for this recipe varies with the type of flour. Some flours need a little more; some less. The right amount is soon found with very little experience. The special properties of the bran for holding water keeps the bread moist even longer than in the case of wholewheat bread made without added bran. When three days old, the bran-plus loaf still tastes like new bread.

The best way to keep this bread is to wrap it in two clean drying cloths or serviettes and then place in a convenient cool cupboard. In cold weather, the bread will keep longer. A plastic bread tin is not recommended. If using fresh yeast, the best way to keep this is to wrap it in greaseproof paper, place in a plastic bag and store in the refrigerator.

The bran-plus loaf is an entirely novel and delicious bread with an attractive nutty flavour.

An alternative

To those who have not the time or facilities to make this bread it is recommended that they purchase a true wholewheat loaf, such as Allinson's or Prewett's at a Health Food Shop or other supplier, and then supplement this loaf by taking ordinary unprocessed bran as well. This raw bran can now be obtained in Health Food Shops, and at corn-chandlers and even at pet shops. Raw bran has the advantage that its vitamins are intact—it is a key source of the B vitamins—and its bowel-stimulating qualities maximal. Also it is very cheap, costing only 5p at a Health Food Shop for a twelve ounce packet, and about half that price at corn-chandlers and pet shops for non-proprietary brands.

Unprocessed bran is impossible to swallow when dry. It can be washed down with water or fruit juice. It can be added to wholemeal porridge, or sprinkled on muesli, fruit or custard. It is excellent when added to soup.

Bran may cause flatulence in some people for the first two weeks, but this must be ignored as it passes off. At first, two teaspoonsful twice a day are taken before meals and, after two weeks the amount is increased if easy evacuation is not achieved at least twice a day. (For a detailed description of what constitutes an "easy evacuation" I would refer the reader to Page 83 of the above work.) People who have been constipated for many years may need a great deal of bran in addition to wholewheat bread, fruit, and vegetables. One tablespoonful, however, taken in a glass of water at bedtime, is sufficient in most cases. I have recommended this amount to many people through the years with excellent results.

One of the authors of the book referred to above has been engaged in a hospital trial on the effects of unprocessed bran on about three hundred patients. First impressions suggest that it is 80 per cent effective. Moreover, the high residue diet provided by the bran makes early haemorrhoids more comfortable and will prevent them developing to the stage when they need surgery. It is safe as bran has been a constituent of man's diet since the dark ages when he first ate cereals.

Doris Grant

Classified Adverts

COMMUNITY/NORFOLK: Shared experience of survival methods/separate family households. We want to buy a big house and split it up. Could you support yourself in Norfolk? Write: Andrew Singer, The Mill Cottage, Swaffham Road, Boltisham, Cambridgeshire.

FULLY qualified teacher seeking a post in biology and/or general science. Six years teaching experience in both subjects. Wish to emphasise ecological basis of biology and relate ecology to science in general. Information welcomed about posts offering such an opportunity. Write: J. Plowman, 102 Park Rd, Teddington, Middx.

RELATIVITY is used for Bombs, Power, cutting screws in engineering, etc. If we use it on human behaviours, we can greatly expedite removal of unfairness. I need help simplifying unusual thesis putting forward this idea. At present, nearly everybody cannot understand it, but all get its drift, and most approve. Other reactions include hatred of it and its author. If you are unable to accept home truth, this work may offend you. Please enclose 9 x 4 s.a.e. J. G. Hopewell, 45 Coleby Road, Broxtowe, Nottingham NG8 6FT.

ZOOLOGY/BIOCHEMISTRY Graduate (London University) aged 22 seeks employment associated with conservation preferably in or near London. William Hall, 31 Aberdeen Rd, London N5 2UG.

GIRL graduate requires clerical position with ecological/conservation organisation. Accustomed to scientific terminology. Wage immaterial. Box No. E152, *The Ecologist*.

GRADUATE, 23, degree in geography disturbed by the destruction of the environment seeks any work in ecology conservation or similar fields. Box No. E153, *The Ecologist*.

N.E. London Poly., Barking's Environmental Society are to stage an exhibition, contributions of stands, posters etc. or practical help; please write to Sulan Chen c/o Student Union, Longbridge Rd, Barking, Essex.

BOOKS and Magazines on ecology, community, non-violence, liberation and human survival from Housmans Bookshop, 5 Caledonian Road, Kings Cross, London N.1. (Mon-Sat. 9.30-6 p.m. or mail order-lists send s.a.e.).

GIRL, 19, 3 "A" Levels, 9 "O" Levels, interested in working in Conservation. Anything considered except office work. Available as from Sept. '72. Please write to—N. Cole, 30 Scarsdale Villas, London W8.

GRADUATE (21) in Mathematics and Social Anthropology seeks employment in Ecology, conservation or allied fields in any capacity. Neame, 3 "The Knott", Lady Margaret Road, Cambridge.

QUALIFIED ENGINEER, 29, increasingly finds his work ecologically regressive. Now wishes to apply his wide knowledge to socially acceptable work. Adaptable and energetic—all suggestions considered. Box No. E154, *The Ecologist*.

ENVIRONMENTAL SCIENTIST (U.E.A.) graduating 1972 seeks interesting position preferably involving world travel. R. H. Porter, Welbeck Cottage, Brooke, Norwich, Norfolk.

LOCAL FRIENDS OF THE EARTH, Volvo B 121 1964 model: We find we do not often have need to use our above car, as mostly we can use public transport to better advantage, both to us and the community at large. However, there are the odd journeys which make it worth keeping, but the high cost of insuring, taxing and maintaining make these journeys rather expensive.

We wonder if you would like to consider the possibility of sharing the Volvo with us, on a mileage and share-the-cost basis. Whether or not you are interested in the above, perhaps you would like to pop round to 275 Kings Road, Kingston upon Thames, Surrey sometime to say "hello"; you will be very welcome. Hugh and Terry Sharman (new FOEs).

THE UNIVERSITY OF MANCHESTER INSTITUTE OF SCIENCE AND TECHNOLOGY LECTURESHIPS IN POLLUTION STUDIES

Applications are invited for two appointments to be attached to the University's Pollution Research Unit and assist in the teaching of the new M.Sc. degree course in Pollution and Environmental Control. Applicants should be suitably qualified graduates in one of the engineering or biological sciences and have considerable research or professional experience with pollution problems.

Commencing salary within the scale £1,641-£3,705 per annum (£3,852 in Oct. 1972 and £3,999 in Oct. 1973) with F.S.S.U.

Requests for application form and further particulars, quoting Reference CE/55/CH, should be made to the Registrar, UMIST, Sackville Street, Manchester, M60 1QD. Completed forms to be returned by 26th May, 1972.

INFORMATION FOR SURVIVAL Satisfactory first response to appeal for abstractors of current environmental journals. More are required to cover the field. Generally one abstractor will cover one journal. Digests covering say 100 journals sent free to abstractors. Do something for survival. Volunteer to provide abstracts. Those interested should contact: Dr. K. Barlow, The Old Forge, Great Finborough, Nr. Stowmarket, Suffolk.

Apology

The Editor of *The Ecologist* deeply regrets his failure to acknowledge that large sections of 'The Tanzanian Way to self reliance' by Jimoh Omo-Fadaka (February issue) were in fact quotations from the final chapter of Stanley Johnson's new book *The Green Revolution* (London, Hamish Hamilton 1972).

Coming events

31 May—"The Biosphere Cycles", the 5th of a series of lectures on population, resources and environment called **DOWN TO EARTH** held by the Conservation Society at Overseas House, Park Place, St. James Street, S.W.1. Admission 10p at the door, or 50p for the series (also at the door). Commencement 7 p.m.

1-6 June—Independent Conference on the Environment. Gränings Stiftsgård, Saltsjö-Boo, Sweden & ABF-huset in Stockholm. Sveavägen 41-43 Tel. 08-11 07 44; 08-11 12 76.

2-8 June—"L'Homme, L'Air et L'Eau" (Man, Air and Water). International Symposium and Exhibition organised within the framework of the International Week for Environment under the patronage of Mr Jacques Chaban-Delmas, Prime Minister. Enquiries: R. D. Sherman, Exhibition Consultants Ltd., 11 Manchester Square, London, W.1. Tel: 01-486 1951.

5-16 June—**ONLY ONE EARTH**—United Nations Conference on the Human Environment, Stockholm. For further information: Palais des Nations, Geneva Te. 34 60 11.

6-10 June—Slimming, Health Foods and Beauty Exhibition at Free Trade Hall, Peter St., Manchester 2. Further information: John Clarke Ltd., St James House, 44 Brazenose St., Manchester 2. Tel. 061-834 9494/5.

22 June—"MAN IN HIS PLACE" Environment and Behaviour/Population Pressure and the Environment. Annual Symposium—Royal Society of Medicine. Speakers include Sir Frank Fraser Darling and Dr K. Mellanby. Admission is open to non-members of the Society and is by ticket only which may be obtained from The Conference Office, Royal Society of Medicine, 1 Wimpole St., London, W.1. Tel. 01-580 2070.

Environmental Pollution Science

Part-time Masters Degree

Details from Professor G C Bond
Brunel University Uxbridge Middlesex
Telephone Uxbridge 37188



Gulliver in Automobilia

The Author discusses the Conquest of the Air

The Automobilians are much infatuated with the Notion of Speed. Indeed, they are wont to equate the Advancement of a people with the Rapidity of their Movements from Place to Place. They make frequent Complaint that the Pace of Life is of Late Years intolerably quickened, and a great Part of their Discourse is devoted to deploring the "Hurly-burly" with which they fill their Days: yet each new Access of Velocity in the Means of Locomotion is proclaimed as a Step towards the ultimate Perfection of Human Felicity.

Not the least noteworthy Manifestation of this Passion for Speed is the Extension of their Dominion into the Sky itself: for their Engineers have constructed Vessels, light yet wondrous strong, of the Semblance of colossal Birds with Wings outspread. The intending Traveller must submit to be inclosed in the noisome Confines of such a Monster's Belly, where he remains for the Duration of his Journey with no more Mastery of his Fate than the Greeks in the Trojan Horse. The Door is locked, the Passengers strapped to their Seats, and the Vessel, with a prodigious Expulsion of Wind from its hinder Parts, runs forward along the Ground and rises into the Air as if it were light as Thistledown.

The Convenience of the Few is in this Land ever held to outweigh the Hardships of the Many. The greater Part of the Nation never enjoy the Benefits bestowed by these Vessels: not for *them* to break their Fast in the Indies and sup the same Night in Muscovy or Mexico. Yet they must dwell in Sound of the incessant Scream or Roar of aerial Peregrinations: and the Laws of Automobilia, which deal sternly with many a barking Dog or clamorous

Merrymaker, resign all Power to oppose such for greater Noises as set the Ears of a whole county a-ringing. Yet during my Sojourn among them the Automobilians were busied with the Building of yet bulkier and speedier Vessels: it was admitted that the Noise thereof most resembleth an interminable Volley of Cannon, whereby Windows are shattered, Cattle stricken with Panic, Children and aged Persons benumbed with Terror and whole Populations incommoded: yet these Devilments are hailed with Pride, for no better Reason than that they are wondrous difficult and costly to contrive.

In other Ways, too, are the proper Pains of Travel taken from the Traveller and laid instead, in a new Guise, upon those who Stay at Home. It is feared by many that the very Weather is impaired by the Passage of these Vessels: for each one pours forth so great an Effusion of Vapour as to create Clouds in a clear Sky. Thus the People find the very Sunlight, which should be free to all, stolen from them in order that a few rich Merchants may traffick in far Countries without Trouble. Nor can the Harbourage of the aerial Craft be accomplished without great Destruction. For they can scarce alight but if they be allotted a clear League or more of level Ground, which they render sterile for any productive Use and noisome to all Persons of Sensibility: nay, the very Automobilians shun such Places if they may, and commiserate with those whom Poverty compelleth to dwell in the Vicinity thereof. When a new Port for Air-Craft is to be constructed, even this servile and abject People will not gladly suffer their *own* Villages and Farms to be laid Waste for others' Benefit: but argue each the greater Fitness of some other Site, and seek, as Ethelred did with the Danes,

to divert onto others the Destruction which they cannot abolish altogether.

My Readers will perhaps think me a partial Critick, and accuse me of ignoring the obvious Charms of so curious and novel a Means of Conveyance. Must it not be delightful to ride upon the Winds like an Eagle, consort with the Clouds, and view whole Kingdoms with the Compass of a single Glance, like Jove from his Seat upon Olympus? But my Informants were positive that the Experience affords very little of such Pleasures: the Sensation of Flight is almost wholly absent, so smooth and level is the Vessel's Motion; and the Altitude being exceeding great and the Windows no bigger than the Portholes of a Man-of-war, the View of the Earth beneath must needs be limited. The Passengers are more afflicted with Boredom than Fear, and the Crew are at Pains to divert them by filling their Bellies with Tid-bits and their Eyes and Ears with Shews and Mimes.

The Wealth of Automobilia is certainly very great: but I doubt whether it sufficeth long to maintain such prodigal Expense as human Flight must needs entail. The larger the Vessels become, the more insatiable is their Thirst for Fuel: and even so improvident a People as this must at last accept the Limits set by Nature to the Satisfaction of their Greed. Indeed, but for their many attendant Pains and Discomforts, these Vessels might deserve to be welcomed as the Means whereby the Automobilians may be the sooner brought to their Senses. For I am persuaded only Poverty can save them from the Fate their Folly deserves. The Tale of Icarus teaches us that Man's first Flight led only to an early Grave: the Experience of the Automobilians, that human Flight must always be attended by Consequences no less grievous.

Nicholas Gould

Down to Earth



by Lawrence D. Hills

The wind is free

Long ago in the 1930s, Messrs Lucas who now make almost all our magnetos, made the "Frelite" one of the best small windmills ever designed. It was like a six foot aeroplane propeller, with a little dynamo just behind it and fin on rods at the back to keep it pointing into the wind. It cut in when there was wind enough and out when there was too much, swivelling the propeller sideways for weather when millers were no longer jolly, but wrestling with the smoking brakes on shafts that still spun dangerously through the great sails were fully feathered.

We learnt the magic of the turning shaft and the power of gearing from the wind and water mills with their mighty cogs worn into syncromesh as their apple-wood teeth meshed together. First came the watermills, but they were limited by the fall of streams and rivers, with some of the most fertile grain land, the flattest, offering the fewest "steps" with "risers" high enough for a dam and a waterwheel.

The moors of Yorkshire, Cheshire and Lancashire have small and scattered ruins beside their stronger streams, where the industrial revolution began before steam and smoke made the mills that powered the first factories, dark and satanic. The wind was free, and the 30-40 h.p. of a windmill with thirty foot sails has done far more of the world's work through the centuries than nuclear power has so far, with Britain's first windmill "going critical" in 1911.

The winds of the world are as free as the sunlight, but the machinery to turn them into an ecologically ideal power source, without even the silting problem of all hydro-electric dams, costs more in interest on capital and depreciation than nuclear energy. But charge nuclear power stations with the cost of the lost crops on their sites for

up to five hundred years while their spent radioactive cores are running through their half-lives to safety, and of fencing and guarding these dangerous deserts that will grow more common as fossil fuels run out, and the windmills win.

The windpower experiment at Costa Hill, Orkney, in 1949, has shown us the way to harness the winds where these are strong and plentiful.* The windmills of the future will be 225 foot propellers on steel lattice tripods with one leg pivoted in the middle of a circular track on which the other two run on bogies driven by small fantail mills like the one at the back of the doomed top of the familiar white wooden tower that kept the four traditional sails facing the wind.

With a 35 m.p.h. wind (a moderate one for Orkney), each mill would generate 3,670 kilowatts, and 5,400 at 40 m.p.h., at a cost of 0.18 old pence (1951 price) per kilowatt hour. The capital cost, assuming forty were ordered for hill sites spaced over Britain, would have been £150,462 each. Now, the wages of one man to look after five of them would be vastly more than £1,000 a year, maintenance, especially painting, far higher than £1,203 each and interest on capital nearly double the 3½% under the Labour Government that could have bought more than 220 windmills for the cost of the Groundnut Scheme. Today the costs could be counted in Concordes, and the aerodynamic skills of the British aircraft industry have far better long-term prospect in designing super windmills for the power hungry world of tomorrow than for supersonic Jumbo jets.

The Costa Hill experiments show the value of simple, two-bladed propellers, rather than complex sails or discs of steel vanes, because these can take most wind, yet feather themselves for safety when its speed is beyond even their strength. The supermills designed from them would have poured their power direct into the Grid so with gale force winds in districts Rockall and Hebrides in the small hours of the morning, all Britain could have run on the screaming propellers slicing through the black night with tips 22 feet from the ground. They might have taken the

whole load of everyone awakening, even carrying it through tea and shaving-water-kettle-time, with the fuel-using stations cutting in for the trains and awakening industry.

The little Lucas Frelite, of which some specimens were still lighting houses and running radios in the trade winds of St. Helena in the 1950s, produced about 400 watts, and though this rose to over a kilowatt as wind speed increased, the extra was stored in four 6-volt accumulators for still days and when there was only breeze enough for a single light bulb. The patents must have run out by now, and there would be scope for a ten foot propeller model to produce power enough for a T.V. and to fill the night storage heaters with free electricity, at least while the wind blew 15 m.p.h. or more.

The basic problem of the winds is that they come and go, and if the four little batteries on the Frelite are scaled up to Costa Hill sizes, they cost rather more than half as much as the whole plant, tripod, track, propeller, generator and all, and depreciate at the rate of 20% a year. Set the mill pumping water up-hill to run back from the reservoir and drive a turbine to generate electricity for still days and peak periods, and leakage, evaporation and still more interest on capital and depreciation, spend most of the gain, though we may yet be driven to it. Splitting hydrogen from water with electricity generated in gales, and storing the hydrogen in cylinders to burn as fuel, is a theory that has always failed in practice. Grinding grain, or rock phosphate for fertilisers, or pumping water for irrigation are all non-electric jobs windmills could do, and we may well find many more when we must.

The future lies with the super windmills, the "lordly ones of the hollow hills", the silver giants that we shall expect to see striding over the moors, as they pour their power into the Grid and save the last of our coal and diesel oil, and eke out the alcohol and methane we can spare from our tractors for still summer days. Perhaps radio weather forecasters will then be bright and cheerful when they predict gales in all districts in hard winters, just as they rejoice today in fine Bank Holidays that mean perhaps five million gallons of irreplaceable petrol gone up in smoke and lead pollution.

* "The generation of Electricity by Wind Power" by E. W. Golding. E. & F. N. Spon Ltd., 1955.



Books

More of the Same?

THE NEW BATTLE OF BRITAIN, by H. F. Wallis, Charles Knight and Co. Ltd., 75p soft, £2.00 hard cover.

Will we solve our problems with better technology and more stringent "watch-dogs"? The evidence suggests that this approach is less than an unqualified success. True, there are fish in the Thames, but there are drums of cyanide on the beach, there are a million unemployed, Ulster teeters on the brink of civil war, mental and degenerative disease increase, crime becomes more violent and then, in the middle of the debate, all the lights go out. No, all is not well, and these problems are inter-related.

I find our attempts to remedy the ills only after they have occurred, to be condemned to a perpetual tail-chase, wearisome and deeply depressing. I am sure it is this that gives rise to talk of doom. The gains are overtaken by a deteriorating situation and our decline assumes an air of classical inevitability.

The fault lies in a failure to think the problem through to its conclusion, which is that there must be reform of a very radical nature. Once we accept this the gloom lifts. The dangers are great, the transition may be unpleasant, but at least and at last there is reason to hope. Man may have a future after all.

Mr Wallis has gone deeply into the environmental crisis, but not deeply enough. He reminds us of the law of diminishing returns that ensures that the more we have the less satisfied we will be. He points to the gulf between rich and poor. He challenges the view that economic growth must necessarily contribute to the quality of life and he defends the environmental movement against Anthony Crosland's charge of elitism. He quotes Ehrlich on the optimum population for Britain and he

doubts whether we will be able to double our food output by the end of the century as the Agricultural Research Council says we must. His first chapter deals with population—the problem and ideas for solutions—and it is excellent.

The New Battle of Britain is written mainly for planners and legislators and so the emphasis is on planning. Although the challenge to "growth-mania" is maintained, I felt the case weakening as more and more Mr Wallis found himself having to work within existing legislation and concepts. When he urges his readers to join or form environmental groups he is telling them to defend their own environment against attacks he believes to be inevitable, to protect their existing way of life, not to change it. Does this not mean defending one environment at the expense of another? Is this not elitist? The dilemma cannot be resolved without questioning the right of the "attacker" to attack at all. If we are to increase mineral extraction, for example, can we believe that better planning will prevent the dereliction of land? Should we accept the creation of a public fund to reclaim the land afterwards or should we not demand that this cost be borne wholly by the mining company and if this makes their operation uneconomic, then perhaps it should be abandoned for that reason? If this means we must learn to make do with fewer and more expensive minerals, is this not a situation we must face anyway?

Yet the ground Mr Wallis does cover he covers very thoroughly, and he covers most of it. There are chapters on planning, traffic, housing, historic buildings, waste, air, rivers, the seas, water, noise, pesticides, landscape and many more, each with a list of existing legislation, the names of the authorities concerned and a short bibliography. The book ends with a call to direct action and the directory of organisations that is becoming standard in works of this kind.

I have no doubt that the book will achieve its aim. It will provide those new to the problem with a clear, concise summary of its main aspects and because he takes them part of the way, Mr Wallis may stimulate them into challenging the direction of present society. Does the planning approach work? Will more of the same ensure our survival or do we need something more fundamental? The reader must work it out for himself—and legislate accordingly.

Michael Allaby

Sorting it out

ENVIRONMENTAL SOLUTIONS, edited by Nicholas Pole. Eco-Publications, 6 Cavendish Avenue, Cambridge. 60p.

With the environmental debate entering its second phase the first anthology has appeared that centres on solutions to the problem we all recognise. It is a necessary step forward and a brave one, for it supposes that the reader has been exposed to, and impressed by, what has gone before. Just to make sure, *Environmental Solutions* begins with a recapitulation in the form of two essays, one by Paul Ehrlich and the other by Lamont C. Cole, summarising the crisis as they see it.

What is surprising is that already it should be possible to produce such an anthology at all. Most of the chapters are taken from books that were written while others were still engaged in apocalypsysing. True, some of them are strange and their conclusions even stranger. One does not expect to find Buckminster Fuller here, for example, although when he warns that this is the only planet we have and that if we are to learn to live on it we must equip ourselves with a technology as superior to today's as the spaceship is superior to the automobile, he verges on sanity. It is a brief encounter, however, for his conclusion is that salvation lies in expanding the space programme at all costs in the hope of further spin-off.

The outstanding contributions are those from Edmund Leach, Ian McHarg and the paper submitted to the Stockholm Conference by the Intelligence Unit of the Royal Institute of British Architects. They are distinguished by the intellectual courage of

their authors and I wonder whether it is mere coincidence that all of them are concerned with architecture or urban planning?

It takes courage for a planner to say, as Professor McHarg does, that "Architecture is a device to deny the student any possibility of understanding human physiology, psychology, human behaviour or the realities of biophysical forces", or as Dr Leach, an anthropologist, does, that "when there is planning it must be justified by quite arbitrary principles such as aesthetic fashion or religious dogma or even military convenience. The 'needs of society', which it is now fashionable to invoke, won't work at all." McHarg's point is that architecture should be about helping man adapt to his environment for survival. Leach says much the same, in that he would have planners allow for the maximum of social diversification, on the sound ecological premise that diversification contributes to stability and so to survival. The RIBA comes to a similar conclusion and emphasises the need to economise on our consumption of energy and resources and to take account of this need in the planning stage of all new projects.

These are the intellectual fireworks, but there are also calls for immediate reform, as in the chapter on population control by Jean Medawar, who describes what can be done as a background to what needs to be done, and a description of a more personal approach to a solution in a short paper on community living by Sarah Eno.

As though to round off one of the most useful and optimistic additions to the eco-bookshelf I have read, there is a fascinating account of industrial recycling in China. Clearly, it can be done. Where there's a will there's a way!

Michael Allaby

Home is the Hunter . . .

PLEASANT VALLEY by Louis Bromfield, 40p.

THE FRAIL OCEAN by Wesley Marx, 40p.

Published by Pan Books.

Louis Bromfield was living in France at the outbreak of World War II and, thinking that he could do a better job in the States, rousing the Americans to

the evils of Fascism rather than staying to fight in Europe, he followed his family across the Atlantic.

Eccentric, rich, perhaps a trifle arrogant but very knowledgeable, the reader admires him and doesn't begrudge him a penny of his fortune. He uses it wisely.

In the rolling upland country of Ohio, he bought three run-down farms and started to restore them organically. He built a house for himself, his family and a mob of animals: the kind that are members of the family.

He had vicissitudes; in wartime, labour and machinery were hard to get but nevertheless he flourished with his land. He experimented with staple crops, fodder plants, exotic vegetables and fruit, but perhaps his most significant contribution to land husbandry was his discovery that there is a shortcut to humus—even in fields deprived of topsoil by intensive agriculture.

He has ploughed the profits of his writing back into the land with the result that he lives in a small rich world: a community of farmers, their families, their animals and the soil.

A good farmer must be horticulturist, mechanic, botanist, ecologist, veterinary surgeon, biologist and other things. To find a good farmer who can also write with the love, the energy and the enthusiasm of Bromfield is a bonus for any conservationist.

At first the style of *The Frail Ocean* grates: sensational journalese, particularly on dramatic events like the Torrey Canyon, but Marx comes off better when describing personal experiences like exploring the kelp forests off California and watching the grey whales which come to breed in Scammon Lagoon off Baja California.

There are mistakes, some obviously printers', others the author's. Shrimps are arthropods not anthropods—and sea gulls belong to lady novelists, not ornithology.

Otherwise this book is worth its price for anyone who wants to be informed, to write or speak about the sea. Although concerned with pollution and conservation, Marx goes beyond the obvious to the root cause of the trouble: the sea, being common, that is, not defined by national boundaries, should be husbanded and conserved in common and this applies not only to nations, for ever pushing out their limits of jurisdiction until Korea for example reaches 250 miles, but also to individuals, to private companies and public authorities.

San Francisco Bay, already one-third filled by tipping, is only 18 feet deep over 70% of the remainder and this is filling rapidly under the auspices of such agencies as Golden Gate Disposal and Sunset Scavenger Corp.—all for the property developers to build on.

Speaking of the public right to enjoy urban waterfronts, Marx quotes the blurb for new property development at Washington, D.C., "apartments designed expressly for those whose professional stature, social standing, or personal achievement merit true distinction in living".

He is mainly concerned with the Americas but the problem stated here: exploitation and depletion of the sea stocks: fish, whales, seals, kelp; Pollution by sewage, pesticide run-off, and nuclear wastes, disappearing sand (like humus, a vanishing resource): all these are global—as are the solutions. Effective management of the oceans' resources can only be accomplished by international agreement in which the United Nations should give the lead. The International Court at The Hague and regional fish commissions should follow; thus we might find that the greatest contribution of the sea may not be so much to feed the world but to unite it.

Gwen Moffat

Ecological Wolves

NEVER CRY WOLF by Farley Mowat, published by Ballantine Books. 30p.

Farley Mowat went to the Barren Lands of northern Canada for one summer to write a report on wolves for the Canadian Wildlife Service. It appeared that the Arctic wolf was decimating the caribou. The author, in an absorbing book that is occasionally anthropomorphic at the expense of the wolves but often hilarious at the expense of his employers, found that it was "sportsmen" decimating the caribou which, left to themselves and the wolves, would have thrived because the wolves take only the old or sickly. In fact for a lot of the time wolves live on mice. This discovery, and many others concerning the hard but highly organised life of a much maligned animal, makes enthralling reading.

Gwen Moffat

Feedback

1 Blueprint for Survival

Sir D. Renton asked the Prime Minister what studies are being made by Her Majesty's Government of *The Ecologist* report called "A Blueprint for Survival", a copy of which is in his possession; whether any conclusions have yet been reached; and whether he will make a statement.

The Prime Minister: Arrangements are being made for the important issues raised by this document to be studied both within and outside Government. Much relevant work is already in hand, and this will continue. My right hon. Friend, the Secretary of State for the Environment, is holding a series of meetings with the authors of *The Ecologist* report.

Source: *Hansard*

2 Lead in Blood Drastically Reduces Resistance to Infection

A striking example of how pollution can have a devastating but unsuspected effect on normal physiological process has been offered by a Tulane University scientist. He suggested that the process he uncovered might give some insight into the mystery of sudden infant death.

The pollutant studied by Dr Nicholas R. DiLuzio was lead. When he injected it into the veins of rats, he reported their susceptibility to bacterial infection increased as much as 100,000 times. Although the lead caused damage to liver cells, the rats showed no outward change in behaviour, the physiologist said.

It is possible, he suggested, that lead ingested by a child combined with an infection might account for some sudden deaths among infants. Dr DiLuzio told a Senate commerce subcommittee probing environmental problems in the inner city that the next step is to investigate the effects which chronic exposure to lead has on

the ability of animals—and humans—to resist infection.

Source: *Rodales Health Bulletin*, 19.2.72

3 Fertilisers Creating Water Risk

Babies in East Yorkshire may have to be supplied with special drinking water because of a pollution threat to the water supply. It is suspected that "significant changes" in the level of nitrates are due to the use of nitrogen fertilizers by farmers. Excessive nitrates can cause "blue babies" by creating changes in their blood.

The situation is disclosed in the annual report by Mr Harold Ackroyd, engineer to the East Yorkshire Wolds Area Water Board. The supply to about 100,000 people living in an area of 600 square miles is affected.

Mr Ackroyd said today: "There is no immediate alarm. But if the level continues to rise at the present rate arrangements will have to be made to supply nitrate-free water to young babies, who can be affected up to the age of 24 weeks."

His report says that the maximum level for nitrates recommended by the European standards for drinking water is 50 parts a million. Between 50 and 100 parts is "acceptable", but not recommended, and at this stage low-nitrate water should be available for babies.

The report shows that one area had an average of 30 parts, rising to 47.9. Eleven other areas had a maximum of between 26.6 and 39.0. The average level over the area has increased by half in the past two years.

Source: *The Times*, 2.3.72

4 This Underpopulated Country

Patients waiting for non-emergency surgery in National Health Service hospitals may face a wait averaging six months or longer, according to an official report published today.

Although a survey carried out jointly by the Department of Health and the Office of Population Censuses and Surveys shows rapid attention to patients suffering from serious disease, the average waiting time for all diseases and surgery is nowhere less than 11 weeks.

The report, based on 1969 figures, shows average waiting time for all admissions as just under 14 weeks.

Patients awaiting treatment of varicose veins of the lower legs wait 26.8 weeks on average.

Source: *Daily Telegraph*,

24.3.72 Report on Hospital in-patient Enquiry for 1969, preliminary tables (Stationery Office.)

5 Chinese Imperialism

Groups of Chinese workers and army units have moved into the formerly autonomous region of Mongolia, while Mongolian volunteers have moved out.

The total area of Inner Mongolia has now been halved and large tracts of land transferred to neighbouring provinces.

Source: *Sunday Times*, 19.3.72

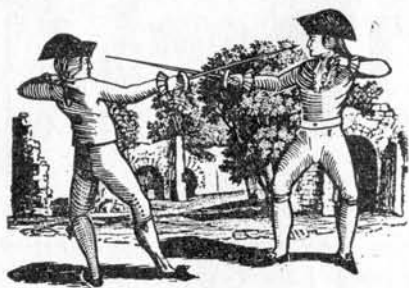
6 What to do with your Old Car

A suggestion that local authorities should get together to buy expensive car crushing equipment for dealing with abandoned cars was made in a House of Lords debate.

Lord Davies of Leek said it was time the government encouraged local authorities to combine to find the necessary money for machinery of this kind. This was a way of preventing dereliction of the countryside without much loss of money and it could be coupled with the imposition of heavier fines for the people who dumped old cars.

Source: *Materials Reclamation Weekly*, 15.1.72

Letters



DDT in Human Milk

Sir,

The usual reason for pointing out the presence of DDT in human milk is to produce in the reader a sense of outrage that this food, sole sustenance of the most sensitive members of the population, should have fallen victim to the thoughtless use of chemicals. Whether articles such as yours serve to discourage the use of DDT I don't know, but given the present minority position of breastfeeding, they certainly serve to discourage this natural mode of infant feeding particularly when the emphasis is shifted from Guatemala (as described in the text) to Western Europe and North America (as featured in your headlines).

If your intention was not in fact to further reduce the practice of breastfeeding perhaps you will allow me to quote from Dr Goran Lofroth himself (paper delivered to Wisconsin Natural Resources Department, May 1969). "Many parents are put before a difficult choice. Should they expose their child, during an important and sensitive phase of the child's development, to an unknown and high amount of organochlorine pesticides, or should they deprive the child of the nutritious human milk and the warm contact with the mother even when the possibility for a rewarding nursing is present. With our present scientific knowledge the general advice is that the positive effects of the human milk preponderate over the negative sides of the organochlorine compounds..."

Additionally the eminent toxicologist has addressed the La Leche League as follows: "I personally believe that human milk, when available, is superior to formula milk—and consequently the solution of the problem is not to abandon breastfeeding and human milk, but instead to decrease and eventually stop the use of DDT and similar persistent chemicals. (In addition I doubt that all

babies in the world can be supplied with formula milk—a few rich nations may afford it.)"

How true, British mothers whatever their dietary indiscretions may rest assured that breastfeeding remains the best means to protect against the whole range of infant disorders from exzema to cot death. As for the rest of the world, perhaps this excerpt from a paper delivered by Derrick and Patrice Jelliffe to a symposium entitled *The Uniqueness of Human Milk*, sponsored by the American Society for Clinical Nutrition will help underline the pathetic futility of public health measures which overlook the importance of maintaining breastfeeding. "A recent estimate has been made that if all the 60 million infants in Asia needed to be fed on cow's milk, and extra herd of 114 million cattle would be required, or an increase of 40% of the total present milk output for the continent." Starvation accompanied by the marasmus-diarrhoea syndrome is the more common procession of events.

Most sincerely,

Joann S. Grohman,
Brockhurst, East Grinstead, Sussex.

Recycling Paper

Sir,

Collecting clean waste paper is the average householder's easiest way to promote re-cycling while diminishing domestic waste output. But what are we to do with salvageable paper no one wants?

In our district the dustmen can't be bothered with the special trolleys designed for clean waste paper; they simply chuck in our carefully bundled up papers with the rest of the rubbish. Last Year I protested against this wasteful practice, both orally and in writing, at Ealing Town Hall. Despite courteous official promises the situation hasn't changed.

My exasperated letter on this short-sighted attitude to the local paper brought a response from the fund-raising secretary of a conservation-minded charity who began to collect waste paper in our area. Then the bottom fell out of the waste paper market and the fund-raiser could no longer sell the newsprint. I am told by a member of the British Waste Paper Association that the demand for salvageable paper is subject to constant fluctuation, just now it is abysmally low, and until the market

rallies, Association members can barely cope with the waste paper output of large firms who are their constant customers.

As much used newsprint is turned into packaging materials, the demand for which isn't shrinking, surely the demand for re-cycling paper shouldn't fluctuate, either. What concerted action can we take to put the collection of salvageable paper on a rational and reliable basis?

Yours faithfully,

Beata Bishop,
34 Esmond Road, Bedford Park,
London, W4.
01-994 5068

Safe Suds?

Sir,

I am a person concerned about our environment and anxious to do what can to help preserve it. I hope you can help me answer a question.

I would like to use an ecologically safe washing powder and wrote to Proctor and Gamble concerning the presence of phosphates in their products. They answered that in Britain phosphates aren't a problem—only in countries like the USA because England discharges waste into moving rivers and the sea. This sounds like a narrow view of ecology to me, but I'm no scientist. Is it safe to use such detergents, and what about bar soap and dish washing liquid? Are they a problem?

There must be many products which the housewife should be boycotting. Is there anywhere that she can find a listing or a concise, factual presentation of the problems so that her buying power can be used to help solve them? I'm afraid most of your articles, thought properly motivating, leave me without knowing what I, as a housewife, can do.

Sincerely,

Mary Anne Baker,
35a Brackenbury Road,
Hammersmith W.6.

Editorial comment It is very irresponsible of Proctor and Gamble to say that detergents are not a problem in this country. This is a false and reprehensible statement.

To my knowledge, there are no ecologically sound detergents. One must simply use as little as possible, and soap should be used instead.

ORGANIC FARMING COURSE

Surrey County Council, Ewell County Technical College, Department of Biological Sciences
Principal: T. A. Buchanan, D.S.O., M.C. Head: L. G. North, B.Sc., M.I.Biol.

A BIOLOGICAL APPROACH TO SOIL HUSBANDRY. In conjunction with the **SOIL ASSOCIATION** it is intended to hold a course on the above topic at Ewell County Technical College in the week July 10-14 1972. The course will take the form of lectures, discussions, demonstrations and a visit to an organic farm and/or market garden.

It is hoped to cover the **PRINCIPLES, VARIETIES OF PRACTICE CONSISTENT WITH PRINCIPLES;** and **ECONOMIC FACTORS** of this method of husbandry.

The cost will be in the region of £10, plus accommodation, at a further cost of approximately £1.15 per night. Canteen services are available if required at £1 per day.

Further information will be sent to those who have expressed interest by returning the tear-off slip at the foot of this notice, or by writing to:

Head of Department, Department of Biological Sciences,
Ewell County Technical College, Reigate Road, Ewell, Surrey. Telephone 01-394 1730/9

I am interested in attending the course 'A Biological Approach to Soil Husbandry' at the above college on July 10-14 1972.

Name..... Address.....

..... Telephone.....

STOP PRESS: Numbers for this course are restricted to 120 and we have almost reached the limit. However, so that those who are interested will not be disappointed it is intended to arrange another similar one-week course from April 9-13 1973. Please write to the above address for further details.

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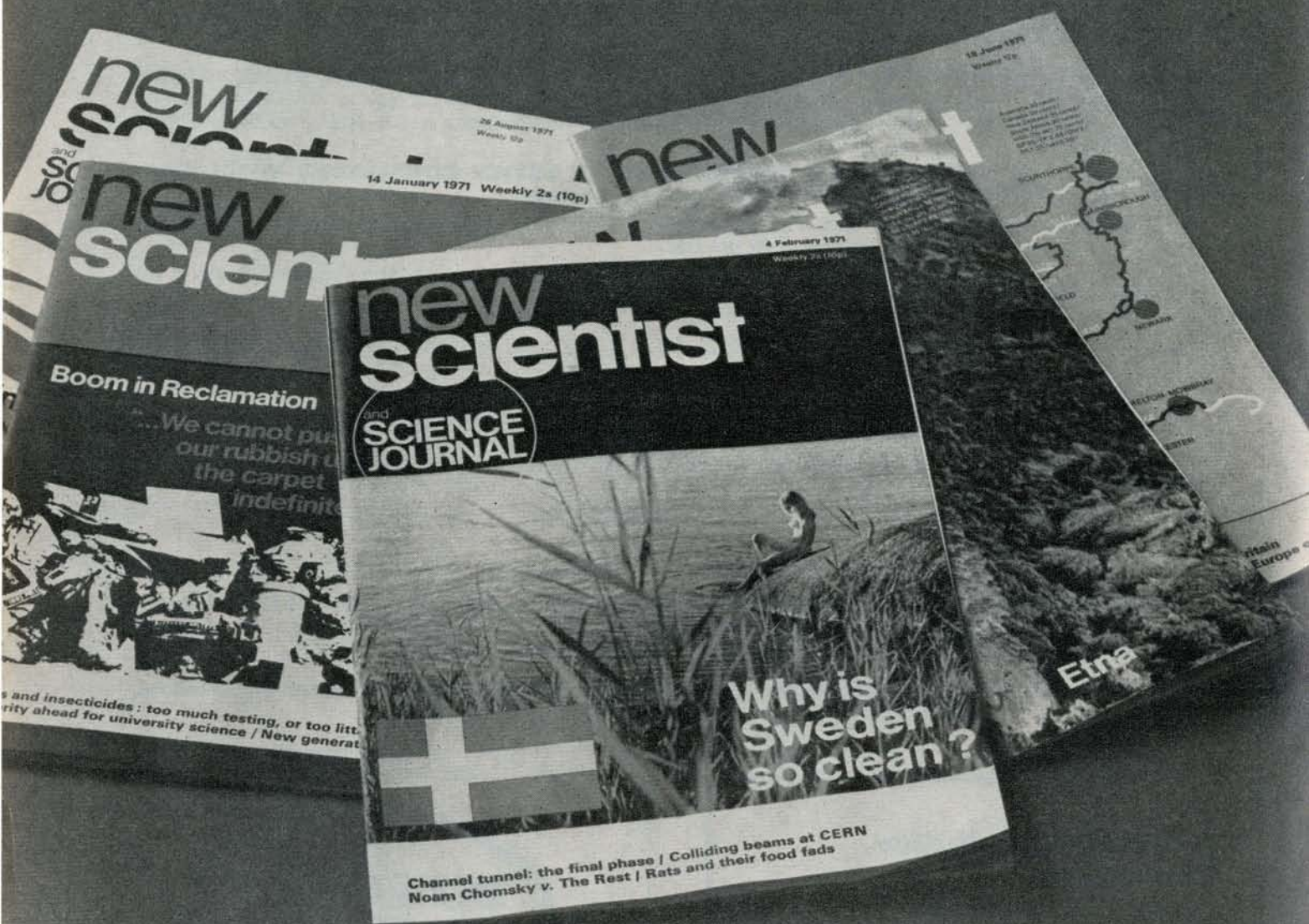
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