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The

Ecologist

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

Vol. 1. No 4 October 1970

Will man adapt to Megalopolis? ▪ The return of the airship

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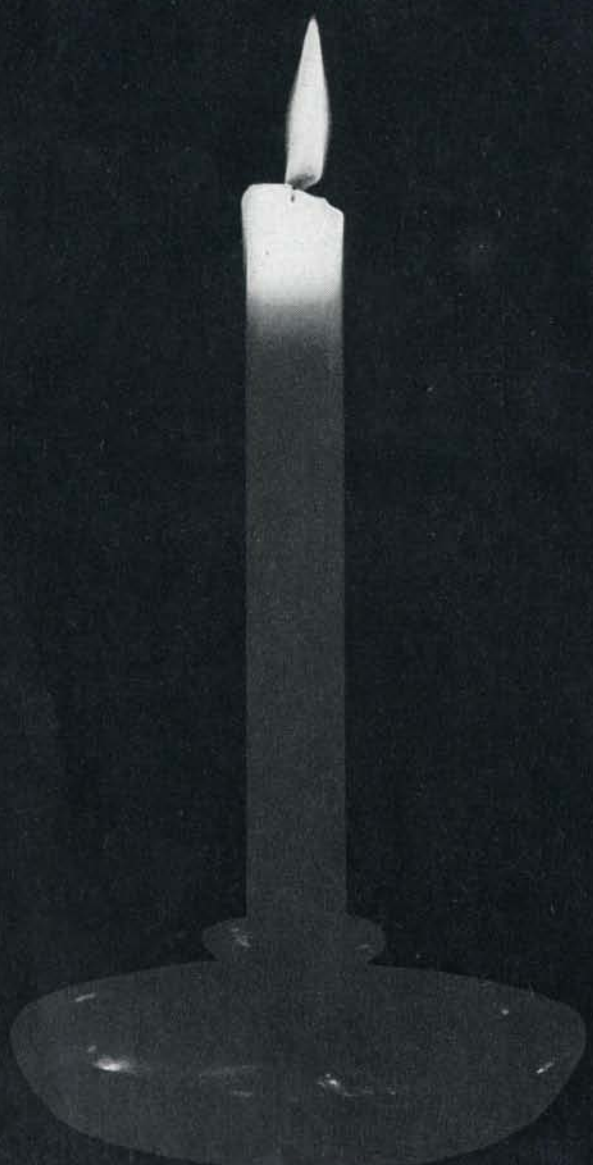

The power crisis

If you enjoy 'The Shadow of Progress', we've failed.

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It examines our technological affluentage and asks basic questions about what we are doing and where we are going.

It's a comment on the generation which put man on the moon without cleaning up his own backyard.

But it's not a film without hope.

It shows how vigilance is replacing indifference.

How technology, which did so much to accelerate the problems of pollution, is now turning its powers towards a remedy.

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But it's one you should see.

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The Ecologist

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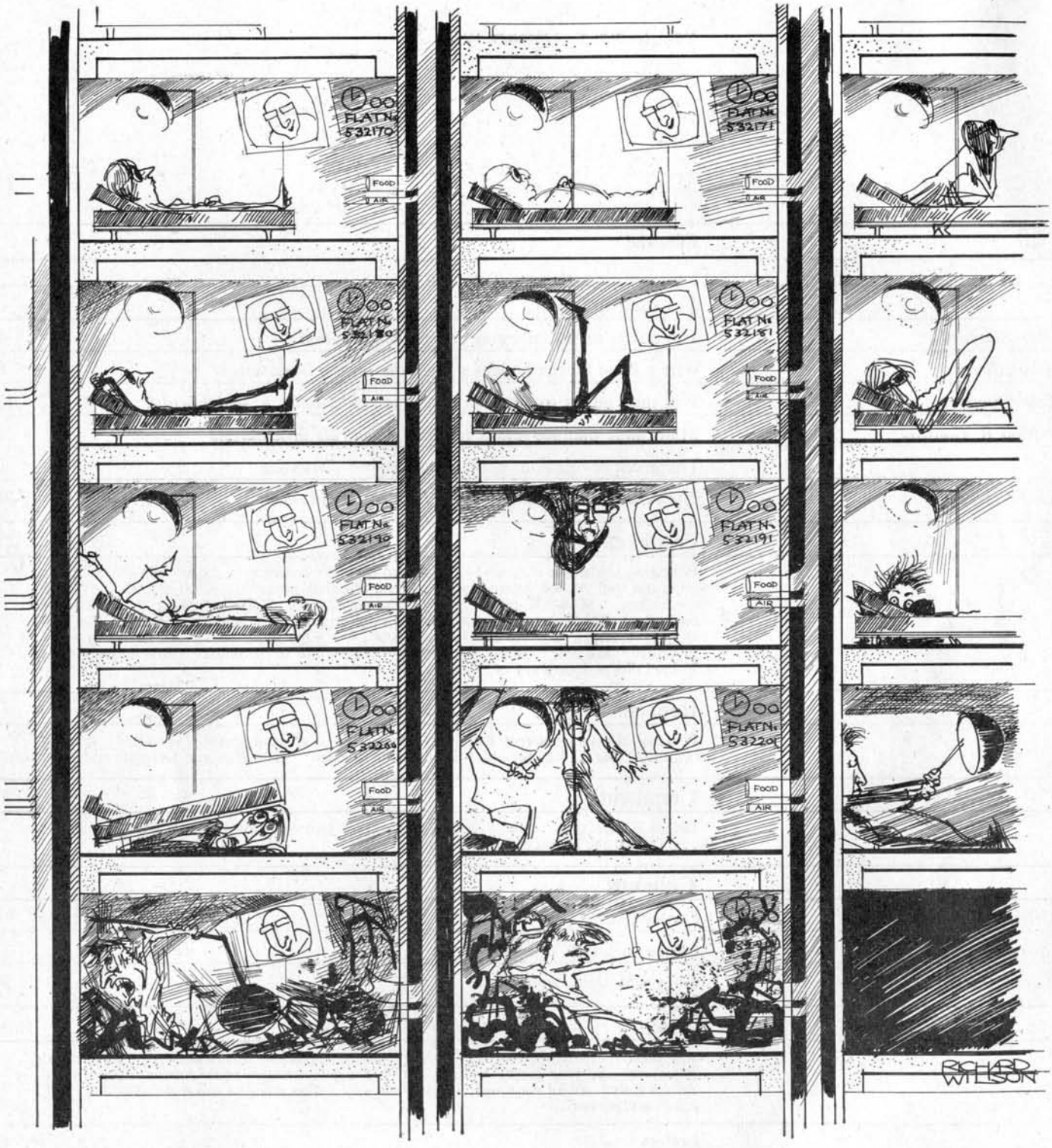


A TV talk on the Infinite Adaptability of the Human Species 2001 AD.

Editorial

An ecological Munich

The Times has had a look at Britain's population problem and concluded that a policy of population control is unnecessary.

In its leader of Wednesday August 19th, "A National Policy for People?", *The Times* stated that such a policy could only be justified if the Government showed (1) that "some clearly identifiable misfortune would otherwise occur"; (2) that "social conditions would become such as to impose more strain than people could successfully adapt to" which, added the writer, "considering the adaptability of the human species is a stiff test"; (3) that "the threat (of environmental pollution or exhaustion of natural resources) arose primarily from greater numbers of people, not from higher rates of consumption"; and (4) that "technical and social means of countering the threat were not available." A brief examination of these conditions should be enough to show how baseless their underlying assumptions really are.

It should be obvious that if Britain's population continues to grow it will be subject to at least one of a number of misfortunes. No organism can indefinitely increase its numbers—at some point a catastrophe occurs and the population crashes. In our case such a castastrophe may be war, pestilence, famine, or an explosion of social and psychic distress. It must not be forgotten that Britain is a part of worldwide economic, political, and ecological networks. We depend on the rest of the world for half our food and for much of the raw materials we convert into manufactured goods to pay for it. This dependency will certainly not diminish.

Yet world population is likely to almost double by the end of the century, and these extra people, like us, will be entertaining rising expectations of the good material life. The majority of them will live in the "under-developed" world and it is unlikely that they will continue to tolerate a situation in which an entrenched minority consumes most of the world's protein, raw materials and energy. We cannot expect them to so generously assist our "development" at the expense of theirs. In addition we will face ever fiercer competition from North America, Japan, and the rest of Europe for those essential resources which, if not entirely depleted in thirty years time, will be exceedingly scarce.

It should not be difficult to predict the consequences of ever more people going after fewer resources. At home there will be social upheaval, while abroad war, both nuclear and conventional will be an obvious diversion.

As for pestilence, with both population and demand increasing so as to seriously strain our present water sources, it would not be unduly alarmist to predict a water-borne epidemic or two during the next couple of decades. René Dubos thinks that even if chemical pollution of water, air and food is kept at a low enough level to cause neither death nor offence to our already blunted senses, over a period of time the result will be "a great variety of delayed pathological manifestations". These could well appear in the near future, and a population so weakened would be highly vulnerable to alien viruses circulating by courtesy of the international airlines from one overcrowded land to another.

We cannot precisely identify whatever misfortune will befall us (misfortunes tend to be clearly identifiable only when they are upon us), but to argue from that as *The Times* does that we should sit back and do nothing is the height of irresponsibility. It is like refusing to take precautions when you cross a busy street because you cannot accurately predict the make of car that will kill you.

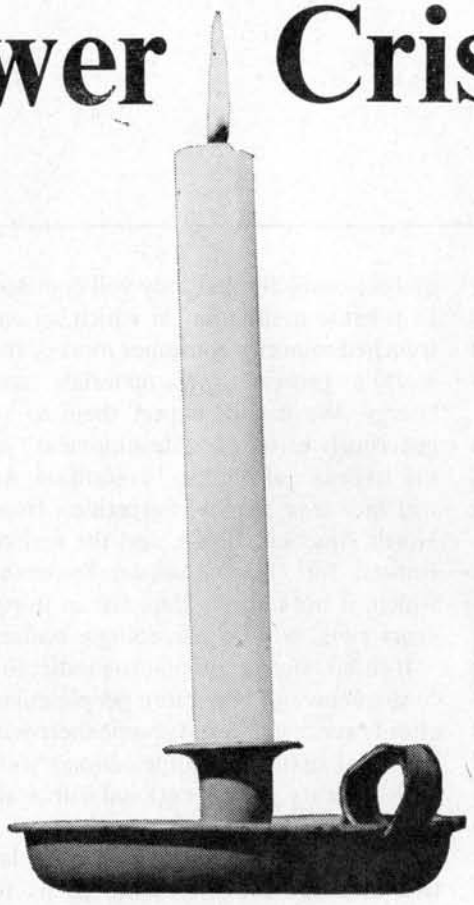
Professor Ivor Mills has eloquently testified to this country's soaring rate of attempted suicide and to growing violence amongst young people. He asks if this is not a sign of social strain and concludes that the quality of life in Britain "is already suffering as a result of the population pressure in an affluent society." Whether or not we become accustomed to this strain is hardly relevant. It is arguable that future generations on this island will adapt to living on top of each other, to poor health, social unrest, and even a diet of yeasts and algae: men have somehow survived concentration camps — but while we may admire man's adaptability it would be plain silly to conclude as *The Times* seems to do that we should permit concentration camp conditions to develop.

It is equally silly to ask that gross environmental pollution and the ultimate exhaustion of non-renewable resources be exclusively attributed *either* to higher rates of consumption *or* to population growth. A child with an abacus could show that both are critical factors. And the assumption that there are purely technical solutions to the problems of growth is a far greater act of faith than assuming we should take steps to safeguard ourselves against disaster.

Such misleading arguments recall to mind the editorials in *The Times* of the thirties, which tried to compromise with the threat of Hitlerism on the grounds that it did not, as yet, embody any identifiable misfortune to the British people. The writer of "A National Policy for People?" believes, like Chamberlain, in "business as usual" when the folly of inaction should be readily apparent.

Nothing was done about cleaning our air despite centuries of warnings—until an extra 4,000 people died in the London smog of 1952. Nobody took any notice of warnings on coal-tip safety—until the tragedy of Aberfan. What kind of catastrophe, and how much suffering will it take to give *The Times* a "double" and to encourage the government to do something about population control?

The Power Crisis



by Peter Bunyard

World energy consumption and the environment

Power failures, with all their associated inconvenience and even dangers, may well be commonplace in the near future if energy consumption continues to soar. After the recent New York failure, Federal Power Commissioner Carl Bagge declared: "We may have to face up to rationing electricity as a matter of national policy." Peter Bunyard examines here some of the environmental implications of our ever-increasing energy production and consumption.

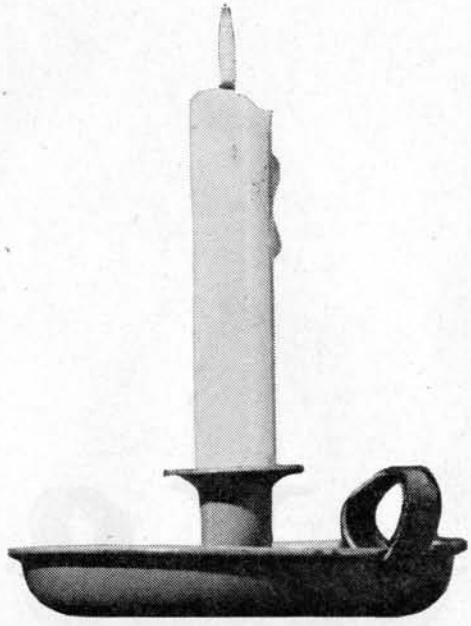
It is apparent that man is indulging in a fantastic energy extravaganza which is totally transforming his way of life. Politicians, economists, industrialists and many scientists view this way of life, with satisfaction: to them it means affluence and a booming economy. Like P. J. Searby of the UK Atomic Energy Authority, who states in *Atom* (1969, *157*, 286) that "energy provides the power to progress . . . with a sufficiency of energy properly applied a people can rise from subsistence level to the highest standard of living . . .", they obviously feel that the benefits of man's new-found affluence far outweigh the disadvantages.

But not everyone is so easily captivated by the power vested in a few billion tons of coal, oil, or uranium ore, and the increasing profligate exploitation of energy as being one of the greatest potential threats to survival that man has ever faced. There are growing fears for example as to what might happen to our climate and other meteorological processes should we continue consuming energy at an ever accelerating pace. Dr David Berkowitz, in *Science* (1970, *169*, 426) points out that we are already releasing a substantial amount of energy into the environment—it adds up to approximately 1/2500th of the total solar radiation balance at the earth's surface, a balance which goes into heating air, evaporating water and driving meteorological processes. If the population

grows at the rate forecast and consumes energy at the rate some scientists and economists would like, he sees a time within the next century when man could be releasing energy into the environment at a rate equivalent to 1/20th of the solar radiation balance with incalculable effects, he adds, on the atmosphere and the world's climate.

In the light of this kind of projection the United States' needs by the year 2000 have a sort of horror-fiction ring some hard rethinking about energy release to the environment from North America alone in 30 years' time is expected to exceed 190 million BTU per year (4BTU are equivalent to 1 kilocalorie), much of which will be released in the Boston-Washington megalopolis area. There will obviously have to be some hard rethinking about energy trends, for three engineers, R. T. Jaske, J. F. Fletcher, and K. R. Wise from the Battelle Memorial Institute, Richland, Washington, have estimated that energy release into the environment will amount to as much as 50 per cent of the total solar radiation striking the area. Water is also closely linked with energy requirements, not only to turn the turbines but also to cool the plant. Engineers estimate that if the United States power requirements were met as currently projected for 1980—just ten years away—then up to one-third of all the water flowing in that vast nation's rivers and lakes will be necessary for cooling. (*The Ecologist*, August 1970.)

If the United States power requirements as projected for 1980 are met, up to one-third of all the water flowing in that nation's rivers and lakes will be necessary for cooling.



Within the next century man could be releasing energy into the environment at a rate equivalent to 1/20th of the solar radiation balance—with incalculable effects on the atmosphere and the world's climate.

How long?

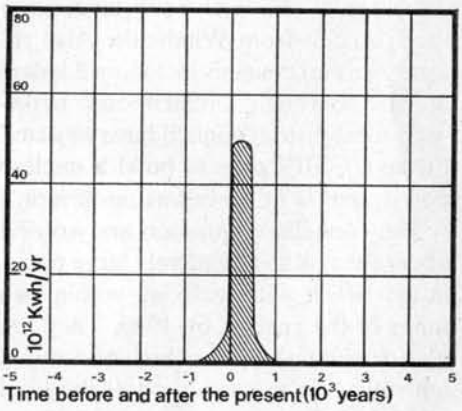
But even if the environmental problems facing mankind were not so momentous, would there always be sufficient energy on tap for as long as man cared to exploit it?

The average person in Britain as elsewhere in the developed nations takes his supplies of energy very much for granted. He is not concerned how petrol got into the garage pumps, nor how at the flick of a switch he can get his electric shaver to work. Neither is he concerned about the future and whether his own personal demands for energy are going to be met. For the most part he believes implicitly that the technologists will solve all the problems.

From this point of view he has many people working for him. There are thousands of geologists and engineers now concerned with finding "adequate supplies of energy in suitable forms, of acceptable quality and at reasonable costs and prices . . ." (Organisation for Economic Co-operation and Development, *Energy Policy*, 1966). But a renowned expert, Dr King Hubbert, sees this great quest for energy as a flash in the pan and he claims in *Resources and Man* (National Academy of Sciences, Washington, D.C. 1969) that "the period of rapid population and industrial growth that has prevailed during the last few centuries, instead of being the normal order of things and capable of continuance into the indefinite future, is actually one of the most abnormal phases of human history . . ."

Most experts more or less agree about how long the fossil fuels are going to last. Dr Albert Parker, for example, states in *Fuel* (1970, *49*, 289) that the coals and lignites that can be mined economically should be sufficient for a good 500 years at the present rates of production and there should be sufficient quantities of petroleum oil to last beyond the year 2000.

This is an extraordinary state of affairs; the fossil fuels have taken some 600 million years to form by geological processes, and here we are, less than a few hundred years after their first being exploited, somewhat self-congratulatory because we have a few hundred years' supplies left. But the real significance of the figures becomes apparent when we look at the recent consumption of the fossil fuels. Coal for example has been mined for about 800 years, and yet one-half of the coal produced during that period has been mined during the last 30 years. The figures are even more dramatic for petroleum—half of the world's cumulative production of this fuel has taken place during the 1960's.



Epoch of exploration of fossile fuels in historical perspective from minus to plus 5,000 years from present (From Hubbert, 1962, fig. 54, p. 91).

Nuclear dice

But man, like an inveterate gambler is clutching at any straw to sustain his profligacy, and one of these straws—nuclear energy—has the eye-catching potential of a titanic. A lot is expected of it and Mr P. J. Searby in *Atom* suggests that by the year 2000 it may be providing one-quarter of the world's energy requirements, and of course much more energy will be consumed then than now. Whether Mr Searby's forecasts are right is a different matter; Britain for example prides itself on being in the forefront of the technology and despite the investment in North Sea Gas, was hoping to have between

one-quarter and a third of her electricity generated by nuclear power in the late 1970's. Yet there have been some recent setbacks, particularly delays in construction and tremendous increases in capital cost, and according to Adrian Hamilton (*Financial Times*, August 6, 1970), by 1975 nuclear energy will only be providing 11.5 per cent of Britain's total output of electricity.

Similar difficulties have afflicted the United States and they too are behind in their nuclear energy programme. They are also having to face an entirely new problem—that of growing hostility towards nuclear reactors by an increasingly aware public. All in all these factors have caused a certain disenchantment with nuclear energy, and the power utilities, having ordered 31 nuclear plants in 1967, only ordered seven last year; since then there have been several cancellations.

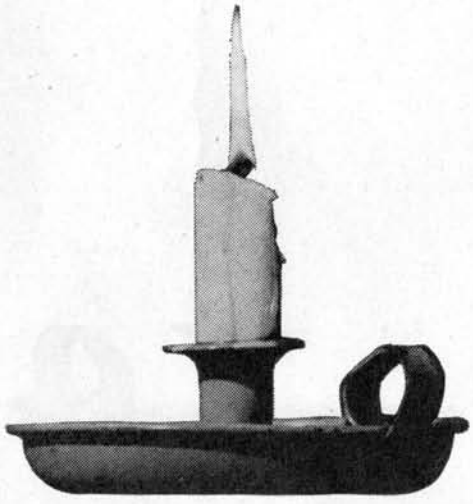
People in Britain are also becoming aware of the dangers of radiation, and there has been some simmering at the U.K. AEA's request to quadruple the discharge of radioactive substances into the Irish Sea from Windscale. Also recently several councils including Kidderminster Borough Council and Droitwich rural district council have objected to the CEGB's plan to build a nuclear power station at Stourport-on-Severn.

The councils in question are worried about the risk to a relatively large population which will be living within two miles of the reactor by 1980. They are also concerned at the loss of "visual amenities" in the area, and at the local effects of the vapour discharged from the cooling towers: for up to 10 million gallons of water, abstracted from the River Severn, will be lost to the atmosphere each day. This vapour, says the Metereological Office, could cause nearby houses to suffer a "very light intermittent drizzle or mist" and houses farther away would feel the "major effect of the plume itself . . . on otherwise pleasant sunny days."

Hope against certainty

On the continent a spate of nuclear power stations are in the offing; indeed some 40 nuclear power stations are planned or under construction in the Rhine catchment area alone (*New Scientist*, August 6, 1970). Elsewhere too, nuclear plants are being planned and built and the demands for uranium fuel are beginning to rise rapidly. According to Dr Hubbert "a very tight situation in uranium supply at anywhere near current prices is likely to develop within the next two decades" and, he claims, unless the breeder-reactor programme can be got underway soon, "the entire episode of nuclear energy will be short-lived".

Half of the world's cumulative production of petroleum has taken place during the 1960's.



"The period of rapid population and industrial growth that has prevailed during the last few centuries . . . is . . . one of the most abnormal phases of human history . . ."

Breeder-reactors could be the answer because unlike the conventional consumer reactor they create as much fuel as they burn. But they are intrinsically more dangerous than even the largest of the consumer reactors. They operate at much higher temperatures; to be economic they need to be loaded with large amounts of uranium-235 or plutonium; and in general they use sodium as a coolant—a substance which explodes violently with water even at room temperatures. Although the technology is advancing fast, no breeder-reactors have yet been commissioned as power plants to feed the national electricity grid.

The other hope is from nuclear fusion, but this has yet to be achieved in a controlled fashion.

Thus in a very short time man has expanded huge capital resources in energy and unless he is lucky with his technology he may find himself facing the next century more or less bankrupt. Undoubtedly he will always have recourse to other forms of power production—solar energy, the tides, water and wind power, geothermal power, but these sources of power although extremely useful can only supply a very small proportion of man's present demands for energy. Palmer Putnam in *Energy in the Future* (Macmillan, London, 1954) sees the plausible input from all these sources added together at costs no higher than twice those in the 1950's coming to between 5 and 10×10^{18} BTU over a total period of 100 years. The possible demand for energy over that period of time could well run into 50 times that amount.

Electric shocks

The crisis is already looming, for the big cities with their very heavy dependence on power have already begun in some instances to outrun their supplies. The black-outs and brown-outs in the United States tell their own story, and according to *Time* (August 10, 1970) during the recent devastating smog that enshrounded the major cities of the north-east, Con Ed—the New York State power utility—had to dole out up to 7,245 MW of electricity in the peak consumption hours, with the safety margin only a few hundred megawatts above this. For once customers were asked to "unplug everything from air conditions, lights to escalators".

But even if the electric power utilities did expand to meet all possible future demands they would soon find themselves not only polluting the environment with enormous quantities of waste, including carbon dioxide, sulphur dioxide and possibly krypton-85 among other radioactive substances, but they would soon run out of pure physical space, for the power plant with its transmission lines and transformers encompasses a large area of land. Indeed it would not take many doublings of the demand for electricity before people would find themselves ousted from the

land by pylons and all the other paraphernalia of the power industry (*Environment*, March 1970.)

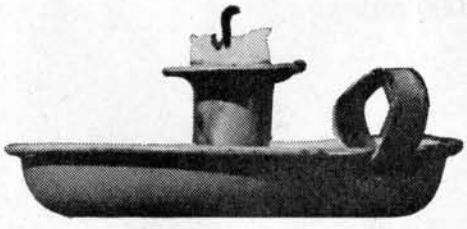
Not that there are any signs at present that energy consumption is likely to go down. Take the world energy consumption for example; in 1950 it was reckoned as equivalent to the burning of 2,642 million tons of coal (one ton of coal gives off 7 million kilocalories of energy), in 1967 it had gone up to 6,004 million tons of coal equivalent, and by 1980, according to Albert Parker (*Fuel*, 1970) it could be up to 8,000 million tons of coal equivalent. The population in the meantime went from 2,517 millions in 1950 to 3,420 millions in 1967 and will probably be in the region of 4,000 millions by 1980. So, while the population would have increased approximately 1.6 times in 30 years the world's energy consumption would have increased over three times—double that of the population. The greatest demand at present is for electricity: for example in 1960 the UK's per capita consumption was 2,600 KWh per annum, and in 1967 it had risen to 3,796 KWh per annum. India's per capita consumption for these two years was 46 and 81 KWh per annum, and the United States' 4,698 and 6,612 KWh per annum (kilowatt-hours.) Projections for 1980 indicate that the United States' per capita consumption of electricity may be up to 11,500 KWh per annum.

A great many power stations will have to be built over the next few years to provide this hungry planet with power; power that has enabled Britain for example to increase its numbers of vehicles on the roads from some 400,000 in 1914 to more than 18 million now, with 26 million projected by 1980 (Parker, A.).

Fatal transition

Everyone realizes that the present phenomenal expansion of the world's population must one day cease but very few people have considered why it is that the population explosion is such a contemporary phenomenon. Palmer Putnam suggests that the most significant factor has been the transition from illiterate subsistence farming to what he calls literate industrial-urban farm patterns. But what he emphasizes is that this transition has to be accompanied by an increase in energy consumption and therefore "a great increase in world population without a great increase in demand for energy is not plausible."

Unless the breeder-reactor programme can be got underway soon, "the entire episode of nuclear energy will be short-lived".



Power has enabled Britain to increase its numbers of vehicles on the roads from some 400,000 in 1914 to more than 18 million now, with 26 million projected by 1980.

But we are now running into an extremely awkward situation. We are running out as we have seen of some of our main sources of energy such as copper, lead, tin, zinc, and the precious metals (Professor Preston Cloud. *The Ecologist*, August 1970) which, with other substances in short supply are extremely important for the capital growth of a nation and for the viability of its industrial processes.

What will happen when the industrial nations can no longer lay their hands on the raw materials that have become so essential for their existence? How for example can a nation as heavily populated as Britain survive when its industries grind to a halt and it has nothing to sell abroad—how then will it pay for imports of food? Equally important, what will happen to agriculture when the farmer can no longer afford chemical fertilizers, insecticides, antibiotics, fuel to run machinery or feeding stuffs for his livestock? What of productivity then?

Blind faith in progress

It does not need much stretch of the imagination to see that terrible chaos lies ahead unless Britain and the other industrial nations turn their backs on their policies of unmitigated growth and expansion. Yet, judging by the exhortations of their leaders for greater productivity and by their obsession with growth, there are few signs that any of these nations are coming to terms with the future. Instead the population expands inexorably, people clamour for a greater and greater share of the dwindling profits, like a laval stream the raw effluent of industry flows ever more profusely into the environment, and the swollen numbers of the poor and deprived see less and less of the promised land.

No solution is simple, but the present blind faith in progress and in the power of a growing gross national product are obviously leading us to an abrupt dead-end. Yet when we think how much we have to depend on energy—for travelling, for heating our homes and running the household gadgetry, for making the nine to five office job possible, for communications—any thought of cutting down on energy consumption may seem out of the question.

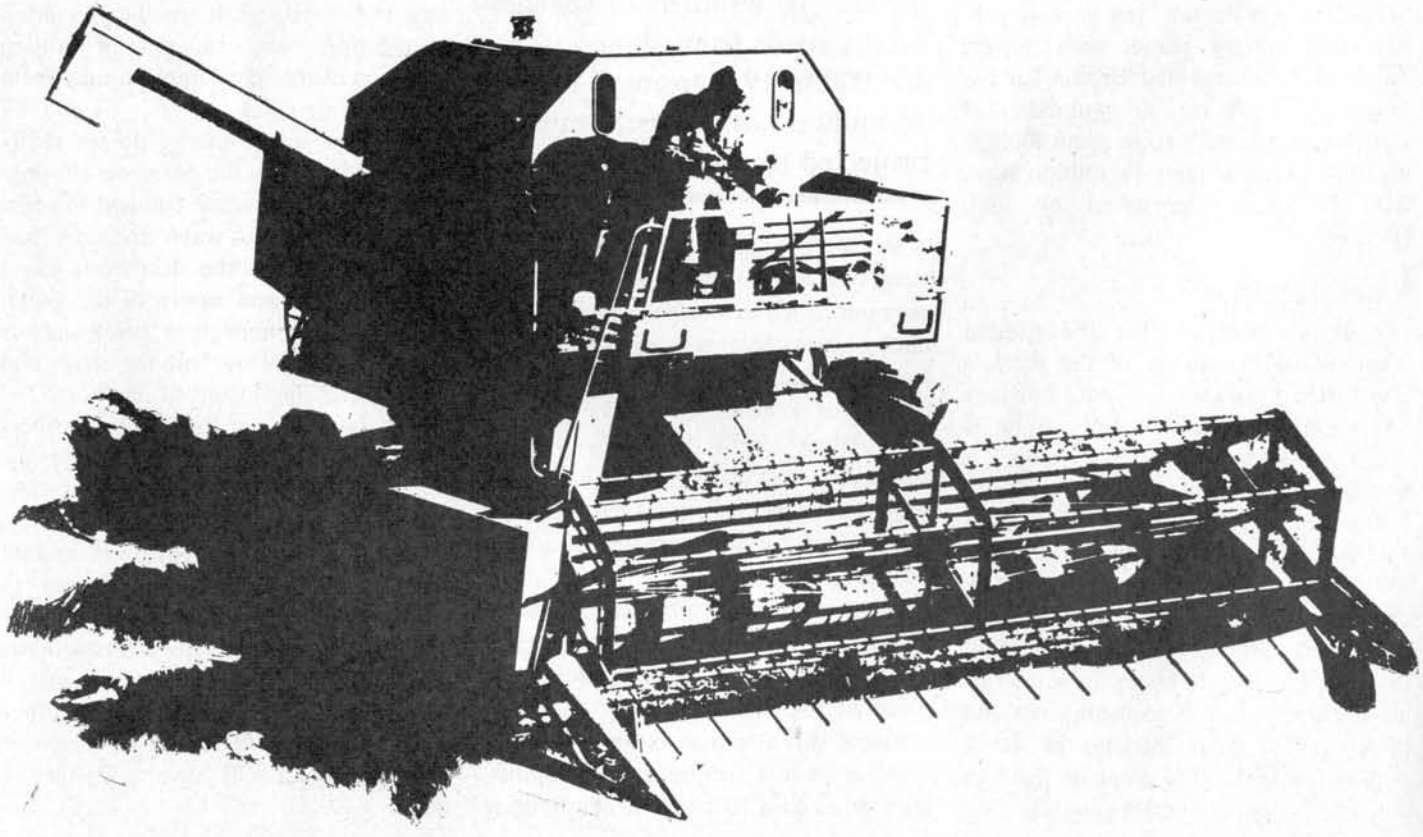
But how much energy do we really need, and what is the price we are paying for it? Has anyone counted the cost of the poisoned air, water and land; has anyone measured the disastrous effect on our health and sanity of the noise, squalor and fumes that beleaguer us when we venture out into the street and to an increasing extent in our home?

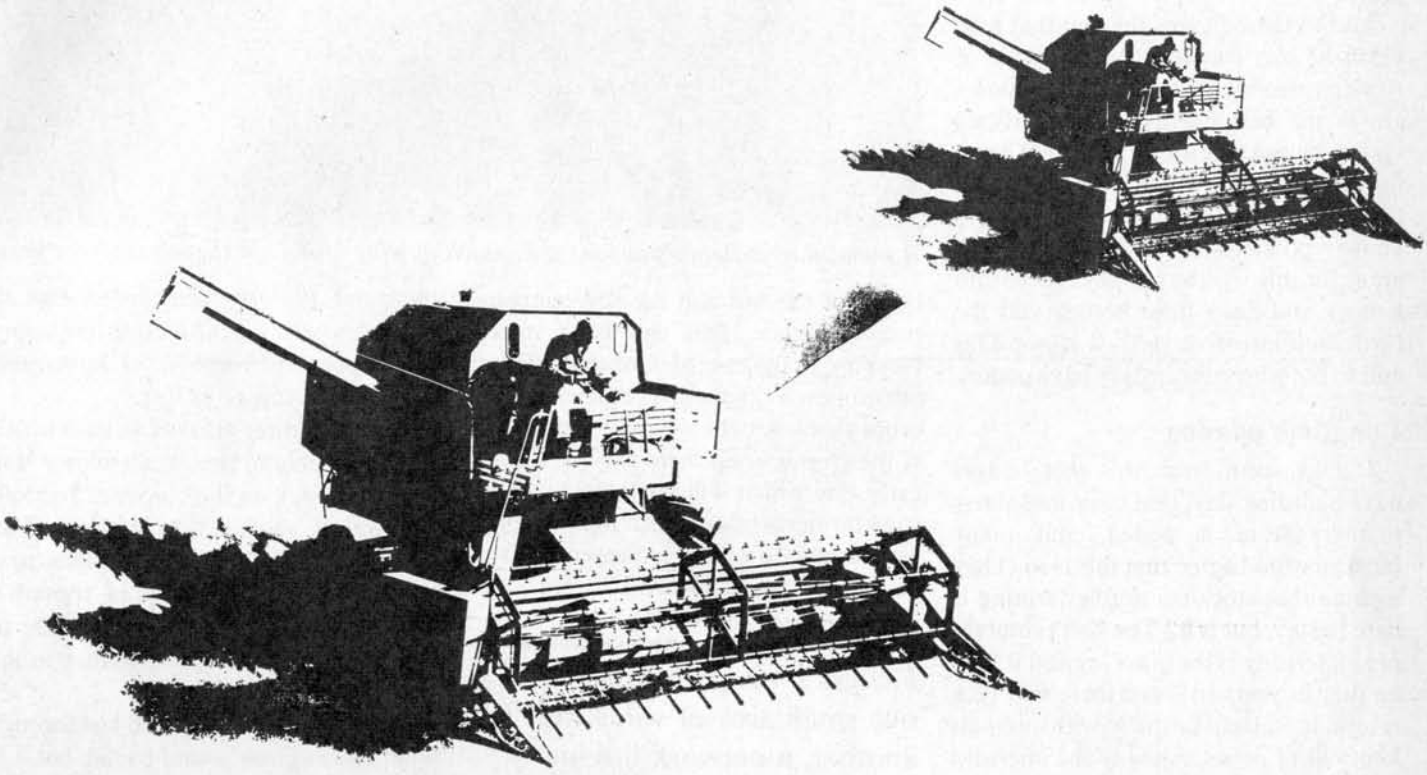
Not that these are the only side-effects —there are many others which are impossible to measure, including the destruction of peoples and their cultures, and of a bewildering array of animal species. Some of us have begun to realize that the equation does not balance up: what man gains through the consumption of more and more energy he loses a thousand times over in other ways. And soon there will be no going back; for man will have sold himself out.

WHERE HAVE ALL THE HEDGES GONE?

by Michael Allaby

The English countryside is changing. If you leave the motorway and take to the by-roads of almost any rural area the landscape may seem strange. If you are accustomed to, and expect, winding, leafy lanes with high hedges on either side you may be disappointed. For the hedges and trees are being removed. The change is more noticeable in some parts of the country than in others, but Britain as a whole loses something like 5,000 miles of hedgerow each year. This figure is a compromise. Some estimates have been as high as 10,000 miles.





In the West Country fields are small and you don't notice that the hedges are going—at least their absence is less apparent than in the traditionally more open parts of East Anglia, where pathetic attempts to imitate American methods for the sake of the "big wheat country" touch send combine harvesters sailing out three or four abreast across the diminutive prairie which stretches hedgeless to the horizon in every direction.

Farming in this country has changed, is changing, and nobody doubts it. It is becoming more industrialised, more conscious of efficiency along shop floor lines. It uses larger machines and fewer people. Labour costs have been rising and the drift away from rural areas has created labour shortages. The economic reasons for the disappearance of the hedges are complex and to the farmer, in the short term at least, convincing. But there are serious considerations both agronomic and ecological which should be taken into account before we let them go.

Hedge money

A traditional stockfarmer who grazes his animals out of doors might have 150 acres divided into 15 fields of 10 acres each. This means he will have about $4\frac{1}{2}$ miles of hedgerow of which $2\frac{1}{4}$ miles mark the boundary of his farm. To maintain these by the cheapest method, mechanical clipping, costs 6s. a chain a year. If he wishes to have his hedges laid in the traditional manner, this will cost him about £6 per chain every ten years, or 10s. a chain a year. Few hedges are laid except in areas where the hunt is strong. Such a farmer may be tempted to remove some of his internal hedges, say 880 yards, leaving the boundary hedges intact. The hedges he removes he will replace with a wire fence. This will leave him with 4 miles to maintain. The cost of removing the half mile will be £4 a chain—£160. He will save the cost of clipping, which will amount to £12 a year, but the fence will cost £10 a year to maintain and at 6s. a yard it will have cost him £264 to erect. He will be out of pocket.

However, if his fields are under 40 acres in size and he wishes to grow arable crops as well as keeping his stock, he will have difficulty in manoeuvring his farm machines. So he may consider removing internal hedgerows without replacing them. Not only will he save the cost of maintenance and achieve more efficient use of machinery, but for every mile of hedgerow he grubs up he will gain an acre of land for cropping, which could bring him in £44 a year. Now the picture begins to look rather different. If he adds together the saving on maintenance and the increase in his cropping area he will find he can expect a 23 per cent return each year on the capital he

invested on removing the hedge.

He may go further. He may find that his return on his arable crops is so much greater than that from his stock that he decides to sell the animals. Now he will need no hedges to retain or shelter them. Even if his fields are already 40 acres each he will be tempted to remove the remaining hedges to save the cost of maintaining them. The gain in crop acreage and the saving in maintenance will pay for the cost of removal in a few years.

Add to these figures the fact that provided he can convince the Ministry of Agriculture that the changes he proposes are in the best interest of his farming system he can receive a 25 per cent grant for removing the hedgerows and if he needs to replace any of them with fences he may possibly be entitled to a further grant for this. As the poultry moves into battery and deep litter houses and the cattle into intensive yards it is not difficult to see where the hedges have gone.

Longtime passing

It may seem from this that hedges have had their day, that their usefulness to agriculture is ended, and many farmers would agree that this is so. They assume that stockless arable farming is here to stay, but is it? The best preserver of soil fertility is the grass ley and it may be that in years to come there will be a return to mixed farming with animals kept out of doors. Already the intensive livestock units are experiencing difficulties which may eventually make them uneconomic. If this should happen we may wish we had retained our hedges.

Even in the short term this is not the whole story. A hedge will help to control

A farmer can expect a 25 per cent grant from the Ministry of Agriculture for removing hedgerows, and if he needs to replace them with fences he may be entitled to yet a further grant.

drainage and its removal may mean field drains must be laid. It provides shelter from the wind for the soil and crops as well as for stock, so that for a distance on the lea side of a hedge equal to twice the height of the hedge wind speed is reduced to zero and for a distance equal to twelve times the height of the hedge it is halved. In the sheltered area moisture is conserved in the upper

A handful of Britain's precious soil, much of which is lost to the winds every year.

layers of the soil and the soil temperature is higher. This can be a mixed blessing. In the case of corn crops it may cause uneven ripening, though with other crops this is less likely to be a problem. If the crop is grass there may be a good early bite which will be valuable to the stockfarmer whose winter feed supplies are running low. The increased yield of grass may be as high as 20 per cent,

Hedges form pathways from one small area of wilderness to another, a network linking together the large habitats throughout the country.

though with other crops the figure may be lower. The figure of 20 per cent is critical, for this is the minimum crop increase which is required to pay for the maintenance of the hedge and so make it an immediate economic advantage.

Blowing in the wind

The removal of hedges may cause other problems. Each year in parts of East Anglia and the east Midlands, there are soil blows. From the 16th to the 20th of March, 1968, wind speed across the fens rose to above 20 knots with gusts of over 40 knots. Snow ploughs were called out to clear the topsoil from the roads and dykes were filled to the brim. The immediate cost to farmers amounted to up to £25 an acre in lost seed and fertiliser. Admittedly, this was a particularly severe example and farmers in the area had to go back to 1955 and 1941 to recall blows like it. But every year for at least a few hours wind speed rises above 33 knots and a little more topsoil is lost.

There are three areas of Britain which are susceptible to large scale blows: the fens, the Breck on the border of Norfolk and Suffolk and the light, sandy soil on the border of Lincolnshire. The peat fens lose about one inch of topsoil a year, but seven eights of this is due to oxidization of the organic matter in the peat.

The one eighth of an inch lost through wind erosion may sound trivial, but it is being lost from the most fertile soil in Britain and it is not replaceable, because the highly organic nature of the peat makes it impossible for the soil to renew itself from the parent rock. A century of careless farming could destroy a level of fertility that has been built up over millennia.

Answer from the land

The Brecklands are very similar topographically to Schleswig-Holstein, the German Land, which stretches from the Elbe to the Danish border, bounded on the west by the North Sea and on the east by the Baltic. The highest ground is only about 90 metres above sea level and much of the area is at 30 metres or less. In places it lies below sea level. Roughly one third of the land area is low lying marsh and fen.

The planting of hedges in Schleswig-Holstein began around 1800, at about the time of the Enclosure Acts which gave Britain its characteristic landscape. In the 1870s to '90s co-operatives were

established which required their members to plant hedges in proportion to the area of their farms. Banks gave good loans for hedge planting. In the 1930s German farming went 'economic' and it was decided, centrally, that hedges and windbreaks were unnecessary. Many of them were removed.

The policy had its opponents. Probably the most notable was Professor Alwin Seifert, the designer of the first Autobahnen, who visited Schleswig-Holstein for the first time in 1934 and saw what was happening. From then on he campaigned against the agricultural economists in Berlin. Twenty years later it was acknowledged that he had been right.

Between 1954 and 1967, over 3,800 km (2,425 miles) of shelter were planted. In 1957 an area on the Danish border was being planted with windbreaks, some form of shelter was planned for the whole of the western fenlands, and more substantial protection was planned for some of the higher ground. At the same time the Ministry proposed to remove some hedges from the over-protected areas. The situation for the farmer now is that he may not remove any hedge or windbreak without the express permission of the Government and this is granted usually only if he proposes to replant a similar length elsewhere. The aim is that there shall be not less than 80 metres per hectare (33½ yards per acre) anywhere in the Land.

The effect of hedges on crop yields in Schleswig-Holstein was measured between 1933 and 1943 and an increased yield was found in direct proportion to the amount of cover:

Hedge length in metres/hectare	20	30	40	50	60	70	80
% increase in crop yield:							
Winter wheat	5.0	6.7	10	15	19	26	35
Winter rye	3.6	5.1	7.2	9.5	12	14	17
Maincrop potatoes	5.0	7.3	10	13	15	17	20

Effect of hedges on crop yields in Schleswig-Holstein.

Remembering that it is an increased yield of 20 per cent which makes a hedge economic in this country, it would seem that under similar conditions to those in Schleswig-Holstein hedges will benefit winter wheat and, to a lesser extent, potatoes. If other crops were considered the advantage might be even more apparent. Schleswig-Holstein conditions will be found in any flat, exposed area of land with a light soil.

> In Schleswig Holstein hedges have increased crop yields by 20 per cent, and farmers may not remove them without the express permission of the government.

Other considerations

Agronomic arguments are not likely to impress the town dweller. While he is willing to concede that farmers must make a living he finds it difficult to think of the countryside as a shop floor. Of course, he is right. The countryside is required to do far more than produce food and there may be situations in which other factors must override purely economic considerations.

We may care about wildlife, for example, and believe that it should be protected. From this point of view hedges are vital. Wildlife needs cover and ecologically hedges are very similar to woodland edge, which is one of the richest habitats. An acre of woodland may contain 2 pairs of blackbirds; an acre of hedge may contain 40 pairs. Hedges form pathways from one small area of wilderness to another, a network linking together the larger habitats throughout the country. If these links are broken the larger areas will become isolated. Fauna living in them will adapt to the particular environment and should there be any change in that environment they may be wiped out. The loss of much of our wild flora and fauna is one price we may have to pay for more efficient farming.

The richness and diversity of the British landscape, the patchwork fields, the trees and hedges, are an attraction to tourists. This is a direct economic benefit which could and should be calculated. Would Americans be willing to travel up to 5,000 miles to see a prairie?

One vast prairie?

The pattern of the countryside is determined by the farmers on the basis of the short term economics of their industry. If society as a whole wishes its landscape to be managed differently, if it wishes factors other than agronomic ones to be taken into consideration, then it is up to society to make known its demands and to encourage the farmer to provide the countryside it wants. If the economics of farming obstruct this, then the economics should be changed. A grant for the maintenance of hedges, for example, would reduce the 5,000 mile annual loss. If boundary and roadside hedges were to be considered separately from internal hedgerows it might be possible for local authorities to contribute to their upkeep.

> A century of careless farming could destroy a level of fertility that has been built up over millennia.

What we must not do is make demands upon the farmer that he is not able to meet. It is senseless to ask him to put himself out of business by burdening him with costs which will bankrupt him. The countryside belongs to all of us, is of value to all of us. It is up to us to see that it is possible for those who manage it to do so in the best interests of everyone. There is not much time. It will not be many years before the whole of East Anglia becomes one vast prairie. Action to save our hedges and trees is in the best interests of farming for in all probability a farm that looks good is good.

Will Man Adapt to Megalopolis?

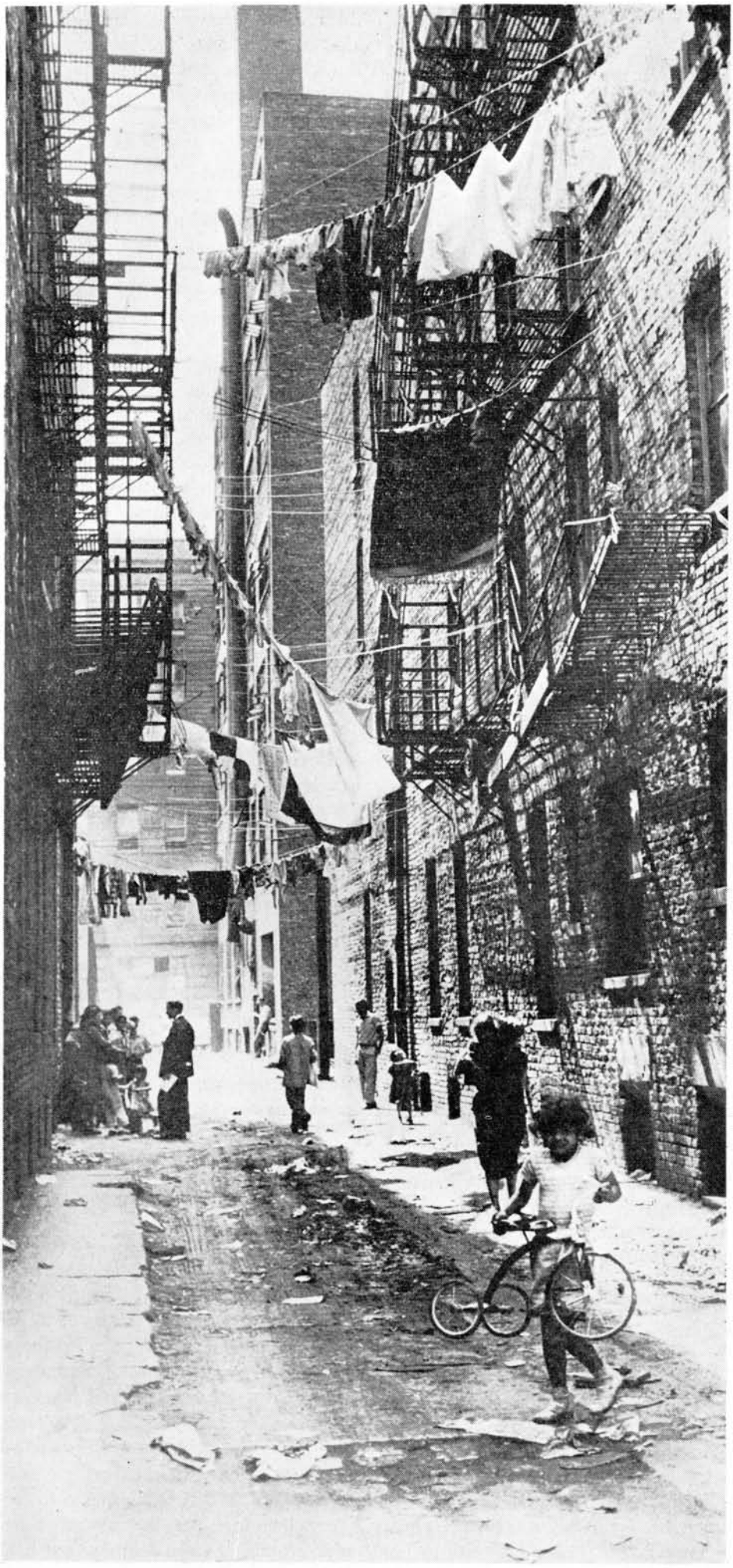
by René Dubos

Member and Professor, The Rockefeller University, New York

One of the most serious threats facing modern man is his very adaptability. He has been able to prosper and be reasonably healthy even in such a harsh environment as the modern urban agglomerations he has created. But the hidden costs of this pseudo-adaptation are unknown. During the next decade it is more than probable that today's evidence of psychic impoverishment and social distress may well be used as proof in the case for rejecting megalopolis.

It can be taken for granted that the world population will increase greatly in the immediate future and probably double within much less than a century. The largest percentage of human beings will be born and will develop within the confines of large urban agglomerations. Whatever individual tastes may be, mankind will thus be shaped by the urban environment.

In view of this fact, it is reassuring to know that contrary to what is commonly assumed (see for example *The diseases of civilization: the declining health of*



urban man, by Robert Waller, in the August issue of *The Ecologist*) life expectancy and the general state of health are now at least as good in certain very large prosperous cities as in small towns and rural areas. Most city dwellers in London, Paris, Moscow, Sydney or New York look as vigorous and live as long as farmers or fishermen anywhere in the world. But while there is no evidence at present that physical and mental health need be impaired by urbanization and industrialization, the urban experience of mankind is so limited that a final judgement of the issue is not yet possible. It seems worthwhile, therefore, to look into the future, beyond the known facts, and examine what possible dangers threaten urban man. Admittedly, civilized man could survive and multiply in underground shelters, even though his regimented subterranean existence left him unaware of the robin's song in the spring, the whirl of dead leaves in the fall, and the moods of the wind. In the United States, schools are being built underground, with the justification that the rooms are easier to clean and the children's attention is not distracted by the outdoors!

Millions upon millions of human beings who have developed in the urban and industrial environment are no longer aware of the stench of automobile exhausts or of the ugliness generated by the urban sprawl; they hardly mind being trapped in automobile traffic, or spending much of a sunny afternoon on concrete highways among streams of motor cars. Life in the technologized environment seems to prove that man can become adapted to starless skies, treeless avenues, shapeless buildings, tasteless bread, joyless celebrations, spiritless pleasures—to a life without reverence for the past, love for the present, or poetical anticipations of the future.

Dangers of adaptation

While there is no doubt that man can function and reproduce in a completely artificial environment, it is probable that alienation from nature will eventually rob him of some of his important biological attributes and most desirable ethical and esthetic values. Until the present era, the population of all large cities has been constantly renewed by immigration from rural areas or from underdeveloped countries, but this biological transfusion will soon come to an end as the whole world becomes urban-

ized. Throughout history, furthermore, city dwellers had easy access to nature; but farmland, meadows, and woods are now progressively eliminated by the urban sprawl. Yet, the pathetic weekend exodus from urban areas and the wood-burning fireplaces in overheated city apartments bear witness that soil, water, sky and even fire still represent values meaningful for human life. In fact, it is questionable that man can retain his physical and mental health if he loses contact with the natural forces that have shaped his biological and mental nature. Man is still of the earth, earthy, and like Anteus of the Greek legend, he loses his strength when both his feet are off the ground.

The most interesting effects of the environment for man's future are the ones that enable him to convert genetic potentialities into phenotypic realities. In this regard, it must be emphasized that mere exposure to a stimulus is not sufficient to affect the phenotype. Environmental information becomes formative only when it evokes a creative response from the organism.

The social importance of the formative effects exerted by the environment was expressed in a picturesque way by Winston Churchill in 1943 while discussing the architecture best suited for the new Chambers of the House of Commons. The old building, which had been badly damaged by German bombardment was uncomfortable and impractical. Yet Mr Churchill urged that it be rebuilt exactly as it was before the war, instead of being replaced by one equipped for greater comfort and with better means of communication. He argued that the style of parliamentary debates in England had been conditioned by the physical characteristics of the old House, and that changing its architecture would

Life in the technologized environment seems to prove that man can become adapted to starless skies, treeless avenues, shapeless buildings, tasteless bread, joyless celebrations. . . .

affect not only the manner of debates but also, as a result, the structure of English democracy. In his words, "We shape our buildings, and afterwards our buildings shape us."

Times Square, New York

Social conditioning

Just as the physical environment can condition behaviour, so does the social environment condition the way people perceive space in interpersonal encounters. Suffice it to quote here a few statements by Edward T. Hall, a social anthropologist who has repeatedly emphasized that people brought up in different cultures live in different perceptual worlds.

"Consider for a moment the difference between a Greek who garners information from the way people use their eyes and look at him, and the Navajo Indian whose eyes must never meet those of another person. Or consider the disparity between a German who must screen both sight and sound in order to have privacy, and the Italian who is involved with people visually or auditorially almost 24 hours a day. Compare the sensory world of the New England American, who must stay out of other people's olfactory range and who avoids breathing on anyone, and the Arab who has great difficulty interacting with others in any situation in which he is not warmly wrapped in the olfactory cloud of his companion. All the senses are involved in the perception of space; there is auditory, tactile, kinesthetic, and even theral space. . . . The kind of private and public spaces that should be created for people in towns and cities depends upon their position on the involvement scale." Needless to say, the national differences in perception of space during interpersonal encounters are not genetically determined; they are expressions of social influences rooted in history.

The formative effects of the environment are especially pronounced and lasting when they occur during the early phases of life. The organism's structure —physical and mental—can be strongly affected only while the processes of organization are actively going on. Furthermore, as the biological system achieves its organization, it becomes increasingly resistant to change. Organization inhibits reorganization. These statements are valid not only for anatomical and physiological differentiation, but also for behaviour patterns. A recent study of Boston slum children, for example, found that they continued to conform to the ways of life of their destitute parents despite intensive efforts by skilled nursery school workers to change their habits and tastes. As early as three or four years of age, the children were already victims of environmentally and culturally determined patterns; and there was much reason to fear that they would, in turn, imprint

It is questionable that man can retain his physical and mental health if he loses contact with the natural forces that have shaped his biological and mental nature.

their own children with these patterns. They were not culturally deprived; they had a slum culture from which they could not escape.

The most crucial phases of physical and mental development occur very early in life. By age six, the brain is three times larger than it was at birth; its cytoarchitectonic structure has been essentially completed through an elaborate sprouting of dendrites and immense proliferation of synapses: language, thought, imagination, and the sense of self-identity have reached a high level of development. It is legitimate to assume, therefore, that the very structure of the brain and the fundamental pat-

terns of behaviour are conditioned by the early experiences of extrauterine existence, because their development occurs during the period when the infant is first subjected to the stimuli of the total environment.

The immense plasticity revealed by the development of the brain and of behaviour patterns accounts for the fact that nurture affects so profoundly the phenotypic expression of human nature. Granted the genetic diversity of human beings, each individual genotype allows a very wide range within which experience can shape the phenotype.

Evolutionary constraints

Man's evolutionary past naturally imposes constraints on his life in the modern world. In fact, the frontiers of technology and sociology are determined by biological limitations built into man's fundamental genetic make-up, which has remained much the same since the late palaeolithic times, and which will not change significantly in the foreseeable future.

There certainly exist in the human genetic pool, on the other hand, rich potentialities that have not yet been fully expressed and that will permit man to continue evolving socially. The diversity of civilizations originates from the multifarious responses made by human groups to environmental stimuli. This versatility of response, in turn, is a consequence of the wide range of potentialities in human beings. Of course, persons differ by reason of their genetic constitution. Except for identical twins, no two individuals are genetically alike. Equally important is that physical and mental traits are profoundly influenced by the accidents of experience, which are never exactly the same for two different people. As a result, each person is unique, unprecedented and unrepeatable.

Contrary to popular belief, genes do not determine the traits of a person; they merely govern his responses to the life experiences out of which the personality is built. Through complex mechanisms that are only now being recognized, environmental stimuli determine which parts of the genetic endowment are repressed and which parts are activated. In other words, the life experiences determine the extent to which the genetic endowment is converted into functional attributes. From nutrition to education, from the topography

Pall Mall, Trafalgar Square

of the land to religious background, countless are the influences that contribute to shaping the body and the mind of man. Each one of us lives, as it were, in a private world of our own.

> In so far as possible, the duplication of uniformity must yield to the organization of diversity.

Whether physical or mental, human potentialities can become expressed only to the extent that circumstances are favourable to their actualization. Society thus plays a large role in the unfolding and development of man's nature.

Diversified environments

In practice, the latent potentialities of human beings have a better chance to become actualized when the social environment is sufficiently diversified to provide a variety of stimulating experiences, especially for the young. As more persons find the opportunity to express their biological endowment under diversified conditions, society becomes richer and civilizations continue to unfold. In contrast, if the surroundings and ways of life are highly stereotyped, the only components of man's nature that flourish are those adapted to the narrow range of prevailing conditions. Hence the dangers of many modern housing developments, which, although sanitary are inimical to the development of human potentialities and are designed as if their only function was to provide disposable cubicles for dispensable people.

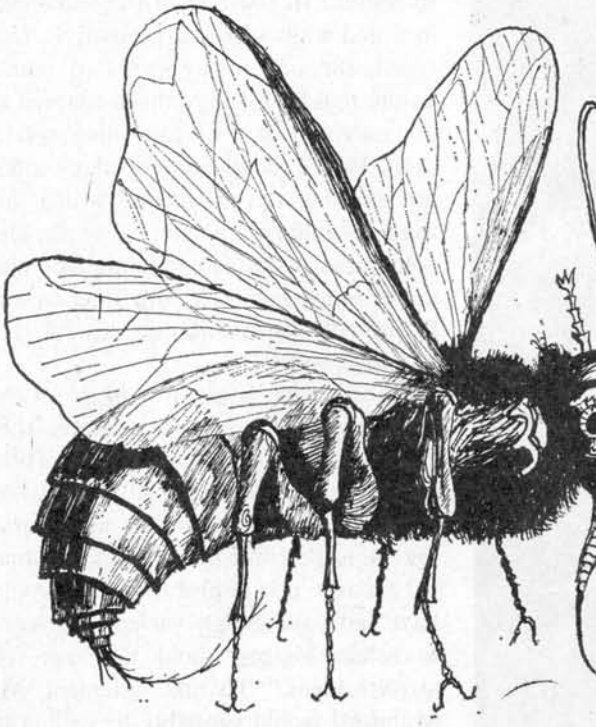
In his recent book, *The Myth of the Machine*, Lewis Mumford states that "If man had originally inhabited a world as blankly uniform as a 'highrise' housing development, as featureless as a parking lot, as destitute of life as an automated factory, it is doubtful that he would have had a sufficiently varied experience to retain images, mold language, or acquire ideas." To this statement, Mr Mumford would probably be willing to add that, irrespective of genetic constitution, most young people raised in a featureless environment and limited to a narrow range of life experiences will be crippled intellectually and emotionally.

We must shun uniformity of surroundings as much as absolute conformity to behavior, and make instead a deliberate

> If man's surroundings and ways of life are highly stereotyped, the only components of his nature that flourish are those adapted to the narrow range of prevailing conditions.

effort to create as many diversified environments as possible. This may result in some loss of efficiency, but the more important goal is to provide the many kinds of soil that will permit the germination of the seeds now dormant in man's nature. In so far as possible, the duplication of uniformity must yield to the organization of diversity. Richness and variety of the physical and social environment constitute crucial aspects of functionalism, whether in the planning of cities, the design of dwellings, or the management of life.

Adapted by the author from his *Environmental Determinants of Human Life*, published in *Environmental Influences*, ed. David C. Glass, Rockefeller University Press, NY 1968.



MAN MADE PLAGUES

by Gordon R. Conway

Pesticides, unless used with caution and subtlety, can drastically increase pest problems by destroying natural controls. The more frequently such pesticides are used the more serious are the emerging pest outbreaks.

In the state of Sabah in Malaysia pesticides have been particularly effective against rice pests; dieldrin has provided a cheap and extremely effective means of combating the locust outbreaks that have previously been so serious, and DDT and dieldrin have been the main instruments of the successful malaria-control campaigns. However, my experiences, and those of other entomologists in Malaysia, suggest that the increasing reliance on these pesticides has not been wholly beneficial. Used without regard to ecological factors they may aggravate existing pest problems or create new ones, and they can produce far-reaching side effects.

Let us take cocoa pests in Sabah as an example. Cocoa is a new crop in Sabah; the first commercial plantings were made in 1956. Ten years later there were some 6,000 acres under cultivation. In 1958 a research station was set up by the Department of Agriculture at Quoin Hill, and as entomologist in the department from 1961 to 1966, I was concerned with cocoa pest problems.

As the cocoa acreage has grown, the primary forest has been pushed back, although the cocoa remains essentially an island within it. Much of the cocoa is thus physically close to primary forest.

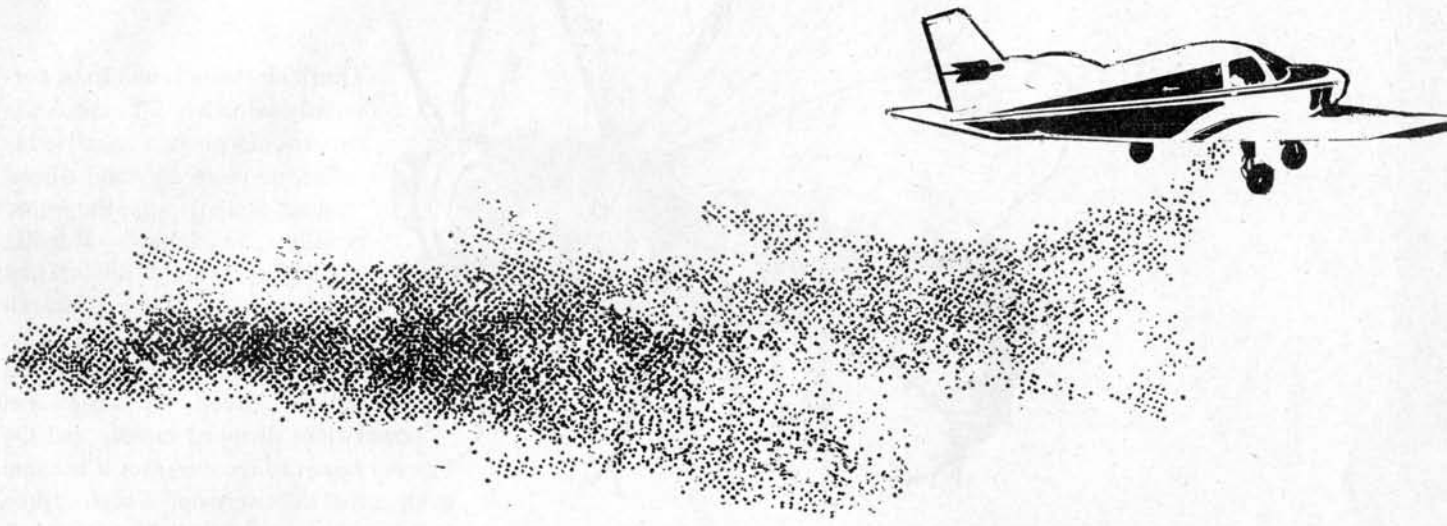
The pests arrive

The first serious insect pests at the Cocoa Research Station were borers—a ring bark borer and two branch borers. The former tunnels into the young cocoa tree, and from the shelter of the tunnel feeds on the bark, often killing the tree. The branch borers tunnel along the upper branches and shoots attacking larger branches as they grow. Initially neither pest was present in large numbers, but they soon became serious pests. During the first two years of growth deaths often amounted to 20 per cent or more per field.

The earliest attempts at control were by hand; labourers were employed to seek out fresh borings and destroy the larvae inside by inserting a wire or by injecting toxic chemicals. This method soon became too costly in labour, and in 1959 spraying with high concentrations of insecticides began. Dieldrin or DDT were applied as high-volume sprays to the branches, fork, and trunk. Spraying resulted in some degree of control, but the inaccessibility of the borer larvae precluded very high kills.

In 1959 several other pests, including various leaf-eating caterpillars, aphids, and mealybugs, became noticeable. Again, these were present in very low numbers, but were considered dangerous and in early 1960 further general spraying was carried out as a prophyllactic measure. Dieldrin, endrin, DDT, BHC, lead arsenate, and a white oil (Albolineum) were variously used and throughout 1960 and 1961 the cocoa received a very heavy insecticide coverage.

The situation, however, gradually became worse. First, the branch borers increased, becoming abundant by the beginning of 1961. Not long afterwards, there were outbreaks of three other



pests. Two were leaf-eating caterpillars: one a looper, or geometrid; the other a nettle caterpillar, or limacodid, hitherto known in Sabah only as a major, periodic pest of coconuts. The third outbreak was of a flatid, or plant hopper. All of these became extremely abundant, the hopper so much so that on being disturbed, the adults, which resembled moths, rose in large clouds from the branches. Both the leaf-eating caterpillars caused considerable damage to the young flush leaves.

A bag of silk

In July 1961 a fourth outbreak, which proved to be the most serious of all, occurred. This consisted of several species of bagworms (Psychidae). As the name implies, the larval bagworm lives in a bag of silk, which is skilfully covered with pieces of leaf or short lengths of twig. The damage caused by bagworms is great, since they are not only voracious feeders but they also chew off large areas of leaf surface to make the bags. The bag gives the insect considerable protection throughout its lifetime, not only from weather but also, apparently, from insecticides. In tests, these showed almost complete resistance to DDT, BHC, dieldrin, diazinon, and dimethoate. However when the larvae were removed from their bags and dipped in the same concentration of insecticides kills were rapid and complete.

The outbreak of 1961 began in one field at the Cocoa Research Station and spread rapidly. By late 1961 some 70 acres were affected, and repeated defoliation had produced large numbers of bare and dying trees. Spraying with DDT, dieldrin, and the other insecticides continued throughout 1961, but the bagworm outbreak persisted unaffected. Some attempt at hand collection was made, but this proved ineffective and very costly. The other outbreaks also continued.

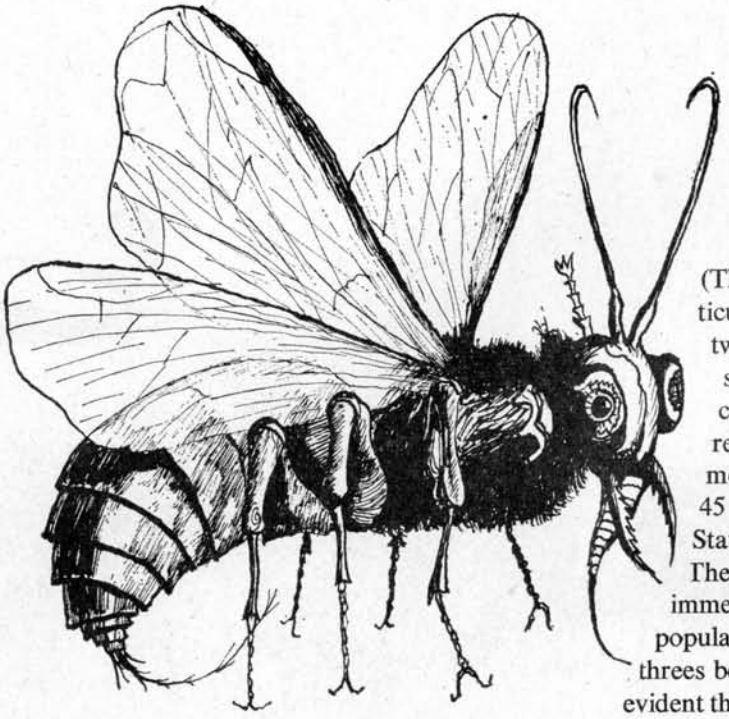
Stop the spraying

Then, towards the end of 1961, with the pest situation extremely serious, a decision was made to stop the spraying. This was done for a number of reasons. First, although some pests had been present since the beginning of cocoa planting, it was only after the introduction of the heavy spraying programme that the major outbreaks occurred. Second, nearly all the insecticides used hitherto were of the broad-spectrum, contact-acting type: that is they killed most insects that came in contact with them.

Since parasitic and predatory insects tend to explore widely, they are more likely to contact insecticide deposits than are pest insects, particularly when these are relatively stationary leaf-eating caterpillars. Differential mortality can thus occur, and the pest species are able to break out from the natural control exerted by their predators.

It was felt that even if this was not the cause of the outbreaks on cocoa, the chances were that the spraying was preventing any possibility of natural predators re-establishing control.

The level of spraying was reduced in October and finally stopped in December, except for two fields with exceptionally severe bagworm infestations, which were sprayed twice more in January and February. Almost immediately a braconid parasite appeared which attacked the loopers. Some twenty or more parasites developed in each looper larva and at maturity emerged to form dense clusters of whitish cocoons on the cocoa trees. The rapid increase in this parasite



caused the looper population to drop suddenly. It remained low until May when it flared back, only to be followed by another parasite build-up. Within three to four weeks, the population had again declined, this time to a level at which damage was negligible. In April and May it became evident that the plant hoppers were also declining rapidly.

The next pests to come under control were the branch borers. In August a decline in new borings became noticeable, and when a sample of borings were opened and examined, it was found that over 50 per cent of the branch borer larvae were parasitized by braconid wasps.

Following the cessation of spraying, it was felt that the damage caused by the looper and plant hopper, and to the lesser extent by the branch borer, could be tolerated without taking any action other than waiting for natural controls to re-establish themselves. However, the damage caused by the ring bark borer and by the bagworms was too severe to be ignored for any length of time and selective means of control were sought for these pests, which would not interfere with any natural control being re-established over the other species.

Selective treatment

Towards the end of 1961, it was decided to revert to inspection and eradication of individual borers. New borings were treated with a jet of 1 per cent dieldrin from a hand sprayer. In this way there was little possibility of affecting the natural enemies of the other pests. At about the same time, it was discovered that an important, alternative host of the borer was a secondary forest tree, *Trema cannabina*. Many of these trees supported considerable numbers of borers. Steps were taken, therefore, to eradicate *Trema* from the cocoa and from the surrounding areas. Combining these two measures proved immediately effective, and borer damage dropped off rapidly. From 1962 onwards, mortality in new plantings during the first two years was usually well below 0.5 per cent.

In the case of the bagworms an intensive search was carried out to find selective insecticides that would give control. Finally, in March 1962 samples of trichlorphon (Dipterex) and of a preparation of the bacterium *Bacillus thuringiensis* (Thuricide) were found to be particularly effective. Of course the two, trichlorphon, a selective insecticide (with only short-lived contact-action) was the more readily available. Regular monthly spraying of the infested 45 acres at the Cocoa Research Station was thus begun in May. The treatment brought about an immediate effect; the bagworm populations dropped rapidly and the threes began to recover. But it became evident that kills were not so high as they had first appeared (probably not much more than 75 per cent). In spite of this regular spraying was continued, and gradually control was obtained, the population dropping lower each month, with occasional mild resurgences. By April of 1963 the damage was insignificant, and the sprayings were stopped.

Back to nature

Thus, during 1962, most of the pests, which had been so important in 1960 and 1961, had succumbed to natural control of one form or another or, in the cases of the ring bark borer and the bagworms, had come under effective and selective artificial control. In 1963 artificial control was no longer needed against the bagworms, and the high incidence of parasitic tachinid flies in the remaining individuals suggested that the tachinids were now responsible for keeping the bagworms in check. Significantly, in the subsequent five years, none of these pests have built up again.

Adapted from *A Consequence of Pesticides* in *The Unforseen International Ecologic Boomerang*, eds. M. Taghi Farvar and John Milton, a Natural History Special Supplement based on the conference *The Ecological Aspects of International Development Programs*, Warrenton, Virginia, December, 1968.

Ecotechnics

by

Arthur J. Puffett

Sulphur dioxide conversion

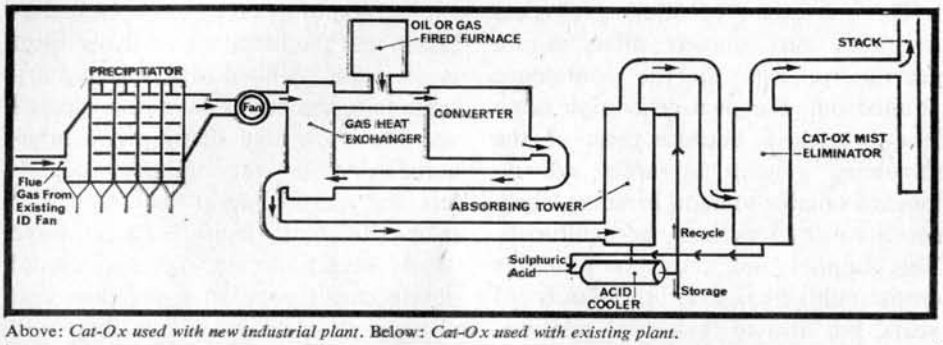
It is estimated that in Britain alone, 6 million tons of sulphur dioxide are emitted into the environment each year, for which power stations and similar large industrial plant bear the chief burden of responsibility. There are two possible solutions to the problem.

The easier method, and by far the cheapest, is to construct smoke stacks so tall—700 ft stacks are not uncommon—that the flue gases remain in the upper atmosphere. Thus we rid ourselves of an unwanted problem! However, recent studies in Scandinavia suggest that the sulphur dioxide and fly ash merely travel several hundred miles and descend on an unsuspecting neighbour.

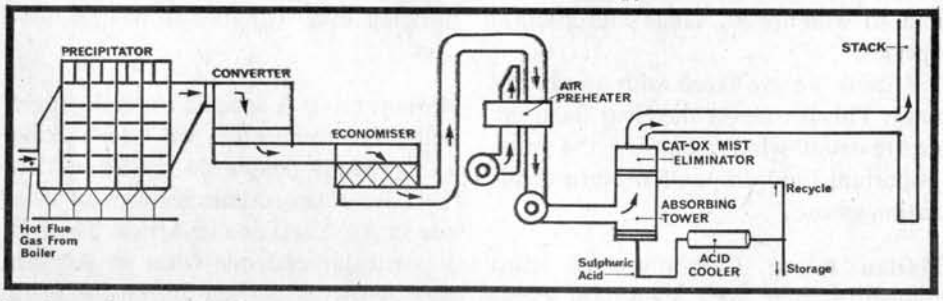
Recycling is the other alternative. Far more expensive to install and maintain but vastly superior in effect, waste products are converted, usually by chemical action, into materials which can be used again.

Sim-Chem Ltd., of Stockport, Cheshire, have recently obtained a licence from Monsanto Enviro-Chem Systems Inc. for the design, marketing and installation of Cat-Ox, a system which converts sulphur dioxide into commercially usable sulphuric acid. Virtually all fly ash is removed from the flue gas together with 85 or 90 per cent of the sulphur dioxide. Sim-Chem estimate that if all thermal electricity generating sets of 100mV capacity and above in the UK were to be equipped with Cat-Ox systems, burning fuels with an average sulphur content of 1½ per cent, some 2½ million tons of sulphuric acid could be recovered each year. The total import of sulphur to Britain each year is more than 800,000 tons. Installation of Cat-Ox systems on our power stations would not only reduce atmospheric pollution but also our import bill for sulphur.

Monsanto, the originators of the system, have received their first order from the Illinois Power Co. who plan to install it at the Wood River power station. More than half the installation costs will be met by the National Air Pollution Control Administration, a US government agency.



Above: *Cat-Ox used with new industrial plant.* Below: *Cat-Ox used with existing plant.*



Carbon monoxide sensor

NASA has begun development of a satellite-borne sensor to measure the concentration of carbon monoxide in the Earth's atmosphere. Estimates suggest that some 500 million tons of this poisonous gas exist in the atmosphere, with an annual rise in level of around 200 million tons, caused chiefly by exhaust fumes from cars. The concentration of carbon monoxide at ground level has apparently not risen over the last few years. The General Electric Co. has been awarded a contract to plot its distribution and to identify the areas where, presumably it is converted into another compound.

Sludge power

Operating under normal conditions, the anaerobic digestion of sewage sludge at the Davyhulme Works of the City of Manchester Rivers Department produces approximately 3 million cubic feet of combustible gas each week, which is equivalent to 10,000 gallons of fuel oil. The gas, composed of two-thirds methane and one-third carbon dioxide, is used, together with diesel fuel, to run six large dual-fuel engines connected to alternators which supply electrical power to all the plant on the site.

Dual-fuel engines, running on diesel or methane, or a mixture of the two, need continuous lubrication. Starting the engines from cold necessitates the use of an auxiliary pressure lubrication system to prevent overheating due to an initial shortage of oil. A Megator sliding-shoe pump is used on each engine for this purpose. The Megator unit is started some five minutes before the main engine pump cuts in, allowing the engines to become bathed in oil before they are started.

Exhaust cooling water, obtained from the engines and gas boilers, is used to heat the sludge in the digester process. The sludge is piped from primary sedimentation tanks, to large sealed tanks. These tanks are kept at a constant 96 F. At this temperature the gas is produced from the sludge and passes through a pipeline to compression units. Compressed gas is then fed directly into the engines. Davyhulme, which is one of the largest sewage works in the UK, provides sewage treatment facilities for Manchester, and many surrounding districts.

Attacking oil pollution

Czechoslovak Ceramics, V jame 1, Prague, have recently held successful tests of a powder which will absorb more than ten times its own weight of oil. Apart from its obvious uses when applied to oil slicks and beach pollution, the powder could also be used on garage floors and machine shops.

The powder is based on the volcanic glass, perlite which is crushed and then made water-repellent and oil-absorbent by a patented process of emulsification. Vapex, as the powder is known, is chemically inert and can be burnt when it has absorbed sufficient oil. Once the oil has been absorbed the powder clings tenaciously to it. Even water speeds of four metres per second will only cause it to release a minute fraction of its captive load of oil.

The green revolution: genetic backlash

Sir Otto Frankel, W. K. Agble, J. R. Harlan and Erna Bennett, four well-known plant geneticists, discuss the genetic dangers which may well result from progress in one direction which produces calamitous loss in others.

Question: While Plant Breeding is nothing new, it has proceeded apace in recent years, and remarkable new varieties have been created. These have spread at an explosive rate, on a global scale. How does this trend towards greater uniformity affect the available resources of genetic plant variation?

Bennett (FAO): Of course, plant breeders are continuously searching for improvements, such as higher yields and greater resistance to disease, and this is all to the good. Plant production must continue to increase, in quality and quantity. But at the same time, this development has destroyed many of the raw materials plant breeders rely upon. The existing reserves of genetic variation are dwindling rapidly and disastrously, as a consequence. What is essential progress in one direction represents a calamitous loss in the other. This is the problem which confronts us with growing urgency.

A conference on plant genetic resources held in Rome two years ago reported that the seemingly inexhaustible range of genetic variation stored in primitive crops and in primaeval forests is fast disappearing due to the extensive spread of high-producing crop varieties. Furthermore, the development of transportation systems has practically eliminated the isolation which formerly protected local variations, thereby aggravating this depletion.

This means that when we most need a continuing rise of productive efficiency, plant breeding and plant introduction—those powerful tools of agricultural improvement—we are deprived of the raw materials upon which we depend.

This erosion of our biological resources may gravely affect future generations, but, as the conference pointed out, our own generation is no less threatened, because most of the remaining genetic resources are no longer available to plant breeders, agronomists, foresters and horticulturists. This applies not only to primitive crops cultivated over thousands of years, but also to their wild relatives, and to wild forest, range and pasture species.

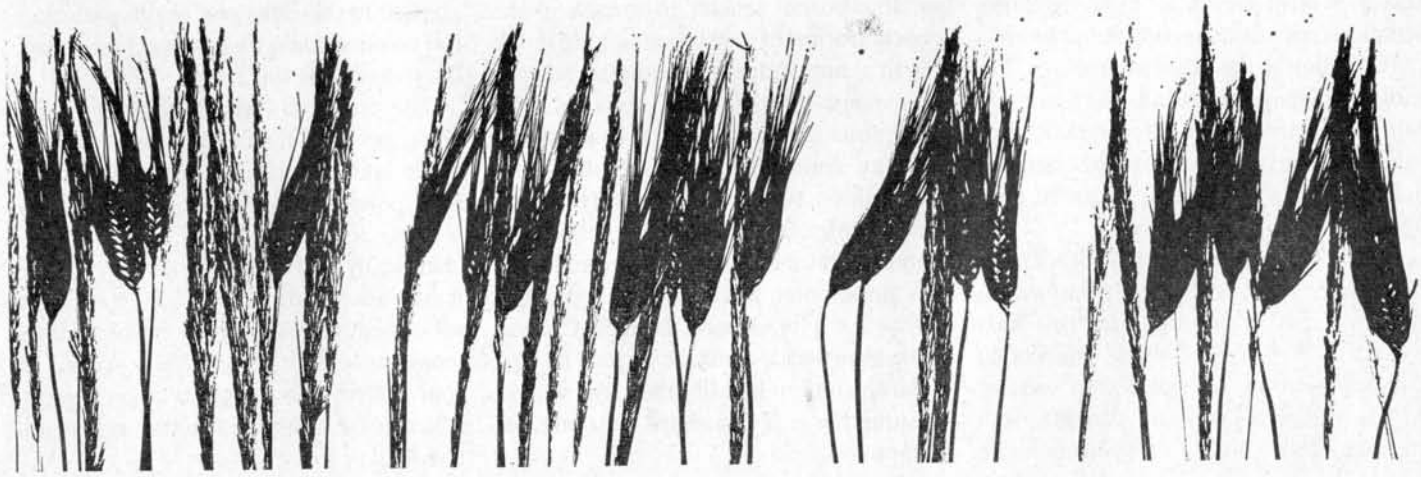
I think we are faced with an emergency. This is true for the Near East, the centre from which some of the most important food crops of western civilization spread.

Harlan (USA): Certainly. We must remember that such important crops as wheat, barley, chickpeas and lentils originated in the Near East. Flax is an example of what we're talking about in respect to genetic loss. In the early 1930s Nikolai Vavilov and Petr Zhukovsky, of the Soviet Union, explored parts of Turkey quite thoroughly and recorded that the Cilician plain was a centre of diversity for flax. I covered the same area in 1948, but could find only one variety, and that was introduced from Argentina. This shows how rapidly germ plasm can disappear, and that genetic erosion is going on at a tremendous speed.

Agble (GHANA): The situation in tropical Africa is probably as bad as that which Dr Harlan describes in relation to the Near East.

Early work on the origin of crops was based largely on the writings of Vavilov. He mentions what was then called Abyssinia as being the gene centre of many African crops. Attention was thus drawn to that area and the rest of Africa has been neglected; virtually no exploration of its crops has been undertaken, and the literature on this subject is very thin. Still, during this century some misconceptions have been cleared up. We know that many crops originated in Africa—the sorghums, the millets, the yams, some of the cotton, and many tropical fruits. These have hardly been collected. Yet agricultural development, population increase, and changes in taste have contributed to bringing some varieties to near extinction.

Harlan (USA): A specific example might help illustrate what we are talking about. Many people do not know that there were two domestications of rice, one in Asia, and one in Africa. There is a particular endemic form of African rice. A survey carried out on the plain of Banfara in Upper Volta in 1935 indicated that about 85 per cent of the rice grown in the region was African rice. A second survey in 1966 showed that this had fallen to less than 10 per cent, the remainder having been replaced since 1935 by introduced forms of Asian rice. Thus, an entire indigenous crop is rapidly vanishing. In some



places where African rice was grown, it is now no longer found. An important source of germ plasm for rice breeding is thus disappearing under our eyes.

Question: You mentioned several centres where important food crops originated. Are there then natural geographical centres of diversity?

Frankel (AUSTRALIA): Well, Vavilov advanced the theory that starting from the place where a crop originated—meaning when man first discovered how to use a plant or its products—a kind of selection took place over a considerable period of time, due partly to a natural process, partly to cultivation, and also, perhaps, owing to the active role of the neolithic cultivators themselves. Vavilov believed that centres of genetic diversity spread from their centres of origin. It has been shown that this is not universally correct, and Vavilov himself came to recognize that a great deal of diversity occurs in areas far removed from the original centres of variation, and even from the centres of origin.

But since the use of plant material is here under consideration, it is not terribly relevant whether these centres are primary or secondary. Whether variation exists is the important point.

Ethiopia is a primary centre for quite a number of plants, but a secondary one for even more. It is an extremely valuable area in which to find variation because of the diversity found there, and because the agricultural flora there is still relatively untouched. This is really the criterion of a centre of diversity, operationally speaking: that there is variation and that it should still exist now.

Question: This pool of genetic diversity, which has been built up by a process of natural selection ever since plant life began on earth, could then disappear practically overnight. What effect would that have?

Frankel (AUSTRALIA): In the 19th century, most plant varieties were primitive ones throughout the world; just as they still are, of course, in some of the less developed countries.

It was by selecting and crossing these primitive varieties that the modern ones were created. These are now grown over a large part of the earth, increasingly so in the developing parts of the world. But primitive varieties possess very many kinds of resistance to pests and diseases; to extreme climates. They are endowed with many qualities the relatively fewer advanced varieties which are displacing them do not have.

These primitive varieties are still what we call a resource: a largely unexploited resource: and one which we, as plant breeders, cherish, but which is tending to erode. Very many plant breeders and others are concerned about the loss of these reserves in many parts of the world.

Harlan (USA): Our main concern is that once this germ plasm is lost, it is lost forever. There is no way in which it can be recovered. Some have felt that one could generate variability by radiation or chemical mutation of genes and so forth, but, in practice, this has not been the case.

The range of variety we find in nature is of a different order from that which can be produced experimentally. It is from this natural variation that we must develop our improved varieties. We not only need to produce better and higher yielding varieties, we must also be able to continuously introduce new resistance against new races of disease, to maintain the level of production which we are now achieving. The food supply for the human race is seriously threatened by any loss of variability.

Agble (GHANA): The exploration and conservation of plant genetic resources are also important for their, as yet unforeseen, industrial potential. Take the case of the oil palm. For a long time it was cultivated for palm wine; then it was taken to the Far East and improved for its oil crop; now it has been brought back to Africa, and plantations have been developed in the Congo, the Ivory Coast and Ghana.

Even sorghum, a major food crop, was not important in the western world until genetic research had been undertaken in the United States.

Agricultural development is proceeding at a fast pace in Africa, and some of the primitive crops have already disappeared. For instance, in Africa, we grow rice mostly in the uplands. It has high drought resistance, but low yield. Now this represents an interesting problem for plant breeders, but if we wait until this germ plasm disappears, then any future improvement in this field is foredoomed.

Bennett (FAO): We should stress that although contemporary cultivars, by that I mean varieties, represent striking advances over primitive varieties in terms of yield and other factors, among which is their notable disease-resistance, their characteristics are not fixed qualities, they are subject to variation and change. Yield depends on adaptation, and universal adaptation is impossible to achieve. Disease-resistance is characteristically unstable.

Let's take for example the wheat variety "Ceres" which was released in Dakota in 1926, and came to occupy 35 per cent of the hard red spring wheat acreage by 1934. It was the first popular rust-resistant wheat variety. Yet, along with "Marquis", with which it accounted for almost 100 per cent of the

American wheat acreage, "Ceres" was severely damaged in the rust epidemic of 1935, causing a loss of more than 120 million bushels. Nowadays, new rust-resistant varieties are grown over extremely wide areas. They have turned some countries, such as Pakistan, which used to import their wheat, into wheat exporters. That is a remarkable achievement. However, reports of rust infection have been received from several areas. It is clearly dangerous to grow uniform varieties with similar disease-resistant characteristics over large areas. The adverse consequences can, of course, be minimized. One may, for instance, introduce other improved varieties with different resistance characteristics. But this can only be done if the raw materials from which new, improved varieties can be developed are available.

The problem is how to preserve these raw materials, and also, perhaps, one of information on the level of planners and producers, who, as they introduce new varieties, should be aware of the need to preserve their raw materials. This is particularly true in developing countries which are the richest in plant genetic resources.

Question: What steps can be taken to safeguard these genetic resources? Could something be done through the International Biological Programme?

Frankel (AUSTRALIA)**:** The 1967 Rome Conference discussed in considerable detail the steps that could be taken. Conservation of genetic resources is feasible but it would be quite impossible to conserve all the variation that now exists; nor is this necessary because we could never use all the variation found in nature.

Living organisms change constantly, by natural selection and other means. We have to reduce these changes if we want to maintain the stocks we are gathering in, and we are now convinced that the best way to store plant material is where there is the minimum of life—and that is in the form of seed.

We have discussed ways in which seed storage could be organized on both a national and an international basis, and be linked up with active research and utilization. This would enable us to preserve our genetic heritage in view of a future when, most probably, the greater part of this natural material will have disappeared in its present habitats, even in the relatively unexploited parts of Africa.

Agble (GHANA)**:** Some action must be taken at the international level, for African governments would find it too expensive to organize exploitation and conservation work by themselves.

Harlan (USA)**:** Dr Frankel is quite correct in saying that we cannot do all that we would like to do. I see no way in which we could conserve all the germ plasm in many of our crops. Every system we have thought of involves a certain amount of attrition and erosion and it is probably quite impossible to collect all of the variation in the first place.

But I do think we can conserve enough of it for future generations, so that plant breeders be adequately supplied with materials.

This can be done, but the need is extraordinarily urgent, and can hardly be over-emphasized. The problem concerns our supply in the immediate future.

Frankel (AUSTRALIA)**:** The International Biological Programme has contributed to bring about a greater degree of international awareness and some appropriate planning. A book on genetic resources, their exploitation, conservation and utilization, will be the main contribution of IBP in this area and may serve as a rallying point and stimulant for action in various parts of the world for scientists and administrators.

Harlan (USA)**:** We must locate the variability available and this requires some exploration around the world. Diversity of crop plants is not uniformly distributed but is concentrated in certain regions, and these are the ones that are being threatened. The exploration part is primarily a matter of locating this variability and collecting it so that we can conserve it by some means or other.

Frankel (AUSTRALIA)**:** We have devised a procedure by which nations, institutions and even individuals can participate in this action. We are quite aware of the fact that FAO cannot be the sole operator. It is clear that a programme of action will involve many people in many countries, that the people in the centres of diversity themselves will have to be helped and that many countries will have to take part in this conservation work.

The immediate need is to salvage gravely threatened gene resources and to co-operate in devising storage facilities for conservation purposes. This is something that cannot wait.

We have met with constant difficulties because of a marked lack of financial support. The financial resources that we require are of an order which is infinitesimally small compared with sums that mankind devotes to far less constructive purpose.

We have elaborated a plan for the next two years and also a long-term plan for the following five years. Unless much of the most important resources of the world are gathered by then, I fear that mankind will have lost them for good and ever.

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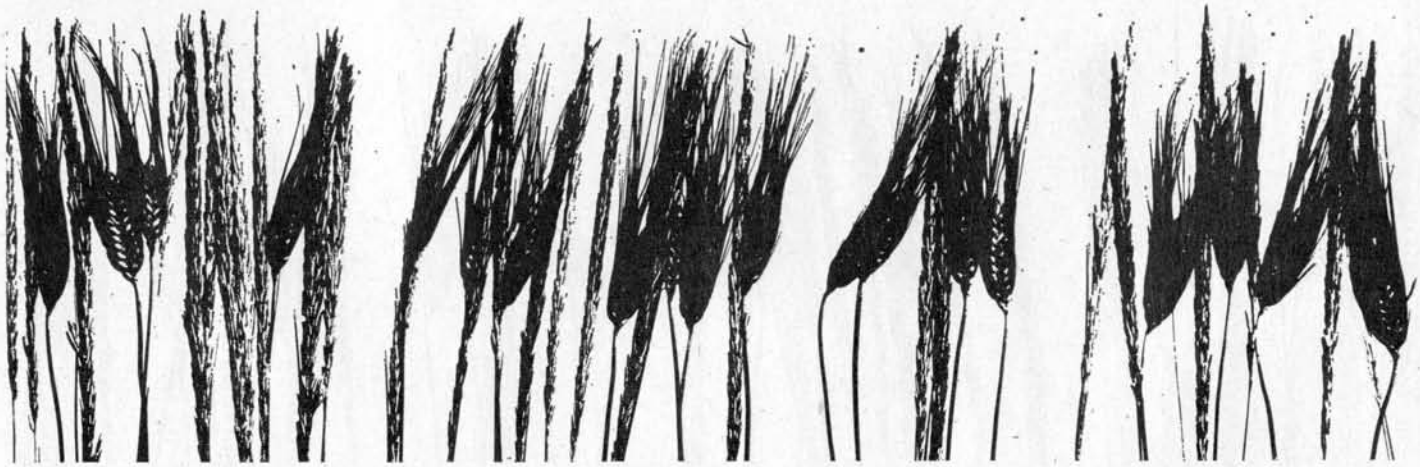


Down to Earth

by Lawrence D. Hills

The trendy cats

England's slug population was roughly 9,610 million in the 1940s, more in wet summers, with the average on every acre of fertile farmland of 300,000. Garden populations can rise to even sixty a square yard, but fortunately only about 10 per cent of their food is seedlings, delphinium shoots, rare alpines and the carrots and potatoes eaten by *Milax sowerbii*, the destructive Keeled Slug that works underground.

Slugs are scavengers for 90-95 per cent of their diet, eating dead or decaying vegetable matter and the droppings and dead bodies of many small creatures. They are almost immune to organo-chlorine compounds and so can go on eating the results of spraying until they become crawling poison pellets themselves with over 28 ppm of DDT in their bodies. There are now more slugs than the pre-pesticide figures calculated from Rothamstead averages, because they can now poison their natural enemies. Apart from birds these are mainly the chestnut brown centipede that devours their eggs, the ground beetles that can eat 50 per cent of the hatch at the small stage, and the hedgehogs which are the best natural control of all.

Hedgehogs depend mainly on slugs for their moisture and this is why saucers of milk in dry springs, when the slug population explodes late, can win a family of hedgehogs as friends for their 4-6 year life. In the autumn they must feed greedily to put weight on with a "mantle" of fat round their shoulders under the prickles, to keep their bodies "ticking over" through their hibernation period. If this fat comes from a diet of DDT filled slugs, the poison will be released in the blood stream as they lose weight in the spring. The result is large hedgehogs dead for no apparent cause.

When we take Canute-like action against the tide of slugs, the slug baits merely relieve our resentment for slaughtered seedlings by showing us a few big dead slugs. The baits are made from meta, or metaldehyde, a solid alcohol that fuels small stoves and once heated travelling irons before electricity. They are cheap, blended with bran and sell in small packets that add up to thousands of tons a year.

If these pellets are eaten by hedgehogs the result is death from uncontrollable vomiting and the loss of the best pest controller in the garden. For unlike birds which eat our friends and foes together, hedgehogs have tastebuds and prefer the vegetarian black millipede to the carnivorous centipede, and weevils to ground beetles because they dislike the stronger flavour.

Every year there are cases of children poisoned by slug pellets, but the classic account of the symptoms (*Lancet* 1958 2, 1, 017) concerns liquid metaldehyde sprayed on strawberries. A girl of 3½ suffered nausea, intense retching and vomiting and lost consciousness when her temperature rose to 105.6 and her blood pressure was too low to measure. Luckily she recovered without developing nephritis and atrophy of the liver. Swift action with a stomach pump can usually save life, but at the cost of considerable shock to child and parents.

This June, Mr John Montgomery, author of "Your Dog" (Collins) "The World of Cats" (Paul Hamlyn) and "Looking After Your Cat" (Allen & Unwin) has discovered that cats and dogs are now getting "hooked" on both solid and liquid metaldehyde. He lost his famous Snowy, regarded as a perfect specimen of the short haired English cat, and his tabby kittens, but his tom, Ginger, was too old and heavy to get over the wall and join the drug scene, and so survived. Three other cats in his neighbourhood became paralysed in their hind quarters from lesser doses and had to be destroyed.

The cause was the liquid put out in bowls, an effective slug trap, but most dangerous for cats and dogs because they are attracted by the scent. The cats vomited, screamed, tried to run up the wall and died in convulsions. The pellet effect is slower and, especially with dogs, a vet summoned quickly can give an injection that will stop the convulsions and vomiting in time, for the symptoms are now well known.

Modest doses merely produce unsteadiness, but the RSPCA reports the case of a doctor whose dog, left in the back of the car, broke open a whole packet of slug pellets, ate the lot and died in a kind of fit. Small dogs and puppies are most at risk, but spaniels, alsatians and other large breeds can become alcoholics like the American tramps described in Jack London's forgotten novel "The Road"—the "alky-stiffs" who were a degree or two lower than meths drinkers.

Though the packets carry warnings on the danger to pets and children, those who have neither use them freely with a risk to neighbour's cats. The RSPCA recommend covering pellets or bowls with wire netting, but this will not defeat a determined cat in search of a fix. Fortunately the fact that the famous Snowy took meta will not be publicised on TV to spread the craze among trendy kittens, and no fashionable authority will proclaim that meta is no more habit forming than fish heads.

If cat and dog lovers would campaign they could win a complete ban on metaldehyde and ensure safety for children, birds and hedgehogs. There would be no hardship for gardeners or growers in banning a poison that keeps pests on the increase by killing their natural controllers. Metaldehyde acts on the slug's "feet"—the muscles that ripple it along, so it cannot crawl to shelter from sunlight. In wet weather they can stagger home and sleep it off, and at this stage the short lived poison in their bodies can add up to danger for thrushes, blackbirds and hedgehogs far faster than any organo-chlorine compound.

There are many safe alternatives and the United States Department of Agriculture recently tested the old fashioned beer trap against metaldehyde, which only averaged 28 slugs a night compared with 300 for this traditional method. Sink soup plates level with the ground, filled with equal parts of water and beer (often free from your local's drip-tray) and brush out the catch each morning into a dustpan, empty in a bucket and kill quickly with boiling water, tipping the result on the compost heap.

An easier alternative is Fertosan Slug Destroyer which works by upsetting the way slugs and snails take up copper, which is unique, and therefore harmless to all other life. Water or spray this where slugs are likely, but keep it off seedlings and soft leaves like lettuce. It will kill by contact, especially on vacant ground where the keeled slug has done its worst, and lower the population enough to allow natural controls to bring it down to a reasonable 300,000 an acre.

The Return of the Airship?

by Basil Clarke

An ecologically sound form of air transport

With the enormous increase in air pollution from the jet efflux of airliners, the dangerously increasing consumption of precious fuel, the ever-greater demands for airport space and the serious menace of aircraft noise, it is obvious that some alternative form of air transport must be found. Only the most unreasonable critic would suggest doing away with the aeroplane, but the number of people who can honestly say that speed is vital is very limited. Most of us can well do without it and, indeed, we would enjoy ourselves much more by slowing down the tempo a little.

Let us look briefly at the advantages and drawbacks of the airship, a form of transport which has today a great deal to recommend it.

Anyone who suggests a return to lighter-than-air craft, i.e. the airship, as a means of transport is frequently dismissed as a crank, as one who lives in the past and would be safer and happier if provided with a keeper. The dramatic pictures of the flaming *Hindenburg* which crashed at Lakehurst in 1937 and signalled the end of airships are brought out again and, usually, that is the end of the argument. But things have changed in 33 years and the airship is again a vessel with considerable potential for both freight and passenger operation.

But let us concede its principal drawbacks, those most frequently cited by its critics. The airship is slow. It is subject to headwinds. It requires very large hangars which may well be considered unsightly. In emergency, especially in high winds, it is difficult, if not impossible, to handle on the ground. It requires, initially, immense quantities of helium, a moderately rare gas. Its capital cost is high. Its slow speed calls for greater numbers of ships than would be required for a similar operation if fast aircraft were used.

But what does it have to offer? The answer is comfort, relative silence, low fuel consumption and a very high factor of safety. It requires less ground space than anything but the light aeroplane, and it can lift extremely bulky loads which are impracticable for any form of surface transport except as deck cargo in ships. These factors need enlargement. Let us start with comfort.

Comfort

Airships, by their very nature, are large things and since space costs nothing to lift, they offer accommodation which no aeroplane can compete with. The late-lamented *Hindenburg* included a dance floor in the amenities provided for the passengers spending two to three days crossing the Atlantic in pre-war days.

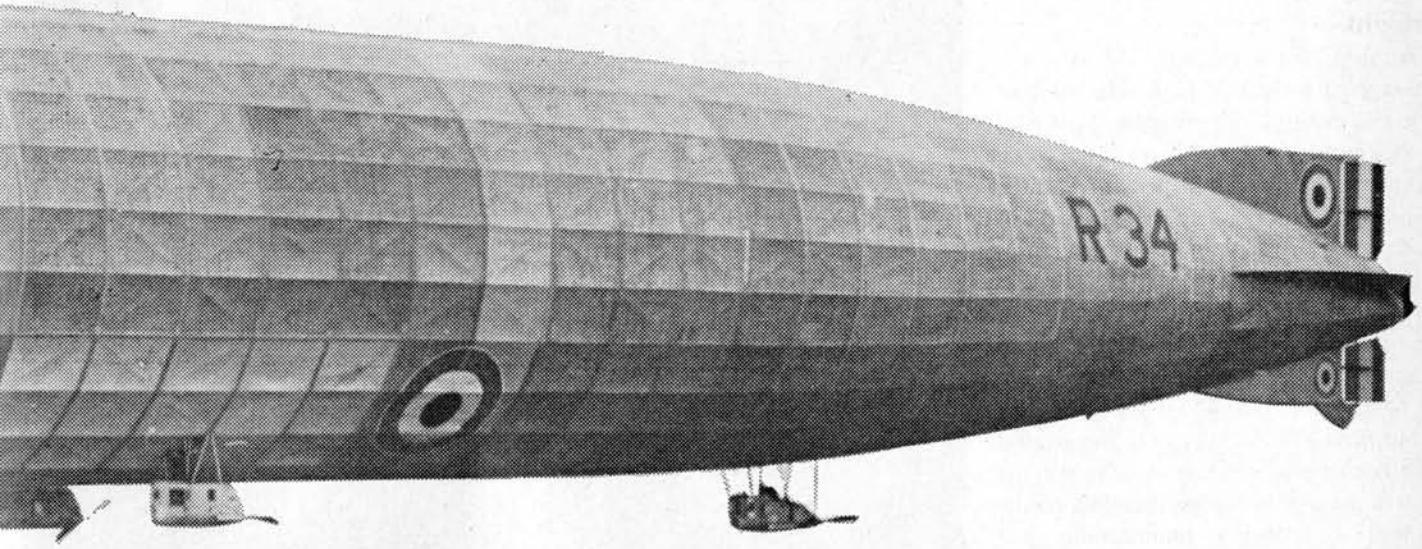
The airship is not fast and is unlikely ever to be so. But speed is not the be-all and end-all for most of us and there are other advantages to offset the longish journey time. It is perfectly feasible to fly only a few hundred feet above the ground—without causing annoyance by noise. At such heights the passengers get a leisurely view of the countryside which is absolutely denied to them in a jet cruising above cloud at 40,000 feet or more. When the journey is worthwhile in its own right, this compensates for its slowness. The *Graf Zeppelin* once did a cruise round the world and, with spacious promenade decks, dining saloon and lounges, plus an orchestra, a good time was had by all, even though the trip took several weeks.

Quiet

Airships are quiet by comparison with aeroplanes because they do not use engine power to stay aloft. The helium gas provides all the lift and engines are only needed to provide propulsion. Thus the power required is almost infinitesimal compared with that for an aeroplane carrying an identical load.

An airship can rise vertically and al-

To suggest resuscitating a form of transport which seems to have failed may appear unrealistic. But sometimes new needs call for old solutions, especially when modern materials and techniques become available to overcome the difficulties which led to past failure. The airship is an acutely relevant case in point. It has a great deal to offer the tense and exhausted last quarter of this century.



most silently from its mooring mast and, though it is a very large object, perhaps a thousand feet long, it needs little more than twice its own length as an aerodrome. The engines will only be ticking over during the take-off phase of flight and people living right alongside the airport will hear little more than a gentle hum. It is true that airships require very large sheds when they go in for major maintenance but, even so, an airport the size of J. F. Kennedy or Heathrow could provide a base for a very large fleet of airships.

Fuel consumption

Helium, an inert gas, is now the lifting medium. It is true that it gives about 10 per cent less lift than hydrogen but it will not burn or combine with air to form an explosive mixture. Critics may claim that helium is in short supply in the world but it is far more plentiful than it was in the thirties because it is found in some, if not all, oil wells. Moreover very little needs to be consumed. The modern plastic fabrics, such as Dacron, which have been used in the last decade by the U.S. Navy for their non-rigid *blimps* are so leak-proof that practically no helium is lost over long periods of operation. And, finally, when the gasbags are deflated the gas is not lost. It is purified by extraction of any air which has found its way into the envelope and the helium can be used again and again. A beautiful example of conservation. And if airships can use petrol, paraffin or diesel oil for propulsion using far less than an aeroplane covering the same distance with the same load, they are to be recommended for that reason alone.

Safety

After the appalling series of disasters in the Twenties and Thirties, any suggestion that airships are safe must sound ridiculous. The reverse is the truth. There were two major snags about the early airships. They used highly flammable hydrogen as the lift gas and were built from designs that we know today left much to be desired by structural engineering standards. Indeed, had they not crashed or burnt up they would almost certainly have collapsed at some point due to metal fatigue.

Today we can produce far better light alloys, with much longer fatigue life, than were available when the R.100, R.101 and the Zeppelins were in service. Very soon, artificial materials such as carbon fibre will replace alloys for structural work. Several times lighter than steel of the same strength, carbon fibres should make an ideal material for an airship framework, and, so far as can be calculated, have a very long fatigue life.

Airships in the past have suffered severe damage to the envelope in really bad weather conditions but the improved materials now ready for use would stand up to the battering very much better.

There is another safety factor which is growing in importance. Busy routes such as the Atlantic are operated very near to the limits of air space available, so that the dangers of collisions increase year by year. When two aircraft are approaching on a collision course at a combined speed of more than 1,200 mph, i.e. 20 miles a minute, there is very little time for avoiding action to be taken and this is an ever-increasing worry to air traffic control authorities. Airships are much slower, and, by virtue of their bulk, provide magnificent radar targets. Ample time to change course is available and near-misses should never occur. Just before writing this I watched a Jumbo take rapid avoiding action to miss a VC.10 over a densely populated area on the outskirts of London. At this season of the year it is more than likely that 500 people were being flown in those two aircraft quite apart from the potential victims down below. And this happened in perfect—repeat perfect—visibility.

Although it is true that it is difficult

for an airship to make an emergency landing, this is equally true of a Jumbo or any other large aeroplane, so the situation is no worse. Moreover, it must be noted that whereas an aeroplane must crash almost inevitably if its engines fail for any reason, the same does not apply to an airship. It can drift while the gas holds it up and the engineers put the matter right, the engines being perfectly accessible.

Freight

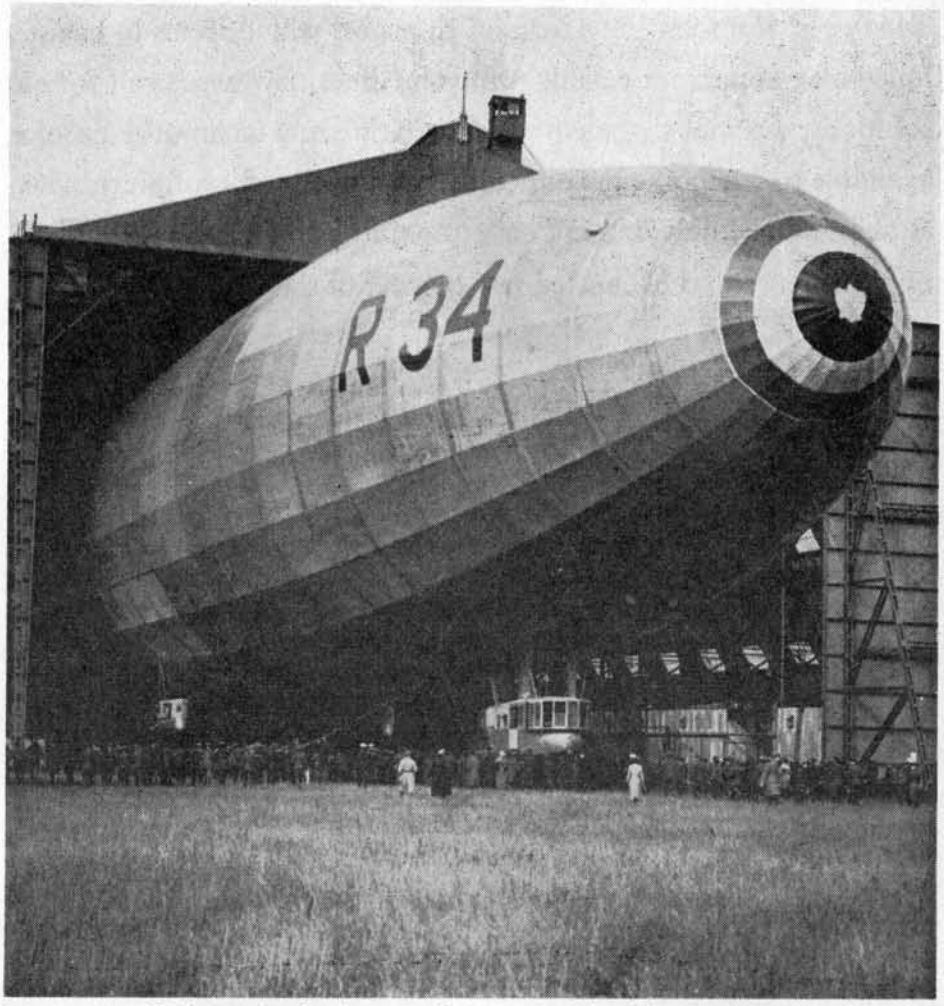
Airships are not ideally suited to the carriage of freight of high relative density. For example, a consignment of gold or platinum would take up little space but might demand the full lift of the ship. When it comes to bulky loads of lower density, however, versatile airships can perform a variety of tasks that the aeroplane cannot. A project exists for airships to be used to fly machinery into remote spots in Siberia where there are no roads, rail systems, or airfields. The airship can lower its cargo to the ground —in reasonable weather—without tying up to a mast or being manhandled on the ground by simply maintaining just enough engine power to keep the ship stationary in relation to the wind. A helicopter could do the same thing except that the size of the load would be limited and the helicopter has an extremely short range over which to operate because of its high fuel consumption.

It was suggested in the United States that airships could fly the complete assembly of a Saturn rocket from its point of manufacture to Cape Kennedy, provided, of course, that the shell was empty. As it is, these huge—but lightweight—shells have to be carried on towed barges and when they finally come ashore they are incredibly difficult to handle. By airship they could be delivered to the exact point on site where they would be needed. Regrettably, neither of these projects has yet been put into operation but they provide excellent examples of the versatility of the airship compared with either surface or conventional air transport.

Slow but efficient

Designs now exist for airships of 10,000,000 cubic feet capacity which could carry more than 400 passengers, at about 100 mph, over distances such as Washington-New York or London-Paris in two hours or so. By comparison this is slow, when we normally use 600 mph aeroplanes, but this is not the whole story. When the Empire State Building was put up in New York it included—and still includes—an airship mooring mast. There would certainly be an outburst of protest if it was proposed to fly airships from Piccadilly Circus to the Place de la Concorde but that would be only because novel forms of transport always provoke initial opposition. Technically it is feasible to do just this, and make city-centre to city-centre elapsed time just two hours in average weather conditions. BEA, with its 600 plus mph Tridents, cannot compare with this. Obviously there are snags. At 100 mph a 50 mph head wind will double the journey time. Over relatively short journeys this is not serious but it must be taken into account. From Europe to America it would be important so it seems unlikely that regular passenger services on long-haul routes would be acceptable to the businessman or those with short holidays. For freight the delay would generally not matter too much except in the case of medical or perishable items which would presumably use the fastest means available, such as supersonic aircraft. If McLuhan's global village ever becomes a reality and political and commercial conferences are feasible by television, it is surely likely in any case that less and less people will want to hurtle about the globe with the sort of urgency which demands supersonic speeds. Research has demonstrated that a jet passenger arrives at his destination with the mental reaction-speeds of a zombie, whose powers of judgement have been, albeit temporarily, very much impaired. It seems likely therefore that companies will be increasingly satisfied to let the second-rank man on the spot get on with the job rather than despatch top men from central office to negotiate with faculties less efficient than those of their relaxed local juniors.

I should like to finish on a personal note. This article was not written to expound merely fanciful theory. I have flown in airships and supersonic aircraft and am aware of the capacities of both. But as the environmental pollution crisis deepens, as we all get more and more exhausted by airport "processing", by the difficulties of getting there and the general level of noise, over-crowding and tension to which urban life subjects us, the slow, quiet, efficient and graceful airship begins to look like a very elegant solution to some of our problems.



R34 entering her hangar after crossing the Atlantic in 1919

Feedback

1 Polluted rats take to drink

Rats exposed to polluted air over a two month period preferred to drink alcohol instead of water, while rats breathing clean air stayed firmly on the waggon.

Dr Robert S. Pogrund of the University of California's School of Public Health, who conducted the experiment, could not really explain why the polluted rats had hit the bottle, but speculated that it had to do with the compound serotonin, which has been known to cause a craving for alcohol, being released from the brain into the blood stream.

The polluted rats also had a curtailed growth rate. Pogrund said that it was too early to start relating his study to human beings.

Philadelphia Inquirer

2 Space spin-off

An instrument for analysing the atmosphere of Mars will also be used for analysis of air pollution on Earth. Its inventor is British Scientist Dr J. Lovelock, who is a consultant to the Jet Propulsion Laboratory, Pasadena, California. The instrument, which is no bigger than a fountain pen, separates and identifies gases. It is hoped that with modifications it will also be able to detect pollutants in water.

Daily Telegraph

3 Poisoning of the 5,000

More than 5,000 fish were killed in the River Cherwell near Banbury, Oxfordshire, when a "caustic discharge" swept downstream piling up dead perch, roach, tench, gudgeon and pike along a mile of the river.

Mr R. C. Dyer, senior river purification officer, said "We have established the deaths were caused by a caustic material and are trying to find out how it got into the water course. We have our suspicions and are taking the matter further with the people concerned."

Angler's Mail

4 Reefs alive and well

Singapore reefs can survive oil pollution was the conclusion of a recent survey carried out by Prof N. G. Maxwell, an associate professor of geology at the University of Sydney. Maxwell said that he had found no dead or dying reefs in the Singapore region. The report was commissioned by the Government of Singapore. *Lloyds List*

5 Self-destruction

A new material that destroys itself and could have important uses in agriculture, medicine and packing has been developed by two American scientists.

It belongs to a class of polymers—chains of linked organic molecules—which break down slowly in water. Herbicides and fertilizers could be converted into such polymers with the advantage of lasting longer on the plants or in the soil and needing to be replaced less often. Trials have already been made. The herbicides were found to be still effective a year after application and the fertilizer release was spread out over several weeks.

Dr M. L. Beasley of Austin Science Associates and Dr R. L. Collins of Texas University, who developed the process suggest that some polymers may be hardened and used for packaging. Cartons and boxes made from it would be broken down by moisture after use, helping to solve the litter problem.

The Times

6 Better late than never

This summer's killer-smog in Tokyo which hospitalized a large number of people has caused the Japanese government to take action at last against air and water pollution. The cabinet has issued an order placing restrictions on the release of polluted water into rivers which will take effect from November 7th.

Another significant development in the battle to improve the environment is the decision of Japan's largest labour union federation to call a strike on October 21st as a form of protest against pollution. *Herald Examiner*

7 "That crank"

On his Australian tour Prince Charles was called a "crank" by the Mayor of St. Kilda, a suburb of Melbourne. The Prince had gone swimming at St. Kilda beach and referred to the water there as "diluted sewage". The Mayor, Mr J. C. Duggan, took offence at this—"an inane remark expected from an inane person", he commented and went on to say that Australians had not given pollution a thought "until that crank came here".

"He's the guy who stirred up this idea of pollution," accused Duggan, "and now everyone is running around worrying about it." *The Guardian*

8 USSR cleans up

The Soviet Union joined in the fight against pollution with a three week clean-up campaign of the Volga river which ran from the 10th–30th September.

Groups from the People's Control Committee and reporters from Soviet newspapers conducted "raids" to check the cleansing of waste products from factories. They also checked on river-boats, sewage and the effects of oil and chemical discharge.

A Soviet conservation official said earlier this year that water pollution alone was already costing the economy approximately £2,790 million.

Morning Star

9 Arctic conference

The U.S. is attempting to organize an international conference to discuss navigation and pollution in the Arctic Ocean, to take place in mid-October. All nations which border on the Arctic or have control of islands there are being invited to take part.

The idea behind the conference is to

counter Canada's effort to establish control over navigation and pollution in the Canadian Arctic.

The Washington Post

10 Clean air car race

Boston Mass. was host in August to an environmental action event which may make motoring history: a marathon Clean Air Car Race across the entire country to Passadena, California. It was organized to determine which cars could combine speed and stamina with negligible air pollution. The 45 student-built cars entered had to satisfy the strict Federal standards proposed for car exhausts in 1975, with all emissions cut to about a tenth of 1960 levels. More than 350 students have come up with a wide variety of propulsion systems—internal combustion engines modified to burn petrol more cleanly, or to use unusual fuels ranging from liquid natural gas, propane gas and non-leaded petrol to methanol and hydrogen. Electric and steam cars were also in evidence. But recent calculations by an American scientist indicate that the electric car is a non-starter. If all cars were battery-powered many new air-polluting power stations would be required to provide the electricity needed for their batteries.

The Observer

11 Toxic tipping

Tighter controls over the dumping of toxic industrial waste were recommended in the report published in August by the Ministry of Housing and Local Government's Technical Committee on the Disposal of Solid Toxic Wastes. But these must be backed by better liaison and more disposal facilities, more attention to reclamation and incineration, and the use of abandoned mineshafts for industrial, tarry and city wastes. The greatest dangers still come from the tipping of liquid wastes which might seep through into underground springs, the source of drinking water.

Financial Times

12 The cost of controls

Shell Oil is preparing to spend up to £200 million in increasing its supertanker fleet partly as a result of pollution control measures. In the past six months demand in Japan and the U.S. has grown for oil low in sulphur, to avoid air pollution. Available from Nigeria, North Africa and Canada, it involves longer hauls and is placing an additional strain on the tanker tonnage currently available.

The Times

13 Roach recession

England's stocks of roach continue to dwindle, according to a recent NFA (National Federation of Anglers) report. The winning weights in Oxford angling competitions have declined from 33lb in 1963 to 11lb 12oz (six fish) in 1968. This is typical of the information supplied to Major Brian Halliday who compiled the report. The survey shows that in the Southern Midlands, from the east right through to the west, there is not only an unsatisfactory population of roach but also a shortage of all other sorts of fish.

Anglers Mail

14 Californian pollution plan

Spy planes operating in the sub-stratosphere to identify air polluters were among suggestions made by Lt. Gov. Ed Reinecke to an International Conference on Water Pollution Research held in San Francisco recently. He also had a programme to dispose of industrial wastes and sewage which would involve the construction of pipelines on the beds of Californian rivers to transport effluents into the ocean where, he claimed, currents would disperse them.

He predicted the pipeline system would have to be used for 15 to 20 years while industry developed alternative methods of waste disposal.

San Francisco Examiner

15 Mercury menace

Man's intake of poisonous mercury in what is now his slightly poisoned air, food and water, has multiplied 10-fold in industrial countries in 35 years and thus may now be causing a wide, unrecognised "mercury epidemic", according to evidence presented recently to the U.S. Senate Environment Subcommittee. Among the symptoms, testified a Michigan chemistry professor, may be "anxiety, excessive self-consciousness, difficulty in concentrating, irritability, resentment of criticism, headache, fatigue, blushing and excessive perspiration." He also claimed that low-level mercury poisoning may bring on premature senility. Ralph Nader, the St. George of the consumer associations, called mercury pollution "a national disaster". He called for emergency action by the President, Congress and federal agencies to ban mercury in much of industry and agriculture.

The Washington Post

16 Ecology shop-in

"Threaten their existence and you threaten your own" said the caption above the blow-up pictures of bird species endangered by pollution. A reasonably unremarkable exhibit at any environmental action show, this one was an eye-catcher because along with several other scenes, it had displaced plastic mannequins draped in high fashion from the street display windows of one of Washington's big department stores. The newly-decreed maxis had been displaced to make room for a series of displays showing how man is fouling his environment. In addition the store had set up a huge display on its first floor devoted to urban blight, polluted water, the nation's dying seas, automobile pollution and forest fires. This exhibition by Woodward and Linthrop, the store, is believed to be the first of its kind in the U.S.

During the period displays were on view, environmental pamphlets were available at booths manned by store personnel and representatives of the Interior and Agriculture Departments, who were on duty to answer direct requests for information by customers.

The Washington Evening Star, Washington D.C.

17 Reprieve

Over 900 miles of the Severn River Authority's 1,162 miles of water covered by a recent Ministry of Housing and Local Government survey are now classified as "unpolluted or recovered from pollution" as compared with 633 out of 1,376 miles revealed by a similar survey in 1958.

Anglers Mail

18 No cockles for Cockneys

East Anglian shell-fishermen predict that before the end of the year there will be no more cockles in the Wash, one of Britain's most prolific shellfish beds. "We are now working on cockles which are 5 to 6 years old. Supplies will have finished by October and we have no new cockles coming on," said Ronald Castleton, a King's Lynn fisherman. 1969's crop of cockles died mysteriously long before reaching marketable size. The Eastern Sea Fisheries Joint Committee is examining the pollution situation in the River Ouse and the Wash estuary, where the cockle beds are located.

Evening News, London

19 Eight-hour haul

Eighty shopping carts, sixty motor car tyres and a safe were just a few of the objects extracted from the mud and

reeds of Darby Creek by ecology action volunteers in a recent eight-hour clean-up. Organised by a local councillor, 25-year-old William Gibbon, the Boy Scout and Youth Corps activists carted away 20 truckloads of abandoned garbage yet "we have hardly made a dent in the problem", Gibson declared.

Philadelphia Inquirer

20 Air advances

Only about 10 per cent of the 13,000 multi-family apartment blocks in New York city comply with the local air pollution regulations. So to tempt the others to follow suit, the Chemical Bank of New York is offering up to a total of $10 billion in loans to New York residents who install air purifying devices for incinerators or refuse compaction units. The loans are on a non-profit basis for a period of up to seven years with rates of interest close to the bank's prime rate. *The Banker*

21 Oil priorities

As if the SST manufacturers had not enough to worry about, a new bogey has now appeared on their stormy horizon. The planned production of SST's by 1980 is 300 Anglo-French Concordes and 80 American Boeing 2707's. These will consume in the region of 320 million metric tons of crude oil each year, which is nearly a third of the total planned oil consumption of Western Europe or the U.S. in the same year, more than one and a half times the assumed consumption of S.E. Asia and more than three times that of all Africa. This means that 380 aircraft will consume about 8 per cent of the total *world* oil demand. This is alarming enough. By 1985, however, there will be 600 supersonics in the skies and around 1,200 by the 1990's. Since no one seems to know quite where the oil will be coming from, there are likely to be some big battles fought over priorities by the end of the decade.

The Observer

22 Sad soil

Farmland soils in parts of England and Wales are in trouble. An official survey has found that the fertility and structure of the soil have broken down to dangerous proportions. Deterioration has gone so far in the clay country of the Midlands around Warwickshire and Northamptonshire that arable farming will probably have to be abandoned.

Mr Emrys Jones, chief scientific adviser to the Ministry of Agriculture, said that the problem had been lurking on the horizon ever since the early 1950's, when economic forces started to press the farmer into mechanized, intensive, single-crop production. It took the wet seasons of 1968 and 1969 to show that the damage was becoming serious. Heavy mechanization, economic pressures to work the land too hard, obsolete drainage systems and unsound soil management are all contributory causes. Mr Jones, vindicating the stand taken by the Soil Association for a number of years, claimed that the only cure would be a major shift back to traditional systems of mixed farming and rotation cropping, with much more land given to grass and livestock. The Ministry will study ways of assisting financially farmers who want to switch over. *The Observer*

23 Follow the anglers

Public relations consultants are now being called in by industrial companies to convert their tarnished image as water polluters into one which will project them as eager conservationists. This was claimed by Mr Charles Wade of the Anglers' Cooperative Association, which exists to fight pollution in the interests of angling clubs. "Some firms," he said, "are trying to give the impression that much more is being done about pollution than is actually the case. This has been especially noticeable during European Conservation Year."

The association is now involved in legal proceedings against 17 companies and organizations aimed at obtaining High Court injunctions to prevent further pollution. It has a further hundred cases for action on its files. Mr Wade declared that the ACA had fought a total of 600 cases of this kind with a large measure of success.

The Guardian

24 Gas bombs in the Baltic

Danish boys who went for a swim in the Baltic off the island of Als were badly burnt by "a concentration of mustard and nerve gas in the water" according to the Danish newspaper *Ryen Amts Avis*.

The seabed between Kiel and the Danish frontier is now being investigated by West German ships in an attempt to locate gas bombs supposedly dumped in the Baltic at the end of the Second World War. *Daily Telegraph*

25 Globe in jeopardy

If mankind does not find global solutions to global problems it will "perish—if not with the bang of a nuclear holocaust, then with the whimper of a species and civilization which ran out of air, water, resources and food," said U Thant, Secretary-General to the United Nations, in a speech opening the biennial congress of the World Association of World Federalists in Ottawa.

U Thant once again called for the creation of "a global authority to deal with the problems of the environment, with the life support system of our spaceship earth, now in serious jeopardy". *Evening Standard*

26 Ireland tilts at doomsters

One of the government's scientists has hammered the "prophets of doom" who have been holding forth in a hysterical fashion about the dangers of pollution.

Mr F. E. Ireland, Chief Inspector of Alkali and Works, whose job it is to deal with industrial pollution, attacked the doom-mongers in his annual report. "This is not a problem to be tackled in a spirit of panic," he said. "The alarmists often prefer not to listen to authoritative opinions on public health hazards, but instead welcome the wider speculations of destruction."

Mr Ireland's report mentioned theories such as pollution causing the ice caps to melt or a belt of dust to form in the atmosphere around the earth. He said there were no signs that physical features like weather, temperature or the position of the magnetic pole are being disturbed by man.

Mr Ireland claims that the press and television have emphasised the worst aspects of pollution and the failures of pollution control. He maintains that the problems of air pollution are mainly economic and if the cash were available few of them would remain unresolved.

Daily Telegraph

(See "Air hares" in this issue of *The Ecologist*, p. 37.)

27 Caspian—a dead sea?

The Caspian Sea, the world's largest lake, could become a dead sea by century 21, warned Soviet ecologist Prof A. G. Kasymov, of the Azerbayijan Academy of Sciences. He said that if the western part of the middle and southern Caspian sea continues being polluted each year by about a million tons of petroleum products and 100,000 tons each of asphalt and sulphuric acid, fish will soon no longer be able to live there. *Evening News*

Gargoyle

by

Wayne Davis

Professor of Zoology
University of Kentucky

Dried-up Dream

California! The Golden State of sunshine and health. Magnetic utopia, attracting ever more people to that great land of opportunity with the promise of a better life.

Within a period of 10 years California will have established two major mile-stones in our nation's history. First was when she overtook New York as our most populous state. With her population growing by 50 per cent per decade, the second is now imminent. This nation within a nation, once the world's greatest agricultural region, will soon join the 130 countries and territories which have more people than they can feed, and are absolutely dependent upon the Great Mid-west for their survival.

This miserable mass of humanity, collectively reproducing at a rate which would double their numbers in less than 25 years, could provide a valuable lesson to the people of California. It includes Haiti, once the wealthiest and most productive of all agricultural regions of Latin America. Haiti is now the most densely populated, most miserable, and has the lowest per capita income to be found throughout that now wretched region of squalor.

It also includes India, once the envy of the world because of its great wealth. The Jewel of the Orient was the inspiration for Christopher Columbus and other European adventurers. Now India, with her 540 million people, is a nation of stupefying destitution, unable either to produce or to pay for the food she needs. Like a blotter she regularly absorbs one fourth of our annual wheat production of 1.2 billion bushels, and "pays" for it in the "funny money" programme by which we now own three fourths of all the rupees in India.

But whereas the overpopulation of India, Haiti and other unfortunate regions was a gradual process built up over the centuries (Haiti, discovered by Columbus, was the first land settled in the New World), California stands poised hopelessly to overshoot the mark within a minute piece of human history. Orange County, which had 61,375 people when Richard Nixon was a boy there, holds 1,300,000 today.

Never before in the history of man has a people rushed in so furiously to bite the hand that feeds it. The fabulous agricultural regions of California are being subdivided and made into homes, parking lots and industrial sites at the rate of 375 acres a day. Even if this rate were to remain constant (it is accelerating), half the productive farm land now in the state would be destroyed within 30 years.

In an attempt to "solve" the water problem of southern California, the voters, outnumbering the bitterly opposed northerners, approved a $4 billion bond issue for the Feather River Project to divert water from the north. The smell of water provided at taxpayer expense attracted land speculators. Deserts previously unsuitable for homes were subdivided with such a rush that the new water supply was gobbled up before it got started.

California's great agriculture lies primarily in the Imperial and San Joaquin valleys. Both are now in such serious trouble that they might as well be covered with asphalt.

Imperial County is consistently among the nation's top three in per capita farm income. It was being irrigated by Colorado River water 30 years ago when Tucson and Phoenix were little desert cow towns. Tucson now has 250,000 people and Phoenix 500,000. For water supply they mine the ground for non-renewable Pleistocene deposits. Tucson goes down an additional 13 feet per year: Phoenix 44. Soon the water will be gone.

After 12 years of litigation the Supreme Court has decided that Arizona, as well as California and Mexico, is entitled to its share of the Colorado River. Tucson and Phoenix are to be saved while the Imperial Valley dies. Since Arizonans cannot afford the cost, their well known senator led the fight to allow the nation's taxpayers to fund the Central Arizona Project to bring their water to them.

The San Joaquin Valley is also irrigation farming. Many civilisations have arisen, flourished, and died on irrigation farming in arid regions of the world. This cycle seems inevitable. Irrigation water evaporates leaving its dissolved minerals behind. Salt content of the soil eventually becomes so high that crops cannot grow. In the United States we accelerate this process by building huge reservoirs in arid regions. Large surface areas and low humidity allow massive evaporation, concentrating the salts in the water to be used in irrigation. This problem is so bad that Mexico has filed a complaint about the quality of Colorado River water she now receives.

San Joaquin farms have a soil salinity problem. A massive engineering project now planned to flush salt from the land has been described as a gamble at best. (*Environment*, June 1969).

Today technological changes and population growth are so rapid that a young person can expect to watch a significant chunk of American history unfold. Here's how. Make two lists of states: those that can feed themselves and those that cannot. Put Kentucky on the former. Now watch the progress as populations grow. Watch industry and people gobble the farm land. We are destroying a million and a half acres per year now and accelerating. Every few years strike a state or two from one list and put it on the other. North Dakota and Minnesota will be the last to go. Will we be here then? Is this what we really want to happen to our country?

Reports

Poisoned drinking water in Britain

It has been assumed for many years that drinking water in the United Kingdom is both pure and wholesome, but are we quite sure that the chemical quality of our drinking water is above reproach? Before water reaches the consumer's tap and can be labelled *drinking-water* it is exposed to many hazards, but the concentrations of pollution which finally reach the public depend largely on the source of the supply.

Upland sources have little animal or human pollution and the main danger is that the waters are soft and tend to be acid, producing chemical reaction within the metal pipes which convey them. In the case of underground water supplies, contamination is usually from dissolved mineral salts and solutions from industrial spoil heaps, while animal pollution is often only of minor significance. River sources, however, contain every type and concentration of impurity imaginable: sewage and trade effluents; agricultural waste including herbicides, pesticides and manures; animal and vegetable decompositions; effluents from mine and quarry workings; run off from industrial and chemical waste tips—the list is inexhaustible.

Obviously all water undertakings carry out some form of water purification to eliminate the impurities found at the source. They usually succeed in removing bacteriological impurities, but the same cannot be said when it comes to the removal of trace chemical elements and compounds, many of which pass through the purification process. Further, having carried out purification, sources of contamination still exist in the pipes and fittings used for the distribution system particularly when the water is soft.

Scrutinising all possible sources of contamination, we determined at Liverpool University to establish in as great detail as possible the true picture of what was contained in the drinking water supplies of the United Kingdom. We were not interested in the water leaving the purification works, only in the water as it leaves the consumers' taps. We carried out a survey of all the water supplies serving some fifty large towns, each with a population of 100,000 or over, representing a total water supply to over twenty million people. As with most research work, limited facilities and finance restricted the scope of what should be done, and we decided to focus attention on those impurities which have been classified quite definitely as either carcinogenic or toxic.

The survey team was astonished to discover that the chemical quality of United Kingdom drinking water left much to be desired. Trace elements looked for were compared with the maximum allowable concentrations listed by the international authority of the World Health Organisation. To obtain a full picture, some of the contaminants found in the waters tested are dealt with at length.

Lead, an insidious and cumulative body poison offering chronic insult to man, is leeched from pipe walls and lead joints and enters the water. Although lead is not used in modern buildings, there are hundreds of thousands of older houses with lead service mains and plumbing, and many of the modern plastics have lead as a filler. Even where copper piping is installed a lead alloy is often used for soldered connections. It was found that 94 per cent of the population surveyed was being supplied with water which at times is sufficiently acid to dissolve lead. When random tests were taken to establish the exact concentration of lead in water delivered through taps it was found that out of 47 samples analysed, 22 had either the International Standard maximum allowable limit of lead in them or slightly more, whilst three samples had more than twice the allowable limit. So two million people were being regularly exposed to the risk of lead poisoning! It is an alarming thought too that miles of new lead pipe are installed each year by plumbers carrying out repair work. We found that when all the water samples taken were placed in a coil of new lead pipe for only ten minutes, they dissolved more than twenty times the World Health Organisation maximum allowable concentration. Even allowing that a protective coating forms eventually to some extent on the inside of pipes, for how long are unfortunate users subjected to intensive lead poisoning when repairs have been carried out? Positive evidence of this was produced by Dr M. D. Crawford and Dr T. Crawford in 1969. Examining people who had died suddenly from an accident or ischemic heart-disease, they found that the lead content of ribs was considerably higher in a soft water than a hard water area.

Looking for cadmium concentrations is a slow and unrewarding task, and it appeared that all the towns included in the survey were free from this poison. However, one town was eventually found to have a concentration greater than the permitted limit and apparently the authorities concerned were completely unaware of it. This in fact is considered to be one of the most significant results, as it highlights the urgent necessity of complete chemical analysis for toxic substances by all water undertakings. Only constant monitoring can ensure that consumers are protected. Cadmium illustrates that where, in general, the hazard of any given toxic substance may be negligible, when a particular supply is investigated the hazard may be very real.

Phenolic substances have been found in all waters in concentrations which give cause for alarm. Many of the towns examined had concentrations *in excess of 16 times what used to be considered a safe level*. The World Health Organisation in their latest standards have

taken phenolic substance out of the toxic category and replaced it with the heading: "may give rise to trouble". This is no doubt due to the fact that phenolic substances include phenols and cresols in undefined proportions, some of which could be relatively harmless from vegetable origin. However, it is useful to quote the case of a well-known river used for water supplies to a concentrated population of some million persons. The river takes many industrial discharges and one in particular has its cresol concentration in the effluent limited to 2 parts per million. When it is realised that the maximum allowable concentration for phenolic substances quoted in the World Health Organisation International Standards is 0.002 mg/litre it will be realised that a 1000 to 1 dilution is necessary to bring this about. Comparing the allowable discharge from this factory with the state of the river at times it is found that the dilution can work out to 68, and this is only one of the many permitted discharges. The medical profession seem unable or unwilling to commit themselves to any threshold of allowable concentrations of phenolic substances as a guide. Yet can anyone contend that high concentrations of phenolic substances in drinking water should be tolerated?

Cyanide, an extremely lethal substance, is limited in the International Standards at 0.2 mg/litre and in the European standards at 0.05 mg/litre in drinking-water. As with cadmium we have found another isolated case where the concentration in a sample from the tap of an ordinary consumer was 0.1 mg/litre. Yet another example of danger lurking in unsuspected places. If large and well-equipped supplies can be shown to present these hazards what may be the position of small undertakings with limited finance and facilities?

It is impossible in a short paper to deal with all the trace elements and compounds which may be present in water, but the necessity of complete and constant monitoring can easily be appreciated. This need is increasing every day as greater demand forces water undertakings to use water sources they would not even have considered only twenty or so years ago. The position is made worse by the diversity of the sources of pollutants and the increasing host of new and varied chemical processes used by modern technological progress. It is in general true to say that water laboratories are unequipped to deal with sudden unusual contamination, and even if pollutants are recognised the methods of purification used are incapable of eliminating them from the supply.

Typical examples of casual or accidental poisoning of river supplies are numerous. Pollutants such as cyanide and hexavalent chromium from plating or chroming works get into the water in spite of the vigilance of river boards. Here usually the first evidence is a few dead fish, which may not be observed until large quantities of water have been processed and distributed. Sometimes the pollution is spotted by chance by an employee at the water purification works, but can this be described as a satisfactory twentieth century method, and how much poison passes through while the employee is having his lunch, or at night, or during bad weather?

In the final assessment there is no doubt that the responsibility for a wholesome potable water supply rests with the Central Government and the Statutory Undertakings. They have to consider whether, having allowed our drinking water supplies to become so polluted, in many instances a point of no return may have been reached. Will it ever be possible at an economic rate to purify our supplies to the correct standard, or are our supplies in some instances so foul that they should only be used for purposes other than drinking? In the country we still have some good supplies of clean water which should be carefully husbanded and used in conjunction with strict chemical control and a separate piped system of drinking-water. This would necessitate two piped supplies to each household, one pipe of small capacity being for drinking and the other pipe for general domestic use. We can immediately hear the questioning howls concerning the expense involved, but when the savings of the lower quality required for the non-drinking part of the supply are taken into account, this may not be a major factor. In the final reckoning, is it really worth while compromising our health for purely financial considerations? After all is it not more precious than the consumer products that these savings enable us to acquire?

J. A. Tolley
C. D. Reed

"Too thick to drink and too thin to plough" Paul Ehrlich

The shadow of Westway

"Get us out of this hell" is the way residents of North Kensington greeted the recent opening of the £30 million 4 km long Western Avenue Extension. Hell, for the people who live in Westway's shadow, already consists of overcrowded, squalid conditions, coupled with the roar of jets overhead and the rattle of underground trains below.

Now, after four years of construction work, the opening of a motorway standing an average of 30 feet from the lines of terraced houses has given hell a new dimension. Carrying 45,000 vehicles a day, its bulk straddles some of the most densely populated housing in the UK. But this is only one "small" section of Ringway 1—the innermost London motorway box. The rest is yet to come.

North Kensington, the most overcrowded of all London Boroughs, consists of four wards containing 83,000 people. One of these, the Golbourne Ward, is an area, where relative to the housing situation in the rest of Britain (which is far from brilliant), *everybody*

is deprived of one bedroom and 40 per cent of the residents are deprived of two bedrooms.

For instance, in the Acklam Road—one of the hardest hit by noise from the new motorway—you will find a group of 34 houses which hold 117 families (about 250 adults and 150 children). Mr George Clark, founder of the Local Social Rights Committee and spearhead of recent confrontations with the authorities, has called Acklam Road an "emergency social disaster area".

The motorway does not help—nor does it limit its decibel-havoc to the conveniently depressed Acklam Road. Mr Clark points out that as a result of the motorway's "ripple effect radius", a further 220 houses with 1,600 people are affected. Some degree of nuisance is also caused by noise to 5,000 people living in 400 houses.

Because of its varying nature noise is very difficult to measure. Not only does traffic density play an important part, but noise readings can differ considerably according to the point of measurement in a building.

The Wilson Report on noise pollution presented its findings in 1963. It states that the highest tolerable noise level is 50 decibels on the A-scale. In Acklam Road an independent sound engineer recently recorded levels of between 51 and 58 decibels. A peak measurement of 78 dba was recorded in the road 30 ft. away from a traffic stream moving in a 60 mph speed limit. This level is high enough to cause permanent damage to the human ear if maintained.

Acklam Road at night is tersely described by Mr Clark as "like living in a factory". At midnight noise is claimed to be double the normal figure for busy urban areas.

It seems that some residents became almost apathetic to the development, believing that things would improve when Westway was finally opened. But, of course, noise levels not only rose, but are increasing as more motorists become aware of the new route.

Unfortunately areas such as Golbourne Ward consist for the most part of old and sub-standard housing. This kind of property is impossible to soundproof. Such measures as double-glazing are out of the question.

Because the planning advantages involved were apparently considerable, Westway was built parallel to the underground line. But although two sources of noise grouped together do not double noise output, and the overall increase is comparatively small, psychological factors must be taken into account, for most people "feel" that the noise factor has grown far worse because of this.

The same principle applies for air pollution caused by traffic fumes from Westway. The authorities do not feel that there is any danger of a carbon monoxide trap being formed, although again, the residents must bear the psychological effect of an ever-present fear, however irrational, of a substance which cannot be seen or smelt.

People near projects of this kind are also expected to adapt to the change from ordinary street lighting to the glare of low-pressure sodium lighting mounted on steel columns on top of the motorway.

Another factor which they are forced to come to terms with is daylight infringement. The shadow of Westway darkens most ground floors and forecourts in Acklam Road cutting out a high percentage of the light they once enjoyed.

The motorway affects every aspect of people's lives. In its grim presence the word "leisure" becomes a blasphemy. Even before the arrival of Westway, there was a serious lack of amenities in the area, but since then the lack has become a dearth.

Whereas in South Kensington eight children share every $\frac{1}{3}$ acre of open space, in North Kensington 88 children share a comparable area and in the Golbourne Ward 2,400 children now share the only $\frac{1}{3}$ acre of open space available.

It is said to be possible to landscape areas directly underneath elevated motorways, and finance has been allotted for this purpose by the Greater London Council. But what is the point of landscaped areas which would be permanently in the shade?

Nor is there any escape to the small screen for people living at the foot of Westway. Interference from a stream of traffic at such close proximity makes viewing impossible. Television, so often the only place of refuge for city-dwellers, is thus eliminated.

When considering all that has happened, and is still happening, in the Golbourne Ward, it becomes apparent that in many ways this development is something of a test case. What applies here, is likely to apply elsewhere.

Several weeks ago, at the instigation of Mr Desmond Plummer, leader of the GLC, it was announced that about 50 houses in the Acklam and Walmer Roads are to be purchased and the families rehoused. This will cost the GLC about £22,000 because schemes of this kind are not eligible for Government grants under existing legislation.

At the moment authorities are required to compensate those from whom they take land, but are under no obligation to compensate those who suffer loss of amenity.

Even if the authority concerned is willing to rehouse people, they all must agree voluntarily to sell. If some refuse, official and lengthy Compulsory Purchase Orders must be served. This is the "all or nothing" approach provided by a section of the Town and Country Planning Act, 1960. In the case of residents in this instance, 10 per cent of landlords and owner occupiers were hesitant, fearing that full market value for their property would not be realised.

The GLC warn that no guarantees are made that families will immediately be rehoused in the same neighbourhood. This presents a very real problem when one considers the close community ties which exist in areas of this kind.

The GLC stress heavily that the rehousing action is taking place under special emergency circumstances. "The decision to rehouse the worst cases must not be taken as a precedent for future action before Government clarification of compensation policy."

Meanwhile, County Hall has said "no doubt there will be other instances where property will suffer from loss of amenity due to traffic in a new road."

At the moment plans are in hand for the construction of a flyover at the western end of the motorway at the Western Circus. The GLC cannot agree with the Ministry of Transport on compensation terms for the estimated 100 houses which will have to be demolished. If the scheme materializes, good, relatively new homes, both private and council-owned, will face similar problems to that of Westway.

What can be done? It seems that as soon as the correct legislation is introduced, a number of "answers" used in combination will provide a workable solution.

It is, however, to the credit of the GLC, that it has been pressing the Government for years to obtain powers needed to give compensation for loss of amenity. At last the whole question is currently under Government review.

If nothing else is achieved this will at least give legislators a headache, for who can say where the line is to be drawn? How far, for instance, does one have to live from a motorway to merit compensation? Mr Clark has suggested that the "way out" may be the linking of noise limits to distance from these roads. But the subject of noise is extremely complex and involves a great number of variables.

A concrete neighbour for the people of Acklam Road.

Further questions arise. For example, should new developments be considered for compensation? Who are the more needy, people who have to suffer the initial shock of new developments or people who have lived in despicable conditions for the whole of their lives? In any event can the ratepayer be expected to foot the bill?

Evidently the social cost of the urban motorway has been grossly underestimated. If the social aspects are costed within the project at the planning stage, new motorways will undoubtedly be more expensive, and perhaps in turn force greater consideration of possible alternatives.

Soon the traffic supersaturation point of cities will be reached—if this has not already happened in some cases. Perhaps the roar of the urban motorway, on which we vent our impotent protest, is in reality the death-rattle of private transport. Compassion, however, would be more than premature.

A. C. Redding

Dr Liljendhal's vacuum lavatory

The new report of the official working party on sewage disposal—"Taken for Granted"—put a stamp of governmental approval on the work of a Swedish engineer who will succeed Thomas Crapper, the inventor of the water closet, as the chief luminary of the lavatory. Lena Jegar's working party endorsed the invention of Dr J. Liljendhal: the vacuum sewerage system.

The system has everything going for it. First of all, it is sparing of water, since it rejects the use of gravity to convey toilet waste and, instead, uses vacuum. This simple principle makes major savings in water. Since the water closet accounts for about 35 per cent of all domestic water consumption, the advance is valuable. The vacuum system uses only one litre of water per flush, while your average British lavatory uses 12 to 15.

With the future prospect and intermittently the present reality of drastic water shortage, such water savings are essential. The Liljendhal system, in addition, may come to the rescue of sewage works, overtaxed with floods of effluent.

The vacuum sewage system entails a separation of toilet waste water (black water) from household waste water (grey water). This "black water" can be discharged straight into an existing conventional sewage system; it can be collected in a tank and pumped out by a road tanker; best of all, it can be treated on the spot. After a spell in the lime treatment tanks the final waste can be taken away for horticultural purposes.

The main pollution benefits of the vacuum lavatory rest in this black/grey water separation. Sewage works would firstly receive a reduced amount of water; where possible the grey water could be piped straight for agricultural use. Containing mostly detergent, it does not require thorough sewage treatment. And since a good deal of the black water treatment would be on site, in the basement of a block of flats for example, the actual quantity of human waste going to the sewers would be reduced.

Remarkably enough, the installation costs of the new vacuum lavatory in a block of flats is cheaper than for a water closet. This is because the pipes have a smaller bore, and since the transport of the waste works by vacuum, created by an electric motor, the pipes can ignore gradients. The main snag, from a British point of view, is the high capital investment we have already made in conventional sewer systems.

In Britain, pioneer work on the vacuum system is being done by the National Coal Board—it's ideal for pits. In Sweden, it is being adopted on a wide scale. It would be good to see some local authorities in Britain moving in to install the system in large housing projects.

Jeremy Bugler

New drugs for old

Zinc Bacitracin may now be used without veterinary prescription as a growth promoter in pig and poultry feeds. Substantial stocks had been built up in Britain by the manufacturers (Apothekernes Laboratorium of Oslo) by the time the Swann Report was published, and comprehensive marketing arrangements already made with three major UK distributors—the Colborn Group Ltd, Food Industries Ltd (a subsidiary of Unilever) and Vitamins Ltd.

Zinc Bacitracin is claimed by the makers to be highly effective in promoting growth and as rarely giving rise to bacterial resistance: "the few such resistant organisms encountered have been found to be sensitive to other antibiotics." In human medicine it is almost wholly confined to surface application. The manufacturers therefore expect it to be used increasingly in the UK as a standard inclusion in feeds of broilers, turkeys, piglets and fattening pigs. They hope its prescription-free use for calves will soon be permitted, and are carrying out field trials with laying hens. It is said to have been safely used in other countries for many years, and sales have doubled during the last twelve months.

Zinc Bacitracin may be all that its manufacturers claim. The fact remains, however, that scientists still do not know why antibiotics when added to feeds cause animals to put on weight. A fair question is "What sort of weight?"

Also to be considered is the highly intricate organisation of the inhabitants of the animal intestine, where the life of bacteria, fungi and protozoa is as delicately balanced as that of the micro-organisms of the soil or the larger members of the natural order. This complex inter-relationship is not fully understood, but it is known that it can be upset by antibiotics in feed, with disease as a result. Zinc Bacitracin is anti-microbial, but Apothekernes say it "is highly unlikely to cause an unfavourable shift in the balance of the gut flora." They do not claim that it will not do so. It is listed in the chemical encyclopaedia as suitable for veterinary use in enteric infections of dogs and swine, shipping fever of sheep and cattle, erysipelas of turkeys, and respiratory disease of chickens.

Apothekernes say there is no apparent risk to humans, either from direct toxicity or from sensitization, as it is not used systematically in human medicine. This, however, is because of risk of ne-

phrotoxicity (kidney poisoning). Being a mixture, the toxicity of Zinc Bacitracin is uncertain: it is, however, known to be more toxic than the penicillins and cephalosporins, which are now used in its place for other than topical application in human medicine.

"A response in feed conversion," say Apothekernes, "of as little as 0.5 per cent will in general be all that is needed to pay for the cost of inclusion." They indicate that an increase of 2-4 per cent in weight is to be expected. With the side effects of antibiotics, known and unknown, we may wonder whether such an increase is worth any risk.

Growing concern with pure food has created a demand for meat reared without routine antibiotics or other chemicals, and some farmers may decide to aim at this market rather than make another excursion into the unpredictable, in order to increase profits by a type of husbandry which many of them deplore.

Joanne Bower

The lakes of Sweden

Sweden has more lakes than some towns have people—more than 100,000 in fact, taking up almost 10 per cent of the land area. On one level, the nation values its lakes—as part of its landscape, its heritage. On another, the Swedes have treated their lakes with a rapacity only exceeded by the American use of the Great Lakes as industrial and domestic trash-cans.

Many of the Swedish lakes are grossly polluted, their water unfit for drinking or bathing. Fishing from a number of them is banned because of mercury traces in the fish. The Swedes have been extraordinarily myopic in their care of their lakes.

That said, Sweden is taking quite drastic action to redeem itself—much in the manner of its general approach to pollution problems: years of indifference followed by more action in a year than some nations take in a decade. Large experiments are being carried out to save lakes. The evidence suggests these experiments will create a number of standard approaches to lake salvation.

Lake Trümmen, near the town of Växjö, in the central part of South Sweden, is one of a chain of three lakes, all heavily polluted. Being nearest to Växjö, it is in the worst state of all, and a combination of waste from the local pulp industry and domestic sewage over the years has turned it into a swamp.

Restoration of the lake became an issue when the town started to spread towards the lake: the authorities had to take a decision either to fill it in or to restore it. They chose to try to save it, and the Limnological Institute at Lund started an 11-year project to do this with a team of scientists led by Professor Sven Björk, whom I visited recently in Lund.

He described to me various methods of treatment under experiment: "Trümmen has not been used for 10 years for effluent, but because of the previous misuse, it has on the bottom a 20 inch thick layer of black cultural mud. This layer contains most of the pollutants. In particular, it is over-rich in phosphorus and mercury."

After one year spent in studying the lake, the team decided to pump up this thick mud layer, a process that will take three years in full to complete. The mud is disposed of in gravel pits and agricultural land.

Björk is also studying and doing tests with a number of other methods of revivifying lakes. One of the most promising consists in pumping up the dead deoxygenated water from the lake bottom, aerating it in a treatment tank floating on the lake surface, and then pumping the water *back to the level from whence it came*. This final stage is vital because the cold and dead water from the bottom of the lake will create havoc, killing all fish and acquatic life, if it is allowed to return at surface level.

This factor has been a drawback in another treatment method whereby air is pumped in to the lake bottom by means of perforated hoses. Unless handled very carefully, the fresh air stirs up the lake bottom too much, and causes the dead water to rise.

At least one other Swedish lake has been the scene of notable advances in treatment methods: Lake Hornborga, again in south central Sweden. Once it was one of the most important waterfowl lakes in Western Europe, and a link in the migratory chain from the Arctic Sea to Africa. If all the lakes like Hornborga disappeared, so would the birds.

The Hornborga disaster was caused by land-hungry farmers in 1905, who had the water-level of the lake lowered by draining, and then rushed to grow crops on the new land. As an agricultural project this was a farce: the only crops to grow well were reeds. In a short period, the lake was strangled by more than 12 square kilometres of reeds and acres of marsh.

The Swedish Nature Conservancy Office launched schemes to save and restore the lake, an immensely difficult task, because as Professor Björk said "If you merely pump water back in to raise the water level again, the vegetation lifts with the water-level. The problem has been to divert vegetation from over-water reed-beds to under-water vegetation on which fish and water fowl can feed."

Wholesale use of herbicides was quickly ruled out, for obvious reasons. Currently the method being used is reed-cutting, deploying pontoon machines or amphibious harvesters. With the reed removed, a thicker layer of ice forms in the winter and kills off the new shoots of over-water vegetation. First results are encouraging, with large areas of the lake cleared and ornithologists reporting significant increases in water fowl.

The long-term plans for the lake include an archipelago effect, with areas of over-water reeds left as habitat for fowl. Gradually the water level will be raised between three and five feet.

The initial budget for this work at Hornborga is about £40,000, though about £1,000,000 will be needed to complete the project. The size of the budget of course shows how small this Swedish disaster is compared with the Great Lakes cataclysm in the U.S. Professor Barry Commoner, the American ecologist, has calculated that it will take the annual budget of the space programme (before it was trimmed) to save Lake Eyrie. What the Swedish example shows is that the technology and the funds can be found to cope with the small to medium salvage operation. The full-scale disasters may be beyond saving, as long as we continue to give priority to industrial growth.

Jeremy Bugler

Television and delinquency

Third working paper of the Television Research Committee, Leicester University Press

The average British teenager watches at least 20 hours of TV every week. During this time, he sees more beatings and killings than he is likely to witness in reality in a lifetime. At the same time, crimes of violence are increasing at enormous rates. Many people see these facts as closely related.

What—if anything—does TV do to children? Most media officials in this country claim that the box has no effect of any kind. But the thriving advertising industry, and the TV channel it supports, are based on the fact that television can manipulate both attitudes and behaviour. Washing powders are sold

as solutions to stains, violence as a solution to conflict, often as the only solution. Why should the one be effective, but not the other?

In the US, the networks have invented the catharsis theory. They maintain that seeing mayhem acted out can release aggressive instincts in harmless ways. This is a self-serving invention based on the unrepeated work of a single man and is a deliberate misreading of psychiatry. True catharsis depends on active participation in ghoulish deeds, with a resultant sense of guilt and loss.

In contrast, the many senatorial and presidential commissions which have looked into the problem in the US[1] have overwhelmingly concluded that the mindless gore on the box leads to mindless gore in the streets. Despite their warning that to glorify carnage is to inculcate it, heroic violence is broadcast into the living-rooms of America at an ever-increasing rate.

It was not until 1962 that the British government convinced the Independent Television Authority to take an interest. Eventually, they gave £250,000 to the Television Research Committee (TRC), to be used to investigate "the impact of TV on the young, with special reference to its effects on the incidence of delinquency".

Much of this money was frittered away on academic empire buildings, and in projects totally unrelated to the ITA's intentions[2]. When "Television and Delinquency" was finally released, it was claimed to prove that TV had no effect on the incidence of delinquent behaviour, on the grounds that the study had failed to find it.

It proved nothing of the sort. In fact, it proved nothing at all, other than that sociological research can be a costly waste of time. Like the pre-election polls, it was a perfect example of the computer programmer's motto: Trash in, Garbage out. In other words, surveys are no better than the questions they ask.

If the TRC's "scientific" methods were in fact "scientific", then it is clearer than ever that this term badly needs redefining. They subjected a group of teenage probationers and a "matched" group of boy's club members to a questionnaire on their TV habits. Samples from this standard interview included: "What part of an ordinary weekday do you like most?" "Would you say you watched TV in your mother's (and: father's/brother's/dining/sitting/ etc.) room?" "Would you say you talked to your mother (and: father/teacher/brothers/girlfriend/etc.) about TV programmes?"

What information could the answers possibly give about the role of TV in causing (or not causing) delinquency, or anything else? Yet the data was analysed and discussed as though it had the greatest significance. Other questions were hardly more illuminating. All this was surrounded by jargon, statistical techniques, and other mumbo-jumbo calculated to confuse the reader.

It may seem pointless to attack a relatively minor piece of incompetence masquerading as expertise, but this survey may have serious consequences. The ITA's money has been wasted, and with it, a chance to find the answer to an important social question.

Worse, the so-called results will now be used to justify any amount of gratuitous sadism on TV. The programmers and their sponsors are aware that they have created an appetite; in satisfying it, they maintain their audience. (When the US senate ordered American networks to reduce their output of fictional violence, they responded by increasing battle coverage from Viet Nam. It was "news", after all.)[3]

This vicarious addiction—regardless of whether it has a direct effect on the crime figures—is extremely dangerous in the long run. While teenagers are able to distinguish between Steed of the "Avengers" and their own situation, this is not necessarily true of infants. Five year olds see the hero back again this week, after having been variously strafed, knifed, and garotted on the previous show. This tends to make them disbelieve in the real consequences of violence in the world outside the TV set. What are the effects of so much propaganda to the contrary?

There are other forms of pollution than the chemicals which poison our air and water. Any technology misapplied can degrade the environment. The psychic pollution which results from the implantation of false and anti-human values in children by TV is all the more dangerous for its insidiousness.

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Francis Arnold

Comments

Before nature dies . . .

Nature's reviewer (Vol. 227, July 18th) is not the only one of our readers to wonder what kind of ecology it is that we're talking about. "Insofar as it deals with ecology at all," he writes, "*The Ecologist* dwells in a man-centred ecosphere and largely in those parts of it which man is supposed to be damaging beyond repair."

Not unreasonably the kind of ecology we're talking about is the study of the relationships between organisms and their environment. At the moment the organism we have chosen to concentrate on is man because his relationship with his environment is so extraordinary. We would have liked to study moles and nematodes and to draw charts showing energy flow in ponds, but we feel we ought first to dissuade our fellows from digging up the moles, battling with the nematodes, and filling in the ponds.

Man is our subject number one not because the biosphere is man-centred but because it is man-dominated. There's a lot of him around: he represents about one ten-thousandth of the total animal biomass and at his present rate of expansion he will form 100 per cent of it in less than 500 years (which in evolutionary terms is nothing). There will then be about 200 million tons of human being, and whether it will be inert or hideously active nobody knows and we doubt whether anybody cares.

Of course we'll never really get that far because something horrid will happen to us on the way up. We have managed to create deserts out of fertile land and transform rivers and lakes into wastes, and now we are making life very difficult for birds like the pelican. Whether or not you care about pelicans, they are useful biological indicators, and their decline is evidence that we will get hurt if we persist in our abuse of the environment.

It is inevitable that ecology should increasingly consist of appraisals of man's effect on the environment. This involves the study of interrelationships on a global scale and at every level of organization—including the cultural one. It can no longer be confined to the examination in terms of chemistry and biology of clearly defined micro-ecosystems, although of course such work is very useful.

Nor can we afford to be as "detached and cautious" as *Nature* expects us to be. When so many learned men are detached enough to develop nuclear warheads, nerve gas, and organo-chlorine pesticides, and cautious enough to condone the stockpiling of the former and the indiscriminate use of the latter, then it would be irresponsible to be mealy-mouthed. Somebody has to protest when we use our technological bag of tricks so hamfistedly that all but the most blinkered can recognize the damage done to the environment. Somebody has to plead for greater caution, more restraint, in the way wastes and other alien substances are imposed on Nature. *Nature* shouldn't find that too alien an approach . . .

Nixon comes clean

One of the most remarkable things about the Council on Environmental Quality's First Annual Report to Congress is President Nixon's introductory message. It is the first time that a head of state, particularly one so powerful and growth-oriented, has publicly admitted that we face ecological disaster unless vigorous action is taken now. He freely concedes the basic causes of our environmental woes: ". . . our past tendency to emphasize quantitative growth at the expense of qualitative growth; the failure of our economy to provide full accounting for the social costs of environmental pollution; the failure to take environmental factors into account as a normal and necessary part of our planning and decision-making; the inadequacy of our institutions for dealing with problems that cut across traditional political boundaries; our dependence on conveniences, without regard for their impact on the environment; and more fundamentally, our failure to perceive the environment as a totality and to understand and to recognize the fundamental inter dependence of all its parts, including man himself."

A remarkable confession; and Mr Nixon goes on to say that long-term solutions lie in "a basic reform in the way our society looks at problems and makes decisions", in changing our system of values, in what we think and teach our children life is all about. The President knows however that fine words butter no parsnips. Wise head-shaking over our values, and recognition that education has an irreplaceable role in inculcating ecological awareness and an environmental ethic, are not allowed to obscure the need for immediate action. Mr Nixon wants more research, but he also acknowledges that in a number of fields we know quite enough to do a great deal immediately.

Air hares

The Report's 326 pages* make the 29 pages of the Labour Government's White Paper look a little meagre. And Mr Nixon's public recognition of the immense problems his country shares with the rest of the world, makes Mr Heath's silence extra-deafening. Perhaps Mr Heath and his colleagues hope that if they keep quiet about it the environment will go away. Or perhaps they think that environmental action is a socialist fad, stimulated by an hysterical minority which will disappear at the end of that multi-national mistake—European Conservation Year. And perhaps ministerial responsibility for the environment has been lumped together with sport because ecological protest is conceived of as

* *Environmental Quality*, The First Annual Report of the Council on Environmental Quality, will be reviewed in our November issue.

rather a nasty pastime, one that no civilized government should have to cope with—like bear-baiting.

Whatever our prime minister's opinion, one of his minister's obedient servants, the Chief Inspector of Alkali, has decided to use his Annual Report as a platform for some rather confused notions about present-day interest in the air and all that therein is. Mr Ireland certainly doesn't mince matters. There are "prophets of doom" abroad, he says, "who predict the more bizarre kinds of human catastrophe" and who are causing a grave disservice to all of us who like to have a good clean breathe now and then. Apparently these fellows distract the Alkali Inspectorate awfully since their "misleading views" result in a "flood of questions from an alarmed public". Mr Ireland doesn't enlighten us as to who these prophets might be. They cannot be conservationists or antipollutionists since he acknowledges that pressures from them "have helped us to raise standards, gain better enforcement and introduce beneficial legislation".

Perhaps Mr Ireland is thinking of Russell E. Train, Robert Cahn and Gordon J. MacDonald, the eminent members of the Council on Environmental Quality. Mr Ireland contends that there is no sign that weather, temperature and climate are being disturbed by man's efforts. The Council sees things in quite another light, and asks that world-wide recognition be given to the long-term significance of man-made atmospheric alterations. During the past 12 years the concentration in the atmosphere of man-made carbon dioxide has increased from 312 to 320 ppm, and at that rate it will double in about 23 years time. In theory this would result in a temperature increase of 1.4°F, and ultimately in the melting of the polar ice-caps. However, particle pollution and changes in the earth's albedo seem to counteract this effect. All this is by no means so speculative as Mr Ireland would have us believe. They are reasonable predictions from measured changes, and Mr Ireland does us and his inspectorate a grave disservice by belittling them. That so far the net change in climate is not worth worrying about is fortuitous and quite irrelevant—what alarms responsible scientists is that man has the capacity to alter climate, but has very little knowledge of the mechanisms by which he does so. When we are burdening the atmosphere with an extra 20 per cent of sulphur dioxide it is foolish to raise hares about the puniness of our efforts compared with Nature's. We know that sulphur dioxide is dangerous to health and it is perfectly possible that such excess quantities will end in some other form of ecological backlash.

Mr Ireland's outburst received quite a lot of press attention, which lent some point to his remark that it is "ironic that the people who receive the most attention are those who shout the loudest and make the most exaggerated claims". His fears that "creative effort could be diverted from the more profitable pursuit of official duties" are fully justified when he goes chasing after his own hares. Those who are concerned about the wider implications of air pollution and who predict that inadequate measures will end in catastrophe are not irresponsible prophets of doom. They are part of an increasingly informed pressure group which already has been useful to Mr Ireland, as he confesses. There is no doubt whatsoever that the Alkali Inspectorate is doing excellent work, nor that air pollution should be combatted much more vigorously, nor that we as a nation should be prepared to spend much more money on so doing. Money and public understanding will not be forthcoming while legitimate fears are dismissed in a couple of intemperate paragraphs.

Hot water

If the French, West Germans, and Swiss go ahead with their proposals to build 40 nuclear reactors along the Rhine the once limpid cool waters of this now heavily polluted river will undergo a sizeable rise in temperature. It's hard to guess what this rise will be and what sort of witches' brew it will make of the vast assortment of chemicals that pour into the river from the Rhine industries, but the temperature could rise to over 80°F. Under these circumstances stepping into the Rhine will be like taking a warm, though hardly enticing, bath.

The temperature rise will also have a marked effect upon the local climate. It may put an end to frost and ice, but it won't necessarily mean better weather. More likely early morning fogs and vapour plumes from the cooling towers will shroud long stretches of the Rhine from the sun on "otherwise pleasant sunny days" (see *The Power Crisis*, p. 5).

Human nature being what it is most people living close to the Rhine may prefer to sit back and let "progress" take its ineluctable course, but they should listen to some of the fears voiced by American scientists at a proposal to build just two reactors—each of more or less the same size as the proposed Rhine reactors—at Calvert Cliffs overlooking Chesapeake Bay.

The scientists, all from John Hopkins University, include among others, Edward P. Radford, professor of environmental medicine, Timothy Merz, associate professor of radiology and radiobiological science, and Carleton Ray, associate professor of pathobiology and biology. While not denying "other serious insults to the Bay" such as sewage, industrial wastes, pesticides, nitrates, phosphates and other fertilizers", the scientists feel that "nuclear power creates special problems". Calvert Cliffs, they point out in *Environment* (1969, *17*, 20), is a place of great natural beauty much of which will be destroyed should the reactors get built. Nor must it be forgotten that even after they are no longer operational some parts of the reactor structure will remain desolate, uninhabitable masses of concrete on the cliff tops.

The Bay is six miles wide and goes down to a maximum depth of 110 feet. The two reactor units, both of 800,000 kilowatts, will each require water for cooling equivalent to a lake one foot deep and 7.7 miles square each day. The designers estimate that the cooling water will be heated by 10°F when the flow is 1,200,000 gallons per minute. The discharge into the Bay could raise the temperature of its water by 10 to 20°F.

Because it has a different viscosity and density than cooler water, warm water tends to rise to the surface and override the cooler water. Professor Radford and his colleagues fear what a plume of warm water will do to the marine life of the Bay.

Some species will breed early and their larvae will consequently die for lack of food; other species will find their metabolism hopelessly awry—an increase of 18°F for example increases the metabolic rate of organisms from one to six times—and the chances are they will succumb to disease, to physiological, reproductive and behavioural derangements, to premature old age and to excessive growth. The long-term effects of a local hot spot are impossible to gauge precisely but both the distribution and abundance of species in the Bay could become drastically altered.

What about the radioactive contamin-

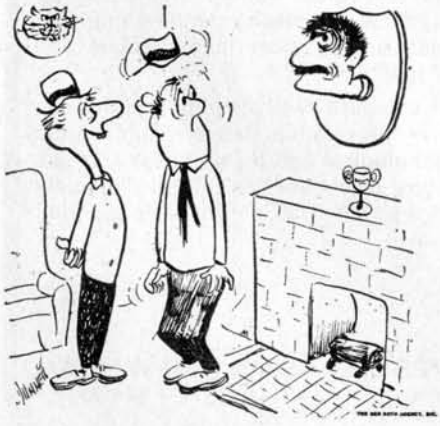
ants? Tritium will be the principal radioactive pollutant discharged into the cooling water, and the scientists estimate that the total quantity of tritium in the Bay at any one time could reach an equilibrium level of some 100,000 curies.

Tritium is chemically identical to hydrogen and quickly becomes incorporated into water molecules. Some of these water molecules are bound to get taken up by plants and built by photosynthesis into their tissues. A proportion of the tritium entering the plant in this way will finish up in the nucleic acids of the chromosomes, and hence via the food chain into the nucleic acids comprising the chromosomes of fish and other marine animals.

The turn-over of nucleic acids is slow in the chromosomes and ultimately the concentration of tritium—which emits a potentially dangerous beta particle when it decays—could be considerably higher than predicted by those scientists who prefer to discount the hazards of this particular radioisotope. In man tritium is most hazardous when it finishes up close to the genes, as it would if contained in nucleic acids.

The other principal radioisotope, krypton 85 will be emitted into the air. During a year's operation of both reactors some 42,800 curies in all could be discharged. Undoubtedly the isotope disperses rapidly and is of no particular hazard to the local inhabitants, but it is worth bearing in mind that a century of electricity generated in nuclear reactors could mean that the presently accepted levels of radiation to which the general public may be exposed might well be exceeded by just this one isotope alone.

Indeed it is the future that we must all be concerned with. One reactor here or there is hardly likely to cause any great repercussions in the environment, and the proposals to put up reactors are usually made on such individual grounds. But what happens when as *Science Journal* (August 1970) predicts, there will be one more sizeable nuclear reactor added to the world's inventory each day. Do we want all our rivers to turn into baths of boiling water? Do we want all the natural species of our rivers and coast to become extinct? And can we really afford to let the levels of radioactivity gradually rise until one day they are no longer tolerable anywhere in the world?



"Oh him, I caught him polluting one of our lakes"

To cast the horoscope of a nation

"... History is never more valuable than when it enables us, standing as on a height, to look beyond the smoke and turmoil of our petty quarrels, and to detect in the slow developments of the past the great permanent forces that are steadily bearing nations onwards to improvement or decay.

The strongest of these forces are the moral ones. Mistakes in statesmanship, military triumphs or disasters, no doubt affect materially the prosperity of nations, but their permanent political well-being is essentially the outcome of their moral state. Its foundations are laid in pure domestic life, in commercial integrity, in a high standard of moral worth and of public spirit; in simple habits, in courage, uprightness, and self-sacrifice, in a certain soundness and moderation of judgment, which springs quite as much from character as from intellect. If you would form a wise judgment of the future of a nation, observe carefully whether these qualities are increasing or decaying. Observe specially what qualities count for most in public life. Is character becoming of greater or less importance? Are the men who obtain the highest posts in the nation men of whom in private life and irrespective of party competent judges speak with genuine respect? Are they men of sincere convictions, sound judgment, consistent lives, indisputable integrity, or are they men who have won their positions by the arts of a demagogue or an intriguer; men of nimble tongues and not earnest beliefs—skilfull, above all things, in spreading their sails to each passing breeze of popularity? Such considerations as these are apt to be forgotten in the fierce excitement of a party contest; but if history has any meaning, it is such considerations that affect most vitally the permanent well-being of communities, and it is by observing this moral current that you can best cast the horoscope of a nation."

Edward Hartpole Lecky
Historical and Political Essays

Freudian slips

One of the defects of many of the disciplines dealing with human and social behaviour is that they are based on a study of a single culture—that in which they were evolved—out of the 3,000 or so that anthropologists have isolated and described.

As a result, their laws apply to the cultural behaviour of a single society as opposed to the total behaviour of the human species.

They are thus 'culturebound' or 'sociocentric' a fact that is well illustrated by the different theories that make up the discipline of psychoanalysis.

As Linton writes (*in The Study of Man*): "... The earlier psychoanalysts carried on their investigations entirely within the frame of European culture and largely within that of a single class in European society. Lacking comparative materials, they took many environmental factors for granted and built up an elaborate theory of universal human instincts. The various attempts which were made by Freud and others to apply its instinctual approach to the explanation of cultural history struck anthropologists as fantastic and led them to minimize the very real contributions which psycho-analytic techniques might make to the solution of many of their own problems."

We can illustrate this with three concepts that psychoanalysts have taken as being genetically determined features of human nature and which cross-cultural examination reveals to be culturally determined and specific to certain cultures only.

The first is the Oedipus complex. Malinowski spent two years among the Trobriand islanders in Melanesia. This society is matrilinear, the head of the family being the mother's elder brother. Hence the function of the father is totally different from that which he fulfils in the sort of culture examined by Freud, and the son's relationship with his parents could not possibly give rise to the Oedipus complex, of whose existence, in fact, Malinowski found no trace. He writes (in *Sex, Culture and Myth*).

"When we come to examine in detail

the original constitution of the human family—not in any hypothetical primeval form, but as we find it in actual observation among present-day savages, some difficulties emerge.

We find, for example, that there is a form of matriarchal family in which the relations between children and progenitors do not exist in the typical form as required by Freud's hypothesis of the Oedipus complex. Taking as an example the family as found in the coral archipelagos of Eastern New Guinea, where I have studied it, the mother and brother possess in it all the legal *potestas*. The mother's brother is the 'ferocious patriarch', the father is the affectionate friend and helper of his children. He has to win for himself the friendship of his sons and daughters, and is frequently their amicable ally against the principle of authority represented by the maternal uncle. In fact, none of the domestic conditions required for the sociological fulfilment of the Oedipus complex, with its repressions, exists in the Melanesian family of Eastern New Guinea. . . ."

The second example is that of anal eroticism. Cora Dubois, whose study of the inhabitants of the Island of Alor in New Guinea has now become a classic, points out that among these people there is absolutely no trace whatsoever of this form of eroticism. The anal zone of the buttocks apparently never acquire any erotic value with the Alorese. The latter, when children are never beaten on the buttocks and anal erotic play is unknown.

The third example is the fear of death. Contrary to what most people think, the fear of death is not universal. It has been developed *pari passu* with the disintegration of societies. Man in a stable society tends to regard himself as but a stage in a long cultural process of which his ancestors constituted previous stages and of which his descendants will be future ones. This process is accumulative, i.e. the dead do not disappear. They remain members of the tribe; they have simply acquired a different status involving the performance of different and more general duties. At the same time, they continue to live on in the "real" world in the persons of their descendants.

In these conditions, death is a very different and nothing like so frightening event as it is among the "isolate" inhabitants of unstable societies. Kardiner (in the *Psychological Frontiers of Society*) illustrates this with reference to the Commanche Indians. The Commanche warrior has always faced the possibility of death, (. . . yet there is no evidence of any neurotic anxiety about the idea of personal destruction, nor are there any desperate attempts to elaborate fanciful conceptions of a post-mortem existence. The inference is therefore justified that an ego-structure devoid of hypochondrial elements created by the suppression of essential drives does not necessarily conceive of death as an anxiety-provoking prospect.

I am sure that a cross-cultural approach would reveal that most of the concepts of psychoanalysis, in terms of which their model of human unconscious behaviour is built, are culturally determined and specific to our own and related cultures.

Books

Key book *Every month a key book or books in the field will be described and analysed in this column.*

The future is red

THE NEW INDIANS
by Stan Steiner, Dell Publishing Co., New York, $2.45.

THE NATIVE AMERICANS
by Robert F. Spencer, Jesse D. Jennings, et al., Harper & Row, London.

The Yankton Sioux of South Dakota once had a problem. They were desperately poor but they were proud. They wanted to share the benefits of the industrial society around them, but they wanted to keep those aspects of their own culture which they valued most. Everybody said that was impossible. But they were determined to have their cake and eat it. And they did.

They began by converting their church community hall into an electronic components factory, which quickly grew from twenty to forty men and became highly respected by the companies which had subcontracts with it. Then they decided they would like to help the Santee Sioux from the other side of the Missouri River by expanding so that they could give jobs to fifty of their men when winter brought unemployment.

So the Yankton Sioux sent a spokesman to Washington to ask for $8,000 for new tools. The Commissioner of Indian Affairs was intrigued and sent along an industrial expert to see what the factory was like. He was so impressed that on his return he proposed a $115,000 electronic plant be built instead.

That was just what the Yanktons didn't want. All they wanted to do was help the Santee, not start an industrial empire. Vine Deloria Jr., the son of their spokesman described to Stan Steiner what happened:

"My father talked to the Commissioner all afternoon, trying to get that $8,000. He was told the government has no way to give a tribe that little money for equipment. It has to be a monstrous program: On the Job Training Centers, Capital Funds for Industrial Expansion, Ten-Year Development Projects, and an investigation as to who is on welfare. He was told: Okay, those crazy Indians want to live in Greenwood way down in the weeds on a dirt road eighteen miles from nowhere. We will build them a great big two-lane highway so the trucks can get in and out. We will build them a huge plant.

"It was incomprehensible to the government. Soon as an Indian got good on electronic work the Bureau would try to send him on relocation to Los Angeles. They would say: 'You can earn $3.75 and $4 an hour out there.'

"But the Indians would say: 'We have been to Los Angeles. We didn't like it. We rather live on the Missouri and earn $1.25 an hour. Here there are no freeways. Here no one pressures us to conform to the white man. Here we are free to be ourselves. We can hold our dances and sings and church services and live simpler and come out ahead. We are happier.'

"The tribe had to go ahead on its own. The Episcopal Church of Boston gave them the $8,000. And they are doing it in their own way. What they are doing is putting the old Indian society together again with the white man's economics. And it works."

Not only does it work, but it works exceptionally well—and in a quite exceptional way. There are no labour disputes and there is no time clock. Every Sioux comes and goes when he pleases. He can work all day and all night if he likes, and then go off for a fortnight. He can work non-stop, or in the intervals between fishing, dreaming or making love. At the end of the month he is paid for whatever work he has done, no questions asked or needed.

This must be the dream of every tortured commuter, every bored frustrated nine-to-fiver. Do we really have to go through so much soul-destroying activity before we can enjoy all that makes life worth living? The Sioux don't think so. "The white man," one of them said, "works like a slave all his life in order to retire, to be able to loaf and hunt and fish. We already have this for which the white man is working. So why should we adopt his ways and work all our life for what we already have?"

The Sioux, like many of the modern North Amerindians, are exercising their right to *selective* acculturation. They are consciously striving to create a society with a future out of their anachronistic past and the white man's problematic present. A new generation has arisen which, educated by the dominant culture, has refused to be dominated by it. In the past the Indians were demoralized by the way their tribal values always conflicted with those of industrial society. Now their children have entered it, have been made articulate by it, and have returned determined to "retain their traditions while integrating into the dominant culture, by choosing the best of both, coupled with a belief in the Great Spirit." Their fathers feared the technology of Western civilization, but they now know how to master it—yet not be mastered by it.

Their aspirations are peculiarly relevant to our own needs. We too would like to continue to benefit from our remarkable technical achievements, but we do not know how to separate those worth keeping from the potentially destructive paraphernalia of the marketing economy. We seem to be trapped by social and economic structures of our own making, and recognizing this the Indian has decided to take what is good about our culture, but not to allow what he values of his own to disappear. There is no reason why we should not drop our pretence of superiority and join them, for as Vine Deloria Jr. suggested to Stain Steiner, the "tribes are not vestiges of the past, but laboratories of the future".

Kenneth Stewart concisely summarizes the issue in *The Native Americans*:

"The Indian of today is neither the Noble Savage nor the Bloodthirsty Savage. A real human being rather than an image of fantasy, the Indian now lives in a world of automation, of expanding urbanization, and of persistent international tensions. The Indian is being inexorably drawn into the maelstrom of this complex outside world with its multitudinous problems which baffle not only the red man but the white man as well. Both races are entangled in this intricate situation. The white man must still assist the Indians, the original possessors of the continent from which they have been displaced. Perhaps the Indian can also help the white man. We are already culturally indebted to the Indians in so many ways; perhaps we could learn still more from them. We might profit by re-examining the world views of the Indians, to see what they still have that we seem to have lost, what it is that has enabled them to survive and preserve so much of their native traditions, despite the profound pressures to remake them."

The number and intensity of these pressures make gloomy reading. The Indians were literally held captive from the time they were defeated to just before the Second World War. The US Army was still on one reservation as late as the 1920's. But they were treated not only as defeated enemies but also as wards, a combination which could not be more effective in demoralizing them. Nor is there any doubt that such was the purpose of the US Administration, for

one 19th century Commissioner of Indian Affairs explicitly stated that he would rejoice once the Indians were "reduced to the condition of supplicants for charity".

An immense amount of time and money has been spent not on helping the Indians but on reducing them to cultural impotence. The goal of both education and the Christian religion has been to deculturise them, to teach them "the manners and ways of the whites". In part they have been successful, but fortunately some religions like that of the Teton Sioux have survived relatively unchanged, while education is now being used to learn the ways of the whites—so that their continued efforts to induce culture change can be resisted!

Whenever the Administration has encouraged industry to open on the reservations, or whenever it has begun housing projects, it has never asked the Indians how they want them to be or even whether they want them at all. The result of such ill-considered skirmishes in the so-called War on Poverty is—poverty. One in three factories on the reservations in 1965 were either closed or temporarily bankrupt because they had to be managed and run the white way "for the good of the Indians". Numerous suburban apartments lie empty because the Government disregards the wishes of the Indians and insists that is the way all good Americans should live. But although the Indians loathe the abject poverty many of them must suffer, few are willing to sacrifice their culture on the altar of a welfare programme.

It is remarkable how well their cultures have survived. When the conquistadores were driven out of the pueblos of New Mexico, they impressed thirty young men of the Pueblo of Isleta to carry their equipment. These men were abandoned in the border town of El Paso. Today, 290 years later, the town has grown into a city of 300,000 and the men of Isleta into an Indian community of 1,000. Known as the Tigua Indians, they retain their government and priesthood, their ceremonials and rituals, even more strongly than has the still-conservative Pueblo of Isleta from which they came.

One reason why the Indians have managed to preserve so many of their traditions is that their kinship systems still survive. Although greatly modified and under some strain they fulfil the function of a kind of unofficial nationwide social security system. They help to strengthen loyalties and maintain the sense of care and affection for relatives however distant. The Indian cannot understand the way we would rather institutionalize an old person than take him into our homes.

Another potent force is their love of the land. The Mohawks of Caughnawaga have only enough land left to be buried on. They work as high structural steel-workers, the "jockeys of the clouds", and yet not one of them has been buried outside his reservation. The Indians of Taos Pueblo cherished "every living thing that grew from the green earth of nature". Indians value their land not because they like to own a useful piece of real estate but because they have an almost mystical relationship with it. Yet they do not contemplate nature as do the orientals, nor of course do they try to conquer it as we do. They themselves have difficulty in expressing the reverence they have for it—often they are content to say they simply *live* in it.

This love of life, "of every living thing, the joys of nature, the harmony of man with the natural world, the communal brotherhood of the tribe, the free spirit of the individual, the loving—not prohibitive—care of children, the larger love of the kinship family, the concept of justice, not punishment, the wholeness of man, the eternity of the present"—these are some of the things implicit in the cultures of most of the Indian peoples, and these, argues Stan Steiner, the Indian can teach us.

An Oglala Sioux, William Fire Thunder, put it another way: "When civilization is ready to destroy itself, Indian youth can rise up and teach the science of survival to the white world. If, that is, the Indian remains an Indian."

Robert Allen

Slicing the cake

POPULATION AND FOOD SUPPLY, Essays on Human Needs and Agricultural Prospects.
Edited by Sir Joseph Hutchinson, Cambridge University Press, US price $4.95 (UK price not marked).

The problem is not food supply, but overpopulation. No matter how great natural resources may be they are finite and the size of the population they will support must be limited. Nevertheless the world population is increasing and provided a solution is sought to the main problem we will need to know how much time can be bought by increasing food supplies.

We tend to think of the population explosion as a new phenomenon. Indeed, many of those who dismiss the predictions of the demographers base their argument on the fact that not many years ago the fear was of declining, not mushrooming populations. If this argument needs an answer outside the tables of statistics it seems to ignore, it may be useful to look back further into history. Pope Urban II, in a message to the Crusaders, urged them to leave their homelands which, he said, "are too narrow for your large population; nor do they abound in wealth; they furnish scarcely enough food for their cultivators". The good Pope's solution was to claim the "land of milk and honey" currently occupied by "the wicked face". Life was simpler then.

This passage is quoted by J. M. Thoday in the first of the essays which the University of Cambridge published, based on a series of lectures given first in 1966 and again in 1967. It was felt that the relationship between human communities and the biological resources on which they depend was imperfectly understood. The aim of the book is to introduce the reader to the biological needs of human communities, to the biological resources by which they must be met, and to the problems of balancing the one against the other.

The aim is noble and the treatment thorough, so far as it goes. Perhaps it should go further, for "biological resources" suggests more than food supply, and agriculture should not be considered outside its wider environmental context. If increased use of pesticides is advocated, for example, we should take account of the environmental damage they are likely to cause and the possible long-term effects on the health of the communities they are meant to serve. However, a line must be drawn somewhere if any particular aspect of the overall problem is to be dealt with in detail.

The book begins with a broad survey of the problem. It explains the rate at which populations are increasing and points out that the most pessimistic predictions have been under-estimates. The danger is not only of hunger itself: if people are hungry enough for long enough they will have no choice but to fight for food or to die. The logical next step is to consider human fertility and the factors which influence it. This is the subject of the second essay, by A. S. Parkes. He mentions that in certain areas of the world at the present time half the population may be under eighteen, or even fifteen, years of age. He describes briefly experiments into the social effects of overcrowding on rats. There are dangers in extrapolating from rodents to man but the signs of social and political disturbance which appeared in the rat communities are apparent among men and if there is a true parallel we may expect worse to come as the pressures increase. His conclusion is not hopeful: "... the medical scientist continues to accelerate the growth of world population, the agricultural scientist struggles with the problem of feeding the multitudes, the educationalist fights a losing battle against illiteracy, and the sociologist ponders on the results of increasing miscegenation. The biologist, less emotionally involved, speculates ... on how soon the crunch will come".

The discussion turns then to economics to show how Malthus' predictions seemed to have been proved wrong as the Industrial Revolution brought a measure of prosperity to Europe and America. This was due, of course, to the opening up of large new resources overseas and it is only recently that the geometric growth of population has begun to catch up again with the arithmetic growth of resources. Even then, R. T. F. King does not believe it will be food supplies which provide the Malthusian factor which prevents further proliferation. He may be right, but I think he is over-optimistic in placing as much reliance as he does on new food technologies. This is one point where a more detailed examination of the wider ecological implications might have been worthwhile. These new techniques may offer considerable hope in the short term but as a major source of food on a world scale, in the long term they are likely to create as many problems as they solve. King points out, quite rightly, that food production is required to do more than produce food for its own sake. The industrialized countries achieved their economic "take off" when they were able to produce an economic surplus for investment. Until the developing countries are able to produce similar surpluses for themselves their economies cannot grow. Our surpluses came from Asia, Africa and America, but now there are no new territories for exploitation by would-be colonial

powers. This leaves no alternative but to produce a surplus internally from a country's own resources, but until production overtakes internal consumption there can be no surplus, and so long as the population continues to expand to increase home demand no amount of personal or national saving can improve the situation. The rich will go on getting richer and the poor poorer.

There are those, too, who accept the Malthusian approach and are willing to sit back and let it happen. For their benefit A. Leslie Banks describes in some detail the nature of this solution: pestilence and famine, malnutrition and disease.

K. J. Carpenter explains man's dietary needs. This is more complex than it may seem, because these vary from climate to climate and from culture to culture. The daily protein requirement for a 25-year-old male, for example, is variously estimated as 70 g for a 70 kg American, 91 g for a 65 kg Englishman and 43 g for a 65 kg Indian. Nevertheless, rough figures have been worked out and corrected for age, body weight, sex and climatic conditions and it is possible to compare production with requirement on a regional basis, if only approximately. The conclusion is that if the problem is soluble at all, it is only on a basis of bare subsistence and with the aid of as much technology as can be brought to bear.

The remainder of the book is devoted to consideration of available food supplies and ways in which they may be increased. In the light of what has gone before, B. H. Farmer's conclusion may appear to be something of an understatement: "... it cannot be denied that there is a serious food problem in many countries, which need all the technical and other assistance it is possible to give them". What I think he means to say is that apart from population control there is no solution, we can but hope and pray.

Is it possible to increase agricultural production, for this, after all, is the theme of the book? Certainly a good deal may be achieved by land tenure reform though W. Allen points out that even this depends on population rates not growing faster than non-agricultural employment. What about the soil itself? Professor Hutchinson, who edited the essays, describes the history of some of the common crop plants and stock and then discusses agriculture's other resources: climate and soil. Man's control of climate is minimal but he has considerable control of soil fertility and there is no doubt that many areas could be made more productive by an improvement in farming methods. But even then ...

The book makes gloomy reading. There have been developments and minor changes since it was written, but its main conclusions hold good. These are summed up by Professor Hutchinson: "In the longer term it should be accepted that agricultural production cannot be multiplied indefinitely. It is no more than common prudence to plan for the stabilization of human populations before the point is reached that food production can no longer keep pace with human multiplication, and readjustment by catastrophe becomes inevitable." Provided population growth is brought under control agriculture can help to bridge the gap by providing more food in the short term. And that is about all.

Michael Allaby

Bring out your dead

A HISTORY OF THE BUBONIC PLAGUE IN THE BRITISH ISLES
by Dr J. F. D. Shrewsbury, Cambridge University Press, 160s.

It is hard to know what to think of a book which states, in passing, for those who may be interested: "... (black death) is a silly nickname, because death from plague is no blacker, figuratively, than from any other microbial disease of man, and though the cadaver of a plague-victim may exhibit a purplish hue, the corpse does not turn black."

In pursuit of cases of the plague, Dr Shrewsbury has investigated the burial records of more than 100 parishes over the years 1348-1665. He has compiled records of payments to doctors, tax relief for lords and clergy, monies for grave-diggers, and for the destruction of dogs. From these and other sources, he has analysed every report of plague ever to hit these islands.

"The Plague" is 538 pages, plus footnotes. This and its price make it unlikely that it will enjoy a wider public than epidemiologists, historians, and the odd necrophiliac. This is unfortunate, for the book gives—sandwiched between the macabre facts and bloodless graphs—a more realistic view of social history than can be found in any school text.

Dr Shrewsbury points out in his introduction, that the plague "was chiefly a disease of the poor ... because the poor lived in single-storey hovels, in the roofs of which, the house rat lived, bred, and died; while from its nests, the starving (plague) fleas fell directly among and upon the humans below". The castles and manor houses were made largely of stone, which protected their inhabitants from this risk.

This higher life expectancy of the rich was just as true of the 19th century. By 1830 the infant mortality rate for the upper classes had been reduced to one in 10; for the lower classes, it had risen to one in four. In fact, it is true today, in the US, at least. "Lung Street" in Harlem has more than twice as many cases of TB *per capita*, in relation to the national average. It would be interesting to know the difference in environmental causes of death between industrial workers in the Midlands, and managers in London's suburbs. But it is not difficult to make a prediction. ...

It is probable that these distinctions will increase as the public realize that pollution can be literally a matter of life or death, and those who can afford to do so act accordingly. The middle and upper classes will move increasingly to areas where the air is unpoisoned and the water safer to drink.

Of course the process is not new, but as times goes on, urban areas will become more and more like ghettoes of the poor. Rateable values and the whole tax base will decline, and essential services like garbage collection will have to be paid for out of the national exchequer or not at all. Local urban authorities will be starved for funds; this is already visible in some schools.

Very likely, the suburbs, seeing themselves as impossibly taxed, will be polarized against their sources of support—the towns. This will be alloyed with racism, overt or otherwise. The process is already moving towards completion in the US, with its higher cost of living and lack of an adequate health service. Spiro Agnew's entire appeal is based on the factors of suburban tightfistedness and fear. Will politicians in this country also seek to exploit the situation? One hopes not, but already there are signs.

If the middle classes are exceptionally shortsighted, and there is no reason to suppose they will not be, the town dwellers, debilitated by pollution, and surrounded by the consequences of a massive breakdown in public services, will fall victims of a plague. With the high population density and efficient transport of England, the countryside, too, will be affected, even more severely, perhaps than in 1348 and 1664-6 when the population was decimated.

Were this to happen, one might expect to find, after the re-emergence of a more than subsistence economy, some two hundred or more years later, an epidemiologist trying to determine the causes of the destruction of the previous civilization.

He would know of the existence of the germ warfare research establishment at Porton Down, and might suspect that despite ministry assurances to the contrary, large quantities of lethal bugs or toxins were being made there. Could they have escaped, he might wonder.

Our future scientist could theorize about a new and rapacious mutant strain of disease, or the reactivation of an ancient one. Perhaps there was an uncontrolled proliferation of a carrier species? But were he to discuss the true causes of that plague, he would be laughed out of academic circles. After all, who would believe that a culture so magnificent—its towering ruins visible on all sides—could have destroyed itself through pure and simple greed?

Francis Arnold

Awful warnings

THEY ALL RAN WILD
by Eric C. Rolls, Angus and Robertson, 1969, 444 pp. 65s.

If only Captain Cook could have taken an ecologist with him, Australia could have been spared the disasters from the Acclimatization Societies, who cannot be blamed for the rabbit and the prickly pear, but "there was never a body of eminent men so foolishly, so vigorously and so disastrously wrong", in the words of Eric C. Rolls.

Acclimatization unfortunately came before ecology, and from 1820 to the 1890's it was thought desirable and practicable for the Englishman overseas to have English nightingales to sing to him from English elms in Australian paddocks, and to bring back Australian magpies to sing from Australian eucalyptus trees when he came home with his fortune made from wool. Trials in the many Jardins d'Acclimation throughout the

world have led to many useful introductions that do not destroy native flora, but Colonial Governors and famous scientists giving the best advice are responsible for the consequences of bringing in foxes to hunt, the trout that destroyed Australia's native fish and the deer that have done so much damage in Australia and New Zealand.

Some of the introductions were intended as biological pest controls and the three commonest birds in Australia, the house sparrow, the starling and the Indian myna were brought to eat the caterpillars that made market gardening almost impossible. Eric Rolls traces the history of the sparrow from the first 120 to arrive in 1862, through the first complaints of damage in 1867 and a Professor McCoy defending the birds by citing Buffon, the French naturalist who stated that each pair ate 4,000 grubs a week and the formation of Anti-Sparrow Clubs as early as 1867, to the use of nerve poisons in 1967. These made as few as 1 per cent of the birds fly wildly and cry loudly which so distressed the rest of the flocks that they flew elsewhere. Starlings were found to eat more predators than pests, and developed a habit of riding on the backs of sheep, six or seven to a ewe, and even nesting there to the distress of the animals that were the only familiar object to the original starlings longing for English meadows.

Private James Brumby, who abandoned his horsebreeding establishment in 1804 when called away by military duties, is responsible for the first of Australia's wild horses, now called "brumbies" and recruited still from escapes, especially in World War II when "many a property of five thousand square miles had no more than one or two competent stockmen to run it". Today they are shot from aircraft and motorcycles, the best portions taken by fourwheel drive lorries to the portable freezers in camp where they become tinned pet foods in one of the latest and most profitable of Australia's well paid and bloody trades.

Though Ned Kelly has the best known name in Australian history, Thomas Austin of Barwon Park, near Geelong, had far the most lasting influence, for he reared and released the first 24 rabbits that produced the population explosion of nuclear proportions that still, despite myxomatosis, hangs like a grey mushroom cloud over Australia. Five had been landed in 1788 with the first New South Wales Settlement, but they died, and in 1806 the Reverend Samuel Marsden had tried to establish a warren at Parramatta, and failed.

The first half of this detailed and painstakingly accurate book is devoted to the history of the rabbit, its spread and the struggles to control it, beginning as a protected treasure, and swiftly becoming a curse. Its history should be studied by all ecologists, for it is one of exploitation, short-sighted expedients, wild ideas, official blunders, and complete disregard of ecology. Mr Rolls, who is an Australian farmer with a love of his great country and its wild life, has a great deal of practical experience of rabbits and the natural history of the imported pests that are the worst pollution of Australia—so far.

He has written a great book by intensive library research and checking with Australian scientific authorities apart from the many in the extensive bibliography. May we hope that he will now write one on the plants that ran wild, for here he has space only for hasty glances at the blackberry and the prickly pear. Could he use the same painstaking industry and the prose that "walks tall" through this hefty book, to tell the story of Patterson, who introduced "Patterson's Curse" (*Echium plantagineum*), Rogers of "Stinking Rogers", the ten foot high *Tagetes minuta*, and of all the other ecological disasters that an age of optimism inflicted on Australia?

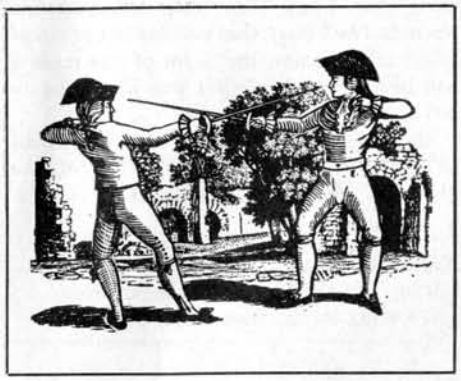
Lawrence D. Hills

Too much of too little

NITRATE IN SOIL, PLANTS AND ANIMALS
Soil Association, Haughley Research Farms, Haughley, Stowmarket, 5s.

As a contribution to European Conservation Year, the Soil Association has commissioned a survey of the world's scientific literature on nitrate in soil, plants and animals. One hundred and eighty-nine references of papers published from USA, Canada, UK, USSR, Germany, France, Holland, Sweden, Australia and New Zealand are included. The dangers of over-nitration of the soil are clearly documented and possible sequelae following nitrate uptake into plants on the health of animals and possibly humans is demonstrated, together with the adverse effects of such over-chemicalization on soil structure and fertility.

Harry Walters



Letters

From the USA

Sir,

I am pleased that your publication has been called to my attention. It has been my view for some time that the news media have a great responsibility to inform the world public of the implications today's environmental neglect has for future generations.

I applaud your efforts and extend to you my congratulations and best wishes.

Yours sincerely,

Gaylord Nelson.
US Senator, United States Senate, Committee on Labor and Public Welfare.

Cages, not maps

Sir,

Mr Goldsmith's systems are cages, not maps. They are too small. (*The Ecologist*, August 1970, p. 16.) He does not see that because our one world is small and crowded, all men are of necessity brothers. If systems are to be employed, they must embrace the totality, not just the inhabitants of this or that cave. The world, it is true, is full of caves. It is time men emerged into the open together..

"What is today regarded as prejudice against people of different ethnic groups is a normal and necessary feature of human cultural behaviour . . . the notion of universal brotherhood of man is therefore totally incompatible with the systemic approach to human cultural systems." These are Mr Goldsmith's limited perspectives. They are quite inappropriate to today's world. They underline the need "to exclude foreign bodies . . . at all levels of organization". He fails to understand that equally generally, creation flows from fusion. Margaret Mead has written that "since the dawn of history, human culture has *grown* (my italics) . . . through the stimulation of strange ideas . . . the interaction between neighbouring tribes . . . between conquered and conqueror, colonizer and native . . ." Mr Goldsmith's words will grow behind the cramped walls of fear. They have no place alongside imagination and hope.

Languages may be learned. So may cultures (sometimes very quickly as in the documented case of the cultural transformation of the Manus people). Certainly the average Eskimo (to take Mr Goldsmith's example) would make a poor Hottentot, but so would an Englishman too stupid to learn French make a poor Frenchman. A man "knowing many cultures" is most certainly a better educated man than one knowing one, even on Goldsmith's "functional" basis, because the world is tiny.

I write with personal feeling here. I am happy to personify the "cultural hybridization" Mr Goldsmith deplores. Far from imagining myself some kind of out-cast, I have truly gained. My wife is from Korea and I am English. Thus we are privileged to the benefits of strong roots in two very different cultures. It is highly rewarding and very easy. There is no conflict. The only thing to fear is bigotry, and there is very little of that. If Mr Goldsmith states that we violate some pristine principle of his cybernetic viewpoint, then I shall bluntly state that that principle is blind and worthless as it stands.

As a contributor to *The Ecologist*, I wish this magazine well in its sincere efforts to educate the public in matters of great importance. Yet I feel that an excess of unsubstantiated opinion may discredit it. But perhaps Mr Goldsmith is too wise to believe all he writes.

Yours sincerely,

Dr Eric S. Albone.
37 Malden Road, Watford, Herts.

Conservation party

Sir,

Following D. L. Reynold's letter (Vol. 1. No. 2.) I would hesitate to suggest, as he does, the formation of a new political party at this time. Nevertheless it would appear obvious that some form of organization is needed to bring together and concentrate the opinions of those individuals who share the same concern for our environment and survival.

A few examples will serve to indicate the advantages and immediate possibilities of such an organization: (i) Individuals throughout the country would bring their friends into the organization, who in turn would do the same, thus forever extending the numbers of "conservationists"; (ii) It would be possible to raise enough money from members' donations to advertise the dangers that surround us, in the national press—as pop-stars advertise drugs! (iii) Public meetings could be arranged to educate more and more people in the very real problems of the population explosion, radiation, etc.; (iv) A thousand people, unified in a cause, can exert more pressure than two thousand individuals, who are simply worried.

I would like to suggest that such an organization might easily be formed through the pages of *The Ecologist*, which could act, not only as a common bond between members, but also, as teacher and guide.

Yours sincerely,

S. I. Galt, LL.B.
11 Clarence Drive, Glasgow, W.2.

Sir,

Like D. L. Reynolds I too have thought of crusading a political party to promote "Conservationism". Two years ago at University we formed such a party, the main policy of which was to bring about population control in Britain and the rest of the world. Our adventure was not a success. The party survived only one term until my co-founder had a nervous breakdown, reducing total membership by 50 per cent. Had it got off the ground at all I doubt whether our ideas would have been warmly received by the Electorate who would certainly have objected to our demand for compulsory birth restrictions. Mr Reynolds rightly warns us of the public's oversensitivity to any infringement of personal liberty, and I have drawn the same conclusion as he—that a successful Conservation Party depends upon its ability to persuade the British people that rabbit-like reproduction is not in their best interests.

Yours sincerely,

David Whitmarsh.
South Winds, Crapstone, Yelverton, Devon.

More than a naked ape

Sir,

The need for such sweeping and vehement strictures as your contributors have uttered is urgent beyond the slightest doubt. The situation is exceedingly serious.

It is true nevertheless that your criticism is almost wholly destructive, though of course this may be remedied in subsequent issues. But the point I want to make is that the attitude of your contributors is not only vehement condemnation of the human animal and all that he stands for, but an apparent denial that he stands for anything worth while. This seems to be a sort of treason against our own kind, and is bound to lead to despair, to a "what-does-it-matter" frame of mind. After all there really is quite a lot to be said in favour of the human race. Apart from this possibly emotional objection, I would like to point out that the attitude in question is sheer reductionism, that pernicious "nothing-buttery" which makes out for in-

stance, as was done recently in an altogether too popular book, that man is nothing but a naked ape. In the same way, here in the *Ecologist* we get a clear impression that civilization is nothing but the accumulation of various forms of waste, that our cities are nothing but concrete jungles, that modern man is nothing but an agent of destruction.

To think in this way is to ignore the very great and exceedingly varied achievements of the human mind and spirit, of which a detached and critical appraisal of our relationship with our environment is not the least notable. We are inclined to wage war on nature because we transcend nature in the important sense that we have succeeded in discovering for ourselves the principles on which it is based. As a result we confer upon ourselves the right to turn our environment to our advantage. Are we justified in so doing? Surely we are, since this is what all living things do. They go about it in long-established and co-operative ways, and it is just this co-operative, give-and-take that we must learn from them.

Man's evolution from his animal ancestors has meant a bitter and bloody struggle, in the course of which he has endured and still endures, the most appalling suffering. No more than a small proportion of this suffering is self-inflicted. Man certainly merits condemnation, but he merits also a deep compassion.

Yours sincerely,

Leslie Reid.
Chapel Cottage, Thornborough, Buckingham.

Environmental stress and heart disease

Sir,

I congratulate you on the initiative taken in establishing *The Ecologist*, against the psychological antagonism derived from the Government's somewhat belated, and diminishing attention. The need is unsurpassable, and yet the problem as I see it, is to achieve a satisfactory means by which the issues at stake can be introduced lucidly to the mass of the populace, and not merely as a constant ideological, intellectual, thought swopping game between scientists.

I would like to make a brief criticism on a technical point that arose in your report "Environmental stress and heart disease". In the passage it is stated . . . "Noradrenaline also antagonizes insulin's action in controlling the entry of glucose into the cells of the body. Thus one of the basic sources of energy is no longer so readily available to the cell . . ."

Insulin does *not* control the entry of glucose into cells. The active uptake of glucose by the cell is a result of active uptake by plasma membrane bound transport proteins, that ferry the glucose into the cell. Once inside the cell, the glucose comes under the delicate control of bio-synthetic machinery; by which in the case of the specialized muscle and liver cells, glucose is transformed to the storage polysaccharide, glycogen. It is this reaction that is the result of the release of Insulin by the Islets of Langerhans in the Pancreas. The reverse process takes place as the result of the copious release of Noradrenaline and Adrenaline from the Adrenal Medulla, into the blood stream. This thereby effects a high intracellular concentration of these hormones, producing an increase in free glucose. Thus one of the prime sources of oxidative energy for respiration is available more readily.

Yours sincerely,

David G. Ellis.
The Retreat, Market Lane, Linton, Cambridge.

Getting to people

Sir,

I felt I must write and congratulate you on the first issue of *The Ecologist*, which has made an enormous and lasting impression on me. The fundamental way it deals with the world problem as a whole makes much of the present talk about conservation, pollution and so on seem trivial in comparison. If you can maintain this high standard in future issues, you are going to have an immense influence on thinking. You seem to be trying to get at the intelligent public over the heads of both the popularisers who are always telling us about some new marvel of science and technology, and the "experts", with their fashionable jargon and inbred ideas of their professions.

For me, and for the one or two people I have shown *The Ecologist* to, it certainly works, because of the intellectual quality of your writers, and the honest objectivity of their approach to their specialist subjects.

Only this week have I been able to find space for a modest piece on *The Ecologist* in our own paper. To be honest, I only realized, when I saw your letter about atomic waste in *The Times*, that you are in our circulation area. I know that a lot of our readers will be interested in what you are trying to do.

Sincere good wishes for success. I shall look forward to the September issue of *The Ecologist* with eager anticipation.

Yours sincerely,

Reg V. Ward.
Editor, The Dimbleby Newspaper Group, 13-14 King Street, Richmond, Surrey.

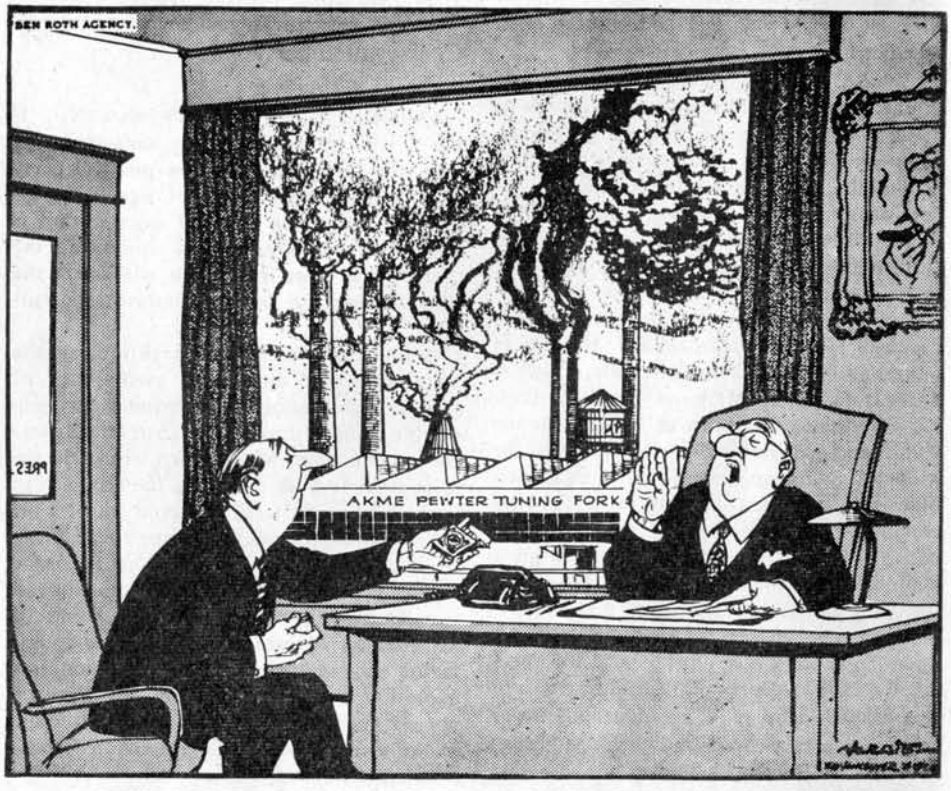
Sir,

Your arrival is an important event, and let us hope that it works a significant upturn in interest and concern about our environment. I have recently returned from a spell in the USA—the problem may not get through to many people here, but over there it hits you so hard there is no avoiding its urgency.

I want to stress to you how vital it is that you not only disseminate information about pollution, population, etc., but also help in the organization of effective social action. We have to organize. I have no idea what organizations currently exist or what they do and would like to know. Unless a nationwide effort is made by co-operating groups and individuals little change is likely—you can become a major medium of communication in this respect. Put us all in touch with each other.

Yours sincerely,

David Beazley.
17 Frognal, London, N.W.3.



"No thanks . . . I've given it up."

RESURGENCE : *Journal of the Fourth World*

What are the political and economic solutions to the current rush towards ecological suicide? have a look at RESURGENCE— the journal of the Fourth World, now in its fifth year of clear thinking and persistent advocacy of positive answers to the distempers of the times. It has been described as the most radical journal around. But judge for yourself . . . Send this coupon to Resurgence, 24 ABERCORN PLACE, LONDON NW8.

Despite the tendentious nature of the above I am curious to see a copy of Resurgence, for which I enclose the incredibly tiny sum of four shillings on the clear understanding that if I am not satisfied it is probably because I am too fastidious for words.

I am a pensioner, or student too hard up to even afford to smoke, — please send me a free copy of Resurgence.

NAME.....

ADDRESS .....

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The Ecologist Environmental News Digest

The Ecologist has much pleasure in announcing the publication of a fortnightly environmental news digest. It will review the fortnight's news as it appears in the English-speaking Press under the following headings:

Conservationist Pressure & Litigation
Pollution Control & Re-cycling Technology
Population Growth & Control
Depletion of Mineral Resources
Man-induced Climatic Changes
Oceans: Resources, Pollution & Control
Rivers: Resources, Pollution & Control
Air: Pollution & Control
Ecological Legislation
Agriculture & Forestry
Natural Resources
Power Availability
Health Trends
Wildlife
Social Structures
Urban Environment

This publication will have 30 pages and will be available by subscription only at £35 per annum. Subscribers will have at their disposal a comprehensive environmental news service. Date of publication: 1 January 1971. If you are interested in this service and would like further information, please complete the form below and send it to The Managing Editor, The Ecologist, 73 Kew Green, Richmond, Surrey.

Name:.....

Address: .....

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Telephone: .....

Coming events

8 October—ECY film "The Second Ark" and lecture by Stanley Jeeves in Cheltenham. Information from CPRE, Lancashire Branch, Salmesbury Hall, Preston.

8 October—Meeting of the Institute of Landscape Architects at the Nash House Auditorium. Information from Miss A. Dale, ILA, 12 Carlton House Terrace, S.W.1.

10 October—Soil Association Conference on Conservation at Repton School, Derby. Speakers: Dr Kenneth Mellanby, A. Harry Walters, Robert Waller and Bernard Venables. Information from Mrs M. Barnett, Birchills, Church Broughton, Derby.

10–18 October—International Building Exhibition in Bologna, Italy. Information from Exhibitions and Trade Fairs (Overseas) Ltd.

12–16 October—Soil Association Annual Conference at Attingham Park Adult Education College, Nr. Shrewsbury, Shropshire. Information from "The Warden" at this address.

12–24 October—Exhibition—"Wildlife and Conservation"—at Passmore Edwards Museum, Romford Road, London, E.15. Information from Mr S. T. Jermyn, Essex Naturalists' Trust, 9 Bury Fields, Felsted, Dunmow, Essex.

14 October—National Photographic Exhibition—"Man and Nature"—at the City Museum Bristol. Information from the Nature Conservancy, 19 Belgrave Square, London, S.W.1.

14 October—Lecture—"The Threats to Europe's Birds"—at Burlington House, Piccadilly, London, W.1. Information from Mrs P. Small, London Natural History Society, 13 Woodfield Crescent, Ealing, W.5.

20–23 October—Annual Conference of the National Society for Clean Air—"1970 European Conservation Year"—at Floral Hall, Southport, Lancs. Information from NSCA, Field House, Breams Buildings, London, E.C.4.

26–28 October—Third Conference—The Countryside in 1970—at Guildhall, London, E.C.2. Information from the Nature Conservancy, 19 Belgrave Square, London, S.W.1.

26-30 October—The Eighth Session of the European Conference of Local Authorities at Strasbourg. Information from the Nature Conservancy, 19 Belgrave Square, S.W.1.

28 October—Lecture—"Beyond 1970 and the New Awareness"—at Burlington House, Piccadilly, W.1. Information from Mrs P. Small, London Natural History Society, 13 Woodfield Crescent, Ealing, W.5.

Classified Adverts

BRETON NEWS. A quarterly summary in English of the nationalist movement in Brittany issued by the Breton Information Bureau. 10/- per annum from 9, Br Cnoc Sion, Baile Atha Cliath 9, Ireland.

TATHATA CENTRE, Newent, GLOS. (Tel: Newent 772). Zen-type Meditation Centre with emphasis on sound ecological living. Send for brochure.

SUPERSONIC TRANSPORT would bring further environmental deterioration. This is one pointless technological excess that can be stopped. THE ANTI-CONCORDE PROJECT is part of a world movement opposing all SST. Organiser: Richard Wiggs, 70 Lytton Avenue, Letchworth, Hertfordshire. Telephone: 046-26 2081.

YOUNG MAN, (25), B.Sc. in Chemistry, seeks work connected with environmental management in or near London, while sitting for part-time degree in Biology. Offers or information to The Ecologist.

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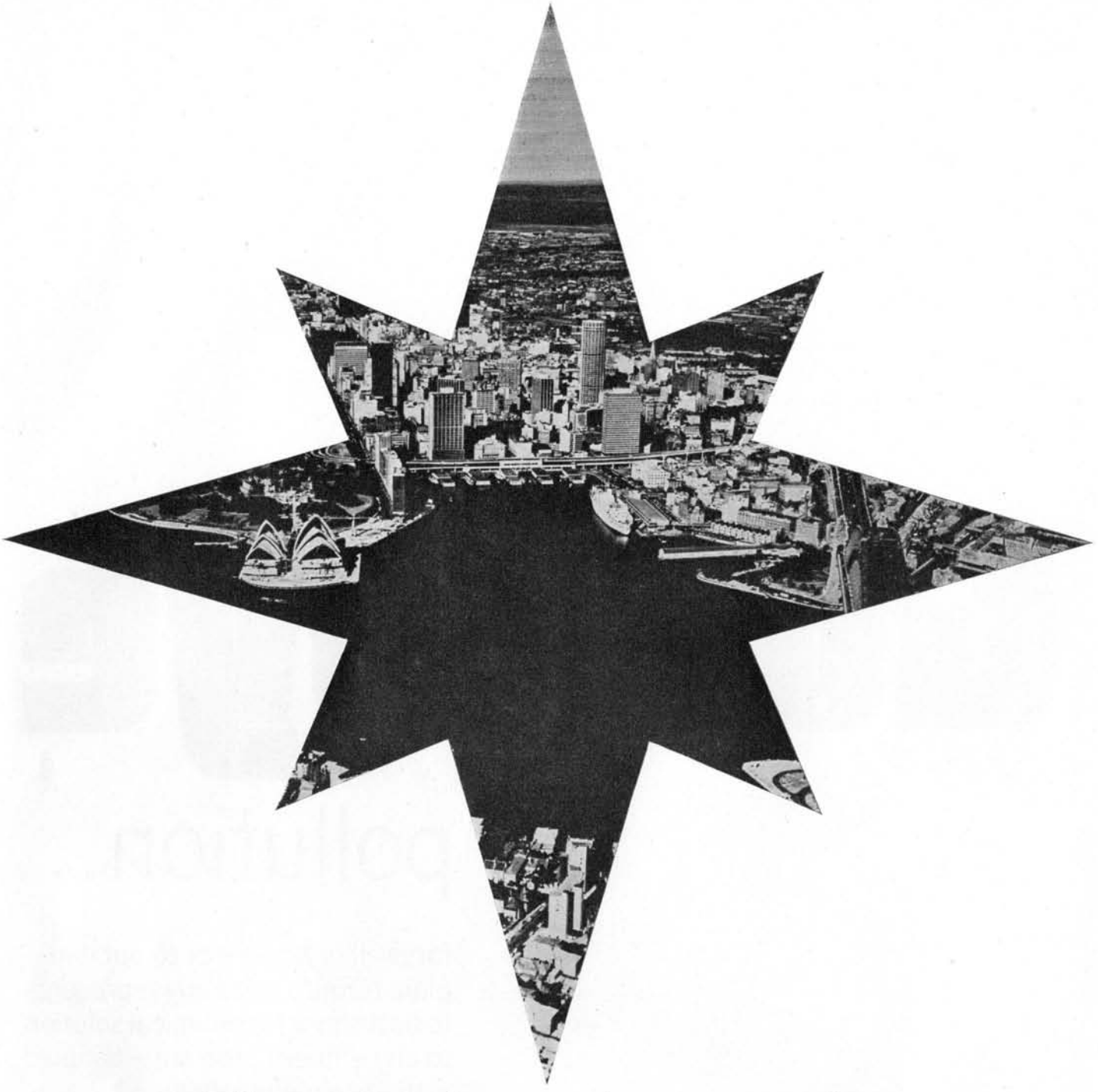
Living with gorillas by John Aspinall. Much is to be learned from the behaviour of one of man's closest relatives.

Fertility or pollution? by Lawrence D. Hills. A plan for ensuring soil fertility and clean rivers.

Can science be reformed? by Edward Goldsmith. The argument for a unified science.

Does Nigeria exist? by Jimoh Fadaka Can a nation be created by the edict of a politician or the pen of a lawyer?

A land in balance, by L. J. and M. Milnes. The Great Plains once sustained a vast and unique pyramid of life.



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