

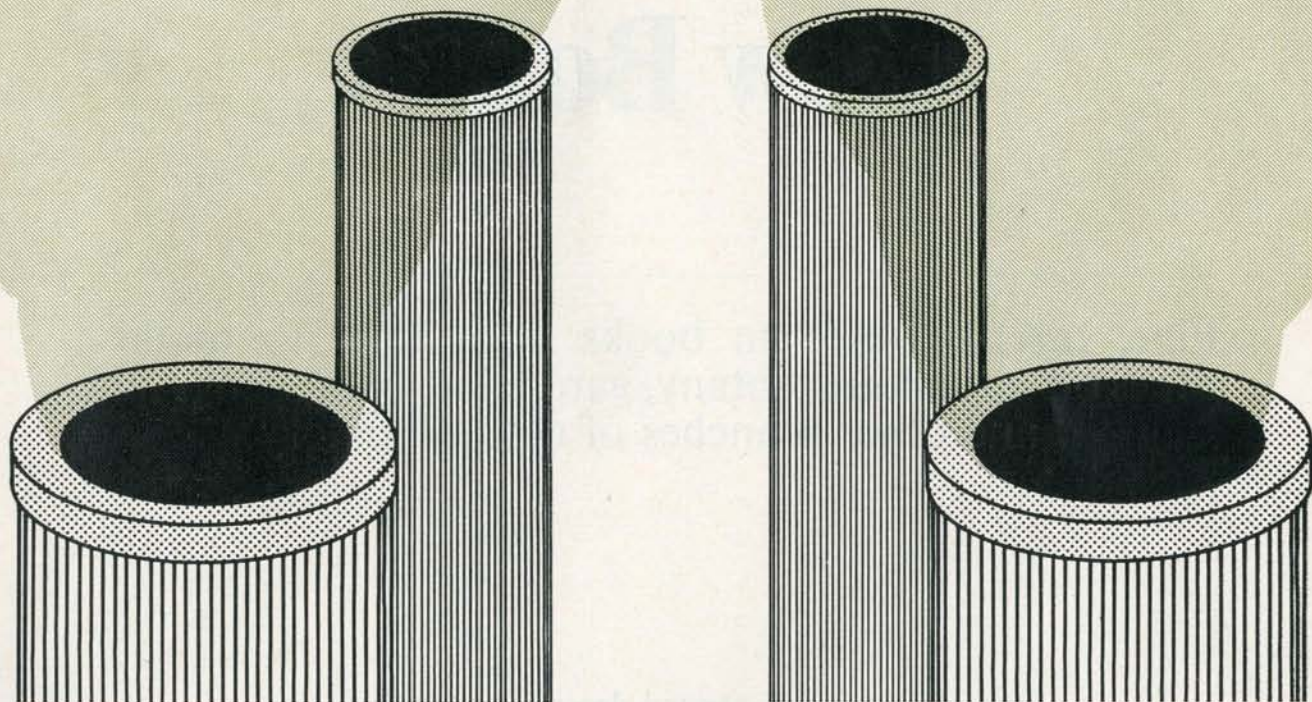
# ecologist

Vol. 2 No. 11 November 1972

25p

## SO<sub>2</sub>: ACID IN THE SKY

BY R.T. BRIGGS



**The threat to tribal minorities:  
what can we do?**





**coming  
from Robinson & Watkins  
November 13th**

---

# **TEACH-IN FOR SURVIVAL**

---

**Paper £1.25    Library £2.50**

---

Edited and introduced by Michael Schwab for the Movement for Survival, from a seminar chaired by Professor John Yudkin

Contributors: Dr John Davoll, Michael Allaby, Dr Kenneth Mellanby, John Langley, Dr Brian Johnson, Edward Goldsmith, Jimo Omo-Fadakah, Derek Bryan, Robert Edwards, MP, Sir Geoffrey Vickers, Dr Hugh Saddler, Roy Madron, students of Queen Elizabeth College London and members of the public

About: Ecology, Agriculture, Industry, Economics, Third World, China, Trades Unions, Population, Enviro-Action, Participation, Media, Aquarian Age

---

**ROBINSON & WATKINS BOOKS LTD • 45 LOWER  
BELGRAVE ST. • LONDON SW1W 0LT • 01-730 9337**

## **Kew Books**

---

Fine, rare, out-of-print books from 1500 to modern times on agriculture, botany, gardening, plant geography and other branches of natural history

Please send for illustrated descriptive catalogue to:  
John Chancellor, Kew Books, 69 Kew Green, Richmond, Surrey, England  
Telephone: 01-940 2512

# ecologist

Vol. 2 No. 11 November 1972

The Ecologist is printed on recycled paper

Michael Allaby	Editorial <i>Fire raisers</i>	3
<b>Feature articles</b>		
Robin Hanbury-Tenison	Tribal societies in the modern world	4
John Hemming	Robbed of a future: the Brazilian Indians	7
Robert Allen	Tribal minorities: what can we do?	11
Peter Delap	Wild deer in Britain	15
John Adams	Concorde: they said the same about the H-Bomb	16
R. T. Briggs	SO <sub>2</sub> : acid in the sky	18
Lawrence D. Hills	Sanitation for conservation	24
Graham Searle	It's a bird, it's a plane, it's Zuckerman!	28
	How to fight a road	30
	Prosecuting for noise abatement	33
Derrick Beecham	Towards a stable Metropolis	33
Peter Bunyard	Breast-fed babies are healthier	34
<b>Columns</b>		
	Friends of the Earth	29
Nicholas Gould	Gulliver in Automobilia <i>The author discovereth the evil consequences of an unsettled state of society</i>	36
Edward Goldsmith	Towards a unified science <i>Vital force</i>	37
<b>Letters</b>		27
<b>Feedback</b>		38
<b>Books</b>		39
<b>Classified advertisements</b>		29

Editor: E. R. D. Goldsmith; Deputy Editor: Robert Allen; Managing Editor: Michael Allaby; Associate editors: Peter Bunyard, John Davoll, Jimoh Omo Fadaka, Gerald Foley, Lawrence D. Hills, Brian Johnson, S. G. Lawrence, Jean Liedloff, Charles Maclean, John Papworth, Robert Waller. Administration: Joyce Robson. Editorial copy and advertising enquiries should be sent to The Editor, The Ecologist, 73 Kew Green, Richmond, Surrey. Telephone 01-948 0690.

Published by Ecosystems Ltd., registered office 11 Mansfield Street, Portland Place, London W1M 0AH and distributed by the Hachette Group, Continental Publishers and Distributors Ltd., 4 Regent Place, London W1R 6BH; Telephone: 01-734 5259; Telegrams: Alibrairi London W1; Telex 25114. Subscriptions to: The Ecologist, 73 Kew Green, Richmond, Surrey. Printed by The Garden City Press Ltd., Pixmore Avenue, Letchworth, Hertfordshire, SG6 1JS.

© The Ecologist, November 1972



Young man (with righteous indignation) "Put out that fire or I'll report you to the farmer"  
Stout farmer (ditto) "What do you mean? I *am* the farmer"



# Editorial

by Michael Allaby

## Fire raisers

"All is safely gathered in,  
Let the autumn fires begin."

As the last strains of the harvest hymn die away the fields of East Anglia are set alight. For two or three weeks a stranger might be forgiven for assuming that the land was being prepared for a hostile advancing army as the farmers celebrate their own, very pagan, ritual: The Burning Of The Stubble.

There are protests, of course. Newspapers carry letters from romantic lovers of wildlife and clean air who object to the devastation and to the choking smoke that billows across country roads and through villages. Thinner-skinned than their industrialist cousins, the farmers wax vehement in their own defence, eventually resorting to blackmail: if you want to eat, leave us alone. It is as though they had no choice, as if unburnt stubble would accumulate year after year until at last it engulfed the cities and silenced the letter-writers for ever.

There are many production processes, and especially in farming, which cause damage of one kind or another at the same time as they confer benefits. The decision whether or not to permit them to continue is a social and political one that cannot be based on precise scientific evaluations, for the quantification of advantage and disadvantage depends on social priorities. Society must choose whether, in its view, the benefit is worth the price that must be paid.

This may be more difficult in the case of farming than for factory-based industry. Industrial pollution, for example, is an undesirable by-product of a process. If by "pollutant" we mean a substance introduced into the environment by man which has the capability of modifying the metabolic processes of living organisms, so producing ecological side-effects, then what are we to make of the farmer who uses pollutants

as the tools of his trade, which is to introduce them into the environment? In practice it is impossible to prevent fertiliser from leaching into waterways, or pesticides from drifting on to neighbouring land, or stubble fires causing smoke that inconveniences country dwellers and outrages visitors from the towns. Moreover, farming is nothing if not an essential activity. We will learn to live without motor cars more easily than we will learn to live without food.

Thus a casual reader of the correspondence columns might conclude that the victory must go to the farmers. They are a special case and the rules we apply to limit the adverse effects which industry has on the environment cannot be made to apply to them, or at least not so rigidly. In the case of stubble burning, this is the view of the farmers themselves, of the National Farmers' Union and of the Ministry of Agriculture. All of them have fallen into the trap of assuming no viable alternative exists and that the farming patterns of today are incapable of any improvement.

The farmer burns straw and stubble for two main reasons. Now that he no longer carries livestock—the animals are all miles away in intensive, indoor units—there is no need for straw for bedding. It is an embarrassment to him. The stubble could be cultivated into the soil, but this would alter the soil's carbon:nitrogen ratio and produce a nitrogen deficiency for the following crop. Burning solves both problems, adds a little potash for good measure and as an added benefit it is believed to destroy weed seeds and the spores of disease-causing fungi. In fact it is very unlikely that by raising slightly the temperature of the top few inches of soil fungal spores are affected and if there is any effect on weed seeds it is marginal.

Even in agricultural terms the advantages of burning may be more than offset by the disadvantages attendant on the loss of valuable organic matter

that could help maintain soil structure and of the protection from the erosive effects of wind and rain that the stubble would afford were it left standing through the winter. Nor is it necessary to waste straw simply because it is not required for bedding. It can be composted into a valuable soil conditioner with far less labour than many farmers imagine. Once it is composted it makes no demand on the soil's available nitrogen.

The social disadvantages of burning are obvious. Not only is it unpleasant, it is dangerous. Autumn is a busy time for rural fire brigades and this year, with a long dry spell before harvest and something of a casual attitude by many farmers for even the most rudimentary safety precautions, there have been more accidents than ever before. Essex Naturalists' Trust has lost part of its nature reserve, noted for its bird life. Thatched cottages have been razed to the ground. Two people were taken to hospital when a car and a coach drove into a fire that had spread right across a road. The NFU became so alarmed at the behaviour of its more pyromaniacal members that it issued a leaflet asking "Which are you, farmer or fire-raiser?" The replies have not been published.

This issue of *The Ecologist* carries one article expressing concern over the fate of British wild deer and another describing the problems of industrial air pollution. Our wildlife is reduced by loss of habitat and by poisoning. Modern agriculture is the major contributor to both. The pollution caused by agriculture affects communities that are more dispersed than the urban populations living close to factories and it is less obvious than brightly coloured effluents or smoking chimneys. Thus it attracts less attention, and less censure, than pollution by industry, despite the fact that it may be more damaging.

It is time that farmers were made answerable for their stewardship of the countryside. This will necessitate economic reform as well as changes in farming practices, yet there are certain steps that could be taken now. At the same time as they reduced the harmful environmental effects of farming they would encourage overall higher standards of husbandry.

We could begin by forbidding the burning of stubble and straw. It is unpleasant, it is dangerous and it is unnecessary.



# Tribal societies in the modern world

by Robin Hanbury-Tenison

Robin Hanbury-Tenison is Chairman of Survival International (The Primitive Peoples Fund). This year he visited two tribes in Panama and Colombia, which in their different ways illustrate some of the problems facing the so-called primitive peoples throughout the world.

The Cuna Indians of Panama have always been fiercely independent and suspicious of outsiders. They are the descendants of a highly developed culture, possibly similar to the Mayans, their social structures are well organised and they nearly all live in villages according to a strict hierarchy. Most of the tribe, which numbers 20,000 in all, live on the San Blas islands off the Atlantic coast, where they depend on an economy based on coconuts and fish, and are increasingly visited by tourists from the Canal Zone.

On the island villages the Indians are often under attack from as many as four separate and rival missionary sects, most of which discourage them from dancing, smoking, singing, and ritual. The pressure from tourists is also corroding their culture, while at the same time a familiar deadly cycle is emerging. Tourists want to visit only tribal groups who have active, lively

cultures and traditional skills. But their presence, paying to see dances which should only be performed at certain times and buying arts and crafts indiscriminately and with little or no regard for the care and love that have gone into making them, inevitably destroys the very things they have come to see. When they move on to fresh fields, the tribe is left with a changed set of values and desires; there is no going back to the old ways, for the necessary skills have been lost; and the way forward into the modern world is suddenly much harder as the tourists leave. The end result is all too often poverty and despair.

However, 1,200 Cuna Indians live on the Bayano river in the interior of the isthmus where they have well-established plantations of bananas, plantain, sugar cane and maize as well as deriving much of their diet from natural products of the jungle. Some game is hunted but the major source of protein is fish from the Bayano river. On one occasion, I saw 400 fish weighing between  $\frac{1}{2}$  lb and 2 lbs taken in one cast of a communally-owned net. The Bayano Cuna are regarded by their cousins on the San Blas islands—and regard themselves—as the true guardians of Cuna traditions and culture. They were granted their territory by Presidential decree in the 1920s and succeeding Presidents have confirmed this, assuring them in letters to the

chiefs (which I saw) that their land would never be taken from them and was theirs in perpetuity.

Now a dam is being built which will flood 80 per cent of the valley and involve the resettlement of about the same proportion of the population. The Indians told me that they had decided to stay and would simply move back as the waters rose. They had no concept of how large a lake would be formed and imagined that the river would flood its banks in only a few places. Instead, since the trees are not being cut down, a vast fetid swamp will form in which it will be most difficult to fish. Around the edges will be a wide belt of dead land, as the rise and fall of the water will be twenty-five metres. Apart from the dangers of malaria, bilharzia and other diseases, damming the Bayano River, which is the main outflow to the Pacific coast, will have a serious and perhaps disastrous effect on sea fishing, upon which much of the local Panamanian population depends.

Once the Bayano Cuna Indians lose their land and their river, their society is likely to break up very rapidly. They will drift to the Panama zone where, without a secure cultural base, they will find it hard to compete in an alien world and many will probably become a social liability. The most outstanding feature of Cuna communities is the very high regard in which their women are



held. The men protect them jealously from strangers and watch them constantly. With their red shawls over their heads and gold rings in their noses, they reminded me more of the Berber women of the Atlas mountains in Morocco than of other Amerindians. This protection will be impossible to maintain in an urban environment with the men at work all day—if they can get work. It therefore seems certain that if the Bayano dam project is completed, the result will be that, apart from the many other ecological considerations, the indigenous inhabitants of the area will be swiftly destroyed.

### The Choco (Embera)

There are about 20,000 Choco (Embera) Indians and they have no reserves, being already scattered over a wide area stretching some 300 miles along the Pacific coast between La Palma in Panama and Buenaventura in Colombia. They are shy and gentle people, who, rather than defend their land against the onslaught, first from the Spanish conquistadores, later from freed slaves and their descendants and now from white settlers from other

regions, have retreated further and further towards the headwaters of their rivers. Now they can go no further, the streams they live on are barely deep enough for canoes for most of the year and fish are less plentiful. They are worried about their land being taken from them as there is now nowhere else for them to go.

Their main fear stems from the fact that a road is being built through their territory, a road which they are fully aware means exploitation, prostitution and fragmentation for them, and the destruction of their forests, rivers and wildlife. The road is the last section of the 13,000 mile highway from Alaska to Tierra del Fuego and my reason for visiting the Darien isthmus was to assess its impact on the region and in particular on the people. I had expected to find that there were strong arguments in its favour, fertile regions to be opened up, mineral resources to be exploited, and population centres in need of outlets to Panama City and Bogota. Instead almost everyone I spoke to, Indians, settlers and scientists alike, viewed the road with grave concern. With the third highest re-

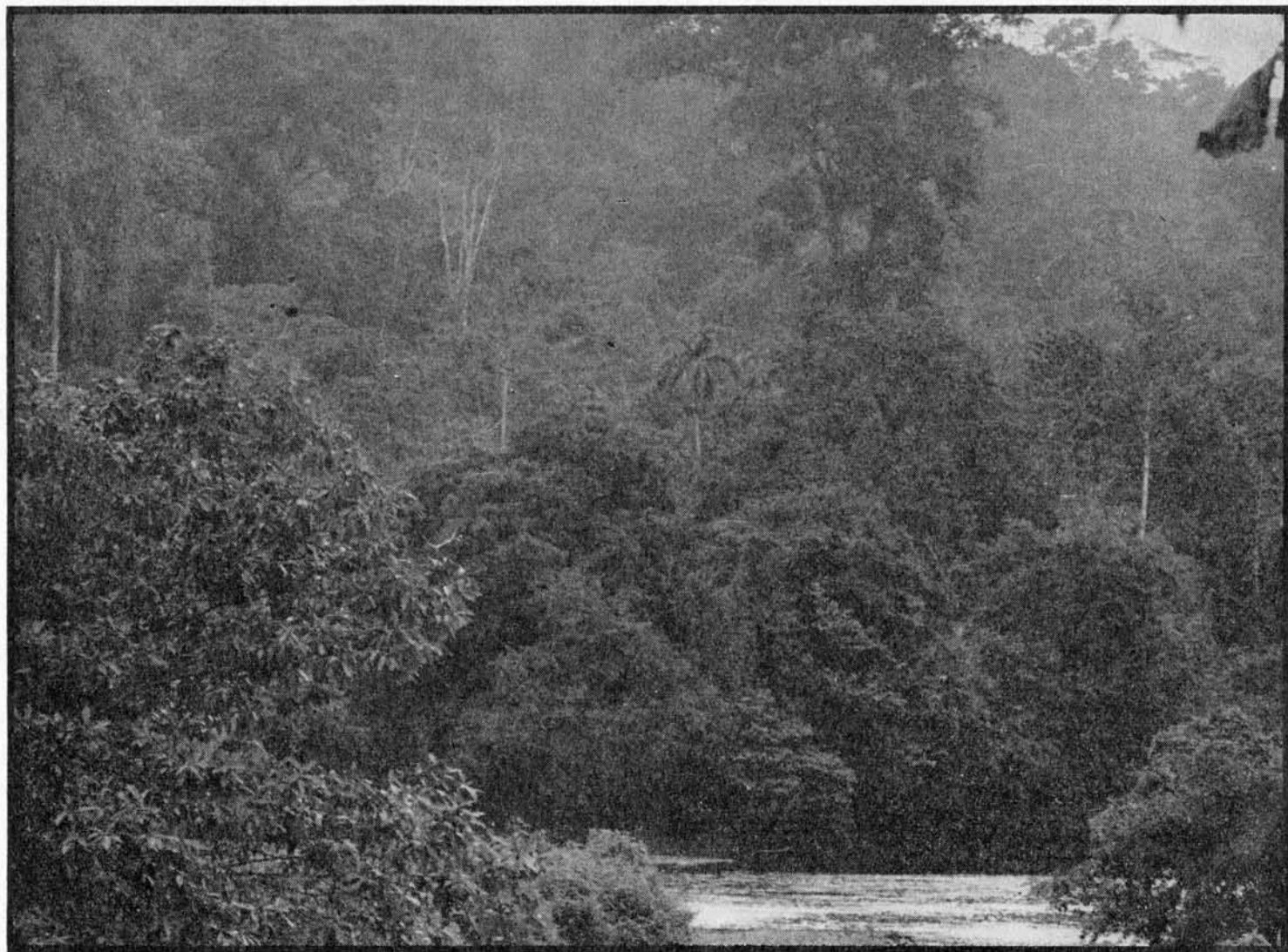
corded rainfall in the world, and a tremendously varied plant and animal life, I several times heard the Darien referred to as "the most fragile and the most threatened ecological zone on earth". The erosion resulting from extensive deforestation is certain to be acute. The isthmus also represents the only effective barrier between South and North America to the spread of foot and mouth disease, the last epidemic of which in Mexico cost the United States and Mexican governments several hundred million dollars to eradicate.

Economic factors also weigh against the road. Since work began last December on the final 240 mile stretch, after 18 years of study and delay, estimates of the final cost have soared and the completion date is regularly put back. A recent article in the June '72 issue of *World Construction* puts the cost as high as "\$90/150 million or more—depending on who makes the estimate" and goes on to say "there hasn't exactly been a mad scramble among the world's contractors to go after the Darien job". Of the eleven firms who originally expressed interest, only three

*Choco village*







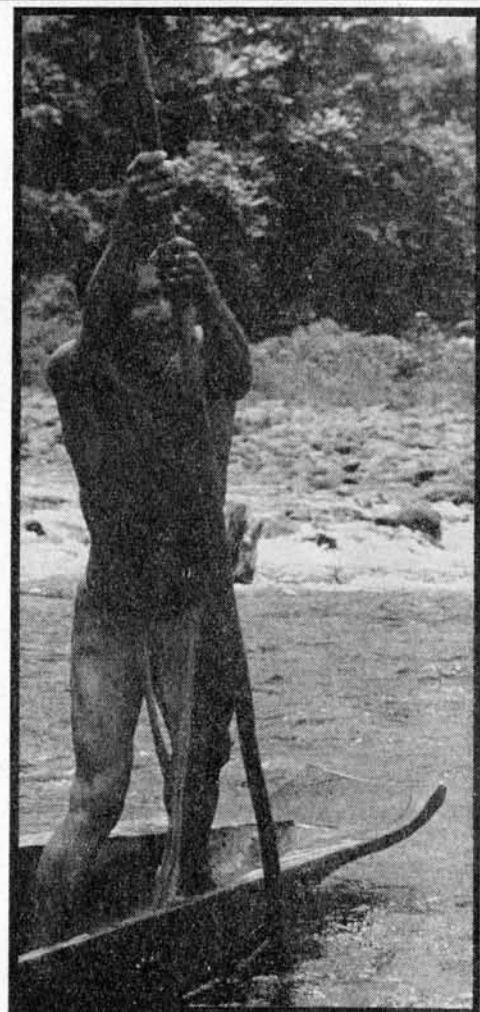
*(Above) a typical section of Darien forest. (Right) a Choco boatman*

finally made bids and these varied by over 55 per cent, which shows how little is known about what lies on the route.

With a noticeable lack of interest on the part of the construction companies, considerable difficulties being experienced by the Panamanian and Columbian governments in finding their share of the money (in spite of a two-thirds grant by the US government) and a growing body of opinion becoming aware of the dangers, and questioning the eventual value of the road, the whole project could well now be abandoned. It is five years before the link is likely to be completed and the sole benefit would appear to be a new line drawn on the map of the world. There is no queue of vehicles waiting to drive between North and South America and the existing sea route from Cartagena to Colon only takes a day—less than a lorry would take by land over the same distance even if the eventual road is an all-weather one. If there really is a desire to link the two continents more effectively, then a SRN4 Hovercraft service could be

introduced almost at once and for a tenth of the cost. The value and potential of the Darien region could then be studied at leisure, the worst ecological abuses avoided, and the Indians granted their land. With this protection, the Choco, who are superb conservationists, could continue to live in a balanced relationship with their environment, and at the same time learn how to deal with the invading modern world and teach us about theirs.

If the cultural basis of the world is going to have to change so that the human species discovers how not to destroy itself, then reappraisals of misguided development programmes and the study of alternatives is vital. If we are to learn how to live a different and less technological life, then we must look where we can for examples and teachers. Of course, we cannot become “primitive” overnight and I don’t suggest we should—far too much good has come and is still coming out of our civilisation—but if we destroy the experts then there is even less chance of our finding a happy compromise.





# Robbed of a future:

## The Brazilian Indians

by John Hemming\*

No-one doubts that the Brazilian Indians are doomed to eventual extinction. The only question is when and how. The Brazilian government could still act to preserve the remaining Indians. It could ensure that when change comes it is introduced under controlled conditions, at the Indians' request and at a speed they can assimilate. It seems unlikely that this will happen.

There are still between 50,000 and 100,000 Indians in Brazil—survivors of an estimated one million to five million original inhabitants. During the four centuries since the conquest started, Brazilian Indians declined by 90–99 per cent while the rest of the world's population soared.

The Indians are members of almost 200 tribes, and are defined as identifying themselves as Indians and preserving elements of a tribal language and traditions. The tribes are in all the varying degrees of acculturation—from uncontacted to almost assimilated.

A few tribes, like the Kren-Akrore of central Brazil and others on the northern frontiers, are still uncontacted. They live as part of the environment, blending perfectly with the forests or savannahs in which they live. When they hunt or fish it is never to extinction. When they farm, they rotate their clearings so that the weak forest soil can regain its strength. They keep their populations small and stable, by birth control, abortion and infanticide. Each tribe is self-sufficient and remarkably free from any spirit of competition or greed. Its members are physically very fit and their diets have

been found to be well balanced.

### Precious heritage

Tribes in this pristine condition form a precious part of mankind's heritage. Each has evolved its own culture, mythology and skilled handicrafts. Young Indians are trained to recognise the profusion of animal, bird, plant and insect life that surrounds them. Some tribes probably know plant properties that would be valuable to our medicine.

The last uncontacted tribes cannot, alas, remain in their isolated splendour. Each must eventually embark on the terrifying process of acculturation, of adaptation to our dominant and aggressive western civilisation. To date all have failed to complete the course. They vanish into extinction or retreat into despairing apathy. Change is forced upon them: I can think of no tribe in Brazilian history that wanted to change its way of life for ours. Tribes that have been in contact for centuries and are aware of the merits of both societies, cling with commendable stubbornness to their language, traditions and community.

The reasons for this reluctance are obvious. For the Indians are not being offered civilisation as we know it. They are offered "rapid integration", which means in practice only rapid disintegration. They are expected to change from a subsistence economy based on communal effort and an existence that values the quality of life. They enter our capitalist economy at the lowest possible level, below the rural unemployed. They approach the challenge totally unprepared and failure seems inevitable.

Indians have no experience of our working methods, of our legal or monetary systems, of our notions of over-production, competition, success, ambition or progress. They have to bridge not only a language barrier, but the gulf between two societies that have developed utterly different philosophies

over the past millenia. Neither society is necessarily better; they are simply different.

Why must our way of life be inflicted on the remaining Indians unless they want it? Brazil is such a vast and successful country that it can afford to be generous to the few survivors of its original inhabitants. These ask for very little. They want secure possession of lands they have always occupied. They want medical protection against diseases from across the Atlantic against which they have no immunity. They want to be left alone, to reach their own decisions about change and acculturation. If they do decide that the time has come for change, they require education adapted to their needs. Above all, they want affection and understanding to help confront the terrible forces closing in on them.

The policy of rapid integration is known to be utterly bankrupt. It has been attempted again and again since the first colonists reached Brazil in the sixteenth century, and it has invariably failed. The Jesuits tried it for two centuries. They shunted tribes about, set up model communities, sent and bombarded their victims with intensive indoctrination by scores of missionaries deep into the hinterland, intelligent, highly trained proselytisers. They soon became aware that the Indians were impervious to it all. The great missionary effort did nothing but destroy the tribes it struck. The Jesuits knew that the Indians they were enticing were doomed to premature extinction from disease or forced labour. They consoled themselves that their flocks perished after receiving the rites of baptism.

Lay handling of Indians was more brutal than the missionaries'. The first colonists wanted Indians to work the lands they had seized. They enslaved the numerous coastal tribes. When these were wiped out by disease and overwork, they plunged far inland to search

\* John Hemming is an authority on South American Indians and the author of *The Conquest of the Incas*, which received the Pitman Prize in 1970 and the Christopher Award in 1971.

for more slaves. Many tribes fought valiantly to preserve their lands and liberty. One by one they were subdued by the superior firepower of our civilisation. With the expulsion of the Jesuits in the mid-18th century, care of the Indians fell to rapacious lay "directors" or indifferent missionaries of other orders.

During the nineteenth and twentieth centuries three "fronts of expansion" moved into the Brazilian interior. One wave brought cattle ranching into the scrublands and savannahs; another pushed coffee into the interior of São Paulo state; the third was the rubber boom that struck the rivers and forests of western Brazil. These movements affected the Indians they met in different ways: but all were damaging or disastrous.

### Pioneer protector

The attitudes of hostility and oppression were checked in 1910 with the creation of the Indian Protection Service (SPI) by the outstanding indianist Cândido Rondon and other sympathisers. At the time it was the best such service in the world. It sought to transform abuse and hatred of Indians into respect and compassion. It rapidly set aside reserved areas for over a hundred native groups, and sought to provide rudimentary medical, agricultural, and educational assistance. Many surviving tribes would now be extinct but for the Service.

Rondon insisted that the Indian Service be non-religious: he knew that attempts to impose Christianity were fatal to tribal cohesion. The Brazilian Constitution incorporated a clause that guarantees Indian possession of the lands always occupied. It insists that their cultures and ways of life be respected, and that there should be no external pressure for rapid change.

Rondon's hopes for the Indians were not realised. His Service was soon stripped of its best men and starved of funds. During the 1930s Rondon quarrelled politically with President Vargas and the Service almost ceased to exist. Since then it has had brief revivals in morale, resources and the quality of its personnel. But at other times its budgets shrank and its management was totally out of touch and sympathy with the Indians themselves. Unable to pay a decent wage or provide the most elementary assistance, it hired many

misfits, incompetents or crooks. It abdicated many of its responsibilities to missionaries of different sects, who infiltrated most Indian posts. Idealists in the Service—these have always existed—despaired at the lack of medical resources to save Indian lives, or legal and surveying efforts to protect their lands.

An ambiguity in the Brazilian constitution apparently ceded Indian lands from federal to state control. The result was that state governments speculated in Indian land; local politicians encouraged their voters to invade Indian reserves as squatters; shady property companies chased the Indians from their homelands or tried to exterminate them.

### Succession of scandals

Most of the 110 reserves continue their daily existence in somnolent quiet. But there continues to be a succession of scandals concerning Indians. The Brazilian press is good at reporting these, and the authorities generally take action. But it seems impossible to obtain convictions against those accused of offences against Indians in the settler-dominated courts of the interior.

In 1946 Francisco Meirelles contacted the fierce Chavante, who had defended their territory beyond the Rio das Mortes for decades. This great tribe is now reduced to living on one small reserve. Two groups of it took refuge on Italian missions catering to their enemies the Bororo. The remainder squat as despised curiosities in the corners of the huge cattle ranches that now occupy their homeland. During the 1950s Amazon rubber interests put pressure on the SPI to pacify the Cayapo, who were fighting rubber tappers in the area between the Xingu and the Tapajos. Meirelles again made some fine expeditions to contact these tribes. He took many men, but did not have the resources or proper medical preparations. The result was that, when he returned on subsequent visits, he found the Cayapo dead or dying by hundreds from diseases transmitted inadvertently by his expeditions.

1963 was a black year. It saw the killing of six Canelas and wounding of 26 in a night attack on their village by cow-hands—solely because they had killed some cattle near their reserve. 1963 also saw the slaughter of a group of Cinta-Largus in the upper Madeira

valley by killers hired by the rubber trader Antonio Junqueira. In that same year a group of Pakaa-Nova in Rondonia had their lands forcibly invaded by rubber men, after the tribe had been decimated by disease and starvation.

Invasion of Indian land is a constant problem. The most serious recent cases have occurred in the rich farming lands of the southern states of Rio Grande do Sul and Paraná, against the Maxacali of Minas Gerais, the Potiguara and Pataxós of the North-East, the Urubu of Maranhão, the Cadiueu of Mato Grosso and many others. The Indian Service often acts to preserve its "Indian Patrimony". But it is very difficult to evict squatters and tenants once they are established on Indian lands, particularly when these lands are not well surveyed, demarcated or registered.

### "Gravedigger of Indians"

In 1972 Funai lost one of its best younger men, the brilliant 32-year old indianist Antonio Cotrim. He resigned in despair at the Foundation's policies. Cotrim had contacted the Gavioes of the lower Tocantins, who were defending their territories against invasion; but the promises of protection that he made them were rapidly broken by Funai. Cotrim was also appalled by the deaths of many Nhambiquara, in Rondonia, who were moved from their lands to territories unable to support them. They tried to migrate home and died by the roadsides. In resigning, Cotrim declared that, metaphorically, he was fed up with being a "grave-digger of Indians".

The Indian Protection Service sank to a nadir during the 1960s. In 1967/8 the Government finally instituted a sweeping and long-overdue enquiry. The result was the Figueiredo Report that exposed corruption by well over a hundred of the Service's 800 employees, and revealed cases of cruelty and criminal neglect. No convictions resulted from all this, as far as I know. But the enquiry at least purged the Service of its worst elements. The discredited Service was renamed the National Indian Foundation, or Funai.

The world's press distorted this enquiry into accusations against the Brazilian government of deliberate genocide. Two thorough missions by the International Red Cross and Survival International (The Primitive



Peoples Fund) found no evidence of any official killing. But they both reported very serious neglect on many Funai posts. Medical assistance was often grossly inadequate and sanitary conditions were often deplorable. All too often the Indians were living in ragged gloom, their tribal traditions almost gone, with no optimism for a future on the fringes of Brazilian society.

### Villas-Boas brothers

All observers are impressed by the work of the Villas-Boas brothers in the Xingu National Park. The upper Xingu river was unique in containing a cluster of uncontaminated tribes living in close harmony with one another. By a miracle of nature, the Xingu was the only major tributary of the Amazon that contained no rubber and had too many rapids to become a waterway. While the other rivers were long ago de-populated by slavers, missionaries, rubber gatherers and other invaders, the upper Xingu remained untouched.

The first large expedition to penetrate the upper Xingu in the late 1940s contained the Villas-Boas brothers. They stayed there and devoted their lives to its Indians. In the past quarter century they have evolved a brilliant

system of controlled exchange. The Indian's lands, health and society are protected by the Villas-Boas in a constant battle against disruptive forces. Xingu Indians are not preserved as curiosities. They can adopt change as they see fit; but most chose to continue traditional ways. Thanks to the affection and understanding of the Villas-Boas, the Xingu tribes have kept their pride and self assurance.

Survival International initiated a nomination of Orlando and Claudio Villas-Boas for the Nobel Peace Prize. The brothers are famous throughout Brazil, and have managed to continue their work under governments of opposing political complexion. But they were dealt a cruel blow in 1971, when, without any form of prior consultation, a Presidential decree suddenly removed the northern third of the Park, replacing its magnificent forests and rivers with bushlands unsuited to Indian habitation.

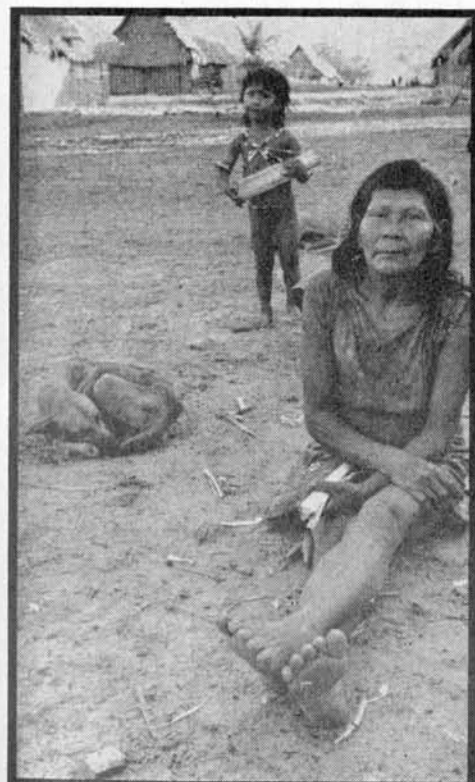
In some respects Funai is now improving. It has a reasonable budget, and its administration is more efficient than in the past. Recruitment is good, and new employees now receive some rudimentary training before being sent into the field. Funai is seeking to double the amount of Indian land that has been surveyed and registered—to

some 25,000 square miles. The Foundation has a few anthropologists and doctors, whereas in the past it often had none. The Brazilian federal government has curbed the States: the result is less invasion of Indian reserves than during recent decades.

But there are very serious problems. Far too much of Funai funds and manpower stay in the cities, absorbed in administrative red tape. Not nearly enough assistance trickles through to the men in the posts and the Indians they serve. It is always difficult to find good men enough for the exacting work or manning Indian posts—and few are prepared to remain there after they marry and produce children.

The Brazilian economy is booming as never before, and the government is driving roads into all the depths of the interior. Places that seemed infinitely remote a decade ago are now being penetrated by road crews and mining prospectors. The threat to the Indian has assumed a terrible urgency. Funai needs to be extremely tough and alert at this time of rapid change. Instead it is an impotent department of the Ministry of the Interior—the very ministry responsible for developing central Brazil.

*A Gorotire woman, one of the surviving Cayapo.*



*(Below) A doctor inoculating Txukahamae women, Xingu National Park.*

*(Right) Bororo chief in regalia.*



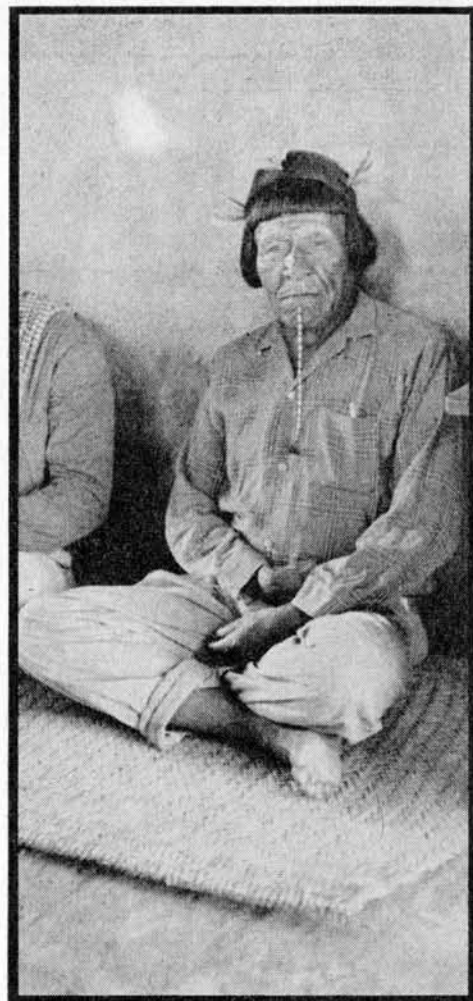
### Deprived of their land

Brazilian tribes, even the most acculturated, do not own their own land. Some reserves produce large surpluses: cattle in southern Mato Grosso and in the northern territory of Rio Branco; wheat in Rio Grande do Sul; timber in Paraná; Brazil nuts in the Tocantins-Araguaia area; rubber on the Tapajós and other rivers. But these surpluses do not remain with the tribes whose land or labour produced them. They are considered part of the "Indian patrimony" and add a small amount to Funai income. The argument is that the more fortunate Indians should contribute their surpluses to the Government to help their less successful kindred. The same policy if it were applied to all citizens would end in extreme communism.

A new Indian Statute is being passed, to "clarify the Indians' legal status". In many respects this legislation embodies the recommendations of the Geneva Convention 107 of the International Labour Organisation, which was concerned to fight apartheid and ensure job opportunities for native minorities. But the Statute does

not give the more acculturated tribes ownership of their lands or the mineral rights on them. It makes no provision for Indian self-government. And it limits by law the size of land that an individual Indian family may own, on a reserve, to five hectares (12 acres).

Funai's most serious problem is one of attitude. Most of its top managers are senior military or police officers, who regard their stint with the Indians as an unwelcome step in their service careers. They seek an efficient solution to the "Indian problem", and hope to eliminate it by "rapid integration", even though this has failed consistently since the sixteenth century and is contrary to the advice of most anthropologists, indianists and Funai's own rank and file. Military men, however conscientious, are unlikely to have any experience, understanding or pride in the Indians. Unless these policies change radically and soon, Funai will continue to lose its best men from disillusion, and the future for the remaining Indians will be bleak.



*Bororo Chief in western dress.*

---

### In January

The Ecologist Editors produced Blueprint for Survival

### Come May

Queen Elizabeth College Students responded with a Teach-in of distinguished contributors chaired by Professor Yudkin

### November 13

Robinson & Watkins, 45 Lower Belgrave St., London SW1W 0LT publish the edited proceedings as

---

## Teach-in for Survival

EDITOR MICHAEL SCHWAB

Paper £1.25

Hardcover £2.50

---

A broad spectrum collection with a few sharp analytical edges  
Good reading for those who want to get on from where we are now

ALL ROYALTIES TO MOVEMENT FOR SURVIVAL

---



# Tribal minorities : What can we do ?

by Robert Allen

The spread of industrialisation and the steadily more uniform culture it imposes on the world's peoples promises a difficult future for all minorities, particularly for tribal ones. This article concentrates on those tribal minorities with a substantial dependence on food-collecting (the hunting of wild animals, including fish, and the gathering of wild plants) rather than food-cultivation, since for them an early compromise with the industrial way of life is likely to be not just difficult but impossible.

A society that depends on food-collecting for 30 per cent or more of its total food supply generally has a much closer bond with the rest of nature than societies that are exclusively agricultural, whatever their level of industrialisation. This bond is reinforced by the hunting society's\* requirement of a relatively large area of undisturbed habitat. Destroy this habitat and you destroy both a way of life and a means for living. It is a way of life that has persisted for thousands of generations while all other peoples have been forced to turn to farming and herding: it follows that it would take more than a few generations to fully convert a hunting society to agriculture without destroying it.

Since the food-collecting way of life is judged incompatible with the development of the industrial nation-state, many attempts have been made to solve the problem either by elimina-

tion or by assimilation. Elimination is rarely the conscious policy of governments that accusers of genocide would wish to make it: generally it is "allowed" to occur as the proper—if regrettable—expression of the frontier spirit. Colonization is for the rough and tough, the men wreathed not in smiles but bullets.

## Ethnocide

Assimilation, however, is deliberate, and fully merits the synonym of ethnocide (see *Ecologist*, Dec. 1971). It is no better than elimination dragged out, and has "worked" only by reducing the minority culture to tatters. Its proponents cannot understand that the culture they wish to change may be no worse than their own. Missionaries generally serve up the way we do things back home, thinly disguised by the grace of God. Liberal humanists are no better: it is very difficult to persuade the most charming of people, proud of their shiny new intellects, delighting in the blessings of Mozart, Milton, and Marx, snug in their fashionably decorated apartments, that their standard of living is not necessarily the highest to which man can aspire. Even if it were, how many of the target minority will enjoy such flowers and when, and how many for how long will spend their days scratching among the roots? The liberal humanist promise, like the Great American Dream, is too often the freedom to kick your brother in the teeth in the struggle for the life of cultivated ease. Is it too much for the vanity of Western Man to accept that most hunting societies already have that ease, cultivated with a culture equal to ours if not superior?

For one culture to replace another, the original must be destroyed, so that, whatever the motives, assimilation has always left the target minority worse off than before. There are too many examples of this—the Indians of North America, the Aborigines of Australia

—for us not to be surprised that the lesson has still to be learnt. Deprived of the means of supporting themselves, dependent on charity, the prey of disease, the faith in all they once believed in destroyed, robbed of dignity and hope, peoples once proud and carefree are reduced "for their own good" to miserable indigence.

Ethnocentrism and a failure to understand the process of culture change are still the spurs of assimilation programmes. If we reject elimination as uncivilized and inhumane, then we must reject assimilation for the same reasons. There is only one course which is likely to work—protection.

## Undisturbed habitat

Hunting societies require that their habitat remain undisturbed and large enough for them to continue hunting, fishing, gathering, and gardening as they have always done. The land they regard as traditionally theirs is generally neither too large nor too small for their needs. They also require continued pride in their way of life, the genuine belief that theirs is a valid culture, even in the face of the technological might of the dominant culture around them. Many minorities have this faith, which is why they still survive despite indescribable odds, but it is easily eroded. The ideal policy would be to leave well alone, but unfortunately just as small boys tend to steal apples so industrialists and adventurers alike tend to view large tracts of land inhabited by "only a handful of primitive people" as ripe for "development". So, however much we may flinch at charges of paternalism, we must accept that tribal minorities require a measure of protection.

Living in Europe, it is of course only too easy to uphold the rights of hunting peoples to their land and life-style, since all but a few of them live in the poor countries of the tropics. For the governments of such countries the

\* The term hunting society is used as short-hand for a tribal minority with at least 30 per cent dependence on food-collecting in whatever combination.

problem is this: How can we tell our growing populations, who are deprived enough as it is, that large areas of valuable land are to be denied them, because a handful of backward individuals wish to remain backward? Is it humane to prevent so many malnourished families from starting a new life? Why should the few merit special treatment?

The answer is that it is in the long-term interest of those malnourished families, indeed of all mankind, that the food-collecting minorities be allowed to live on undisturbed. They live in habitats which themselves are sensitive to the rapid change provoked by settlement schemes. In 1949, an agricultural colony was founded at the confluence of the Madeira and Madre de Dios rivers of Brazil. The forest was cut down and given over to farming, but the soils quickly laterized and within five years the land was so hard and bare that it was unworkable. There are many such examples of the heedless destruction of the means of life. If they are not to go on accumulating, we must learn the tropical habitats as well as have the peoples who have harmlessly benefited from them for so long.

Relatively undisturbed habitats of the tropics are the world's most important sources of genetic diversity, especially of plants. The conservation of such genetic diversity is essential for the world to continue feeding itself. The UN Conference on the Human Environment recognized that the permanent conservation of forests, bushlands, and grasslands, as evolving plant gene pools, is an urgent priority (see last month's *Ecologist*).

The food-collecting minorities of the tropics depend on undisturbed habitats for survival. Such habitats are also invaluable gene pools. We could therefore feed two birds with one crumb, so to speak, by protecting the traditional territories of hunting societies, both as their rightful homes and as areas of genetic diversity. They will benefit, and so will the rest of mankind. Furthermore, such societies have a considerable knowledge of the plants and animals with which they live, plants potentially useful as food, drugs, and so on. Nor is this all we can learn from them. Since as a species we have spent all but a very small part of our evolutionary career as hunter-gatherers, the study of surviving hunt-

ing societies could provide useful insights into what we really are as opposed to what we have been trained to be. It is also worth noting that the problems facing us today boil down to how to live with our environment and how to live with ourselves. Tribal minorities give us examples of many alternative life-patterns, all of which are consistent with the biological and social limitations with which ultimately we must become reconciled. We need not duplicate them, but we can learn some basic principles from them.

The issue therefore resolves itself into a competition between short-term benefits for the non-industrial countries of the tropics and long-term benefits for all mankind including those countries. Accordingly, neither the conservation of the world's genetic resources nor the protection of tribal minorities will be possible without a commitment by the world, above all by the industrial countries, to subsidize a programme for compensating non-industrial countries for setting aside sufficient land for those purposes. This principle is recognized in the World Ecological Areas Programme.

## WEAP

The World Ecological Areas Programme (WEAP) was devised by the *Ecologist*, and is sponsored by two British charities, Survival International (the Primitive Peoples Fund) and the Ecological Foundation, in cooperation with the International Union for the Conservation of Nature and Natural Resources (IUCN). Its aim is to safeguard the future of nomadic tribes and simultaneously conserve genetic diversity, *without* imposing an economic burden on the host nation.

The principal elements of the World Ecological Areas Programme are that:

1. Certain areas of genetic diversity be declared inviolate.
2. The hunter-gatherers and hunter-gardeners within these areas be given title to their lands (i.e. those lands in which traditionally they have gained their living) and be allowed to live there without pressure of any kind.
3. Severe restrictions be placed on entry to these areas by anyone who does not live there (while allowing the indigenes free movement).
4. Sovereignty over the areas remain with the countries in which they lie (which would also be responsible for policing their boundaries).

5. No costs whatsoever be borne by the host countries. Funds would be raised, privately and publicly, from the industrial countries. The funds would be used in four ways:

- a. administration, and the establishment of an ecological and ethno-scientific research programme.
- b. research grants to nationals of the host country to enable them ultimately to take over the research programme.
- c. technical and financial assistance to those people who would otherwise have colonized the area in question.
- d. compensatory payments to the host country in lieu of revenues from alternative forms of development.

## An Ethnoscience Institute

Lest such ecological areas be taken for reservations, it must be emphasized that they would not involve any diminution of territory, any loss of autonomy, or any restriction on movement. Restrictions would apply only to those people who were not members of the protected minority.

For reasons already given, finance must be raised from all over the world, especially the industrial countries. Each area will require enough money to support research and compensation programmes. The cornerstone of the research programmes will be an ethnoscience institute. Conventional ecological research will be necessary to obtain a full understanding of the protected ecosystems, but only an ethnoscience programme can preserve the morale of the protected minority as well as add to our knowledge of the area.

Ethnoscience is the study of an ethnic minority's knowledge, and the two branches that will most concern the ethnoscience institute will be ethnobotany and ethnozoology, particularly the former. For the most part ethnobotanical studies have been casual, arbitrary, and unscientific, their fruits a few herbarium specimens and untested gossip. It is time that a permanent data bank was established; the tribal knowledge and uses of a given plant must be objectively recorded against its tribal name, systematic name and a herbarium specimen. The biochemical and pharmacological properties of the plant should then be tested and written up.

Most if not all of these functions



could be carried out under one roof, and an ethnoscientific institute should be established as a matter of urgency, before the data—in terms both of plants and of tribal knowledge—disappear. The collection of ethnobotanic and other ethnoscientific data involves the researcher in a very rewarding relationship with his source. It is one which in the face of culture contact is vital to tribal societies, since it shows that despite the technological wizardry of our culture we still depend on their intimate knowledge of their environment, and honour them for it. We have something to offer them, they have something to offer us, and perhaps the most valuable function of an ethnoscientific programme is that it transforms the exercise of charity into a dignified exchange.

Neither ethnoscientific nor ecological research should be kept in the hands of the donor nations, and training of citizens of the host country to take over such research should be part of the compensation programme. Perhaps more important is that those people who might otherwise have been transferred to an ecological area as part of a settlement scheme should be resettled and given assistance. Such assistance could include training in the manufacture and use of low impact technologies, together with grants for setting them up. The most difficult compensation problems will arise whenever there is good reason to believe that a hunting society is sitting on top of an oil well or a gold mine. If moving the people to another area of equivalent size and quality is out of the question, and it may well be, compensation must be paid to the host government in lieu of exploitation. This will be expensive, and although much of the support for WEAP could come from private sources, compensation of this order could come only from such bodies as the World Bank.

Detailed budgeted proposals for various peoples in various parts of the world are now in preparation. Once completed they will be formally presented to governments. It is hoped that the operation, which will start with a few countries only, will snowball. WEAP is an ambitious project. It may strike some as too ambitious. However, there seems to be no future for hunting societies without a project as ambitious as WEAP. All other alternatives so far proposed spell their destruction.

# Special Christmas Bargains

**Give your family and friends a future  
Give them**

- ★ A full set of the *Ecologist* Vol. 2 (1972) in binder **£3.75** instead of £4.20
- ★ A subscription to the *Ecologist* Vol. 3 (1973) with index **£3** instead of £4
- ★ A binder for Vol. 2 **£1** instead of £1.20

This offer expires 31st December, 1972

Please send me the special Christmas bargains as indicated:

.....Set(s) Vol. 2 in binder at £3.75 each

.....Subscription(s) starting Vol. 3 No. 1 at £3 each

.....Binder(s) at £1 each

Name .....

Address .....

## DON'T FORGET

### THE ECOLOGIST IS MOVING

The offices of the *Ecologist* are moving to Cornwall. **From the 1st December** all correspondence to the editorial, production and subscription department as well as general enquiries should be addressed to the *Ecologist*, "Catesby", **Molesworth Street, Wadebridge, Cornwall**. Display and classified advertising should be sent to 69 Kew Green, Richmond, Surrey.

# COMPLETE YOUR SET OF THE ECOLOGIST

## by acquiring the back issues (25p each plus p.p.)

The following issues contain these feature articles

Vol. 1 No. 8 February '71	W. M. S. Russell Roy Bridger G. N. Syer	Population and inflation <i>Demographic growth the cause of inflation</i> The pesticide fallacy <i>A critique of the principles of pest control</i> Ahead of their time <i>Two far-seeing Victorian conservationists</i>
No. 9 March '71	J. David George Sir Ashley Clarke Eugene P. Odum G. W. Dimbleby	Can the seas survive? <i>Long-term effects of pollution on marine life</i> Need Venice disappear? <i>How and why floods threaten Venice</i> The optimum population for Georgia <i>Factors that must be considered</i> The Ancient and Ornamental Woods of the New Forest
No. 10 April '71	John Wehrheim Allen Jones D. S. Martin Michael Gurstein Martin and Hilary Waterhouse	Paradise lost? <i>The continuing rape of Hawaii</i> Plastic decay <i>Can we outlive synthetic polymers?</i> Britain's dying chalk streams <i>And how to save them</i> Environmental politics in Britain <i>How to start them</i> Population density and stress in zoo monkeys
No. 11 May '71	Peter Bunyard and Charlie Maclean Brian Johnson Henry A. Schroeder Michael Allaby	The Swansong of the Clyde <i>And how participation was sold down the river</i> Common Market v. Environment <i>The environmental reasons for staying out</i> Trace elements in the human environment How Boophilus tricked the tickicides <i>The victorious tick</i>
No. 13 July '71	F. N. Steele Edward Goldsmith Helen Turner Edward Owen	Nor any drop to drink <i>The future of Britain's water supplies</i> Social disorganisation and its causes Has Oxford a future? <i>A city menaced by the car</i> The man who sued the Torrey Canyon
No. 15 September '71	Edward Goldsmith Richard Warner David N. Leff Michael Allaby Jay W. Forrester	The cost of pollution German moves to protect the environment Politics of pollution Tibetans in Wales Alternatives to catastrophe <i>Understanding the counterintuitive behaviour of social systems, Part 2</i>
Vol. 2 No. 2 February '72	Judith Nottingham Jimoh Omo-Fadaka Gerald Foley W. M. S. Russell Cleeland Bean E. L. Jones Kenneth E. F. Watt	The dangers of chemical and biological warfare (CBW) "Tanzanian Way" to self reliance New myths for old The man who invented conservation We need these soil tillers An education for ecologists The costs of urbanisation
No. 3 March '72	Neiton Pilpel Norman Myers Alfred Leutscher Roger Frith Walter Ryder	Oil pollution of the sea Salvaging the spotted cat The future of Epping Forest To eternity via Stupidity Street Integrated pest control and the human environment A Blueprint for Survival: Comments from Sir Julian Huxley, FRS, Prof. C. H. Waddington, FRS, Prof. D. Gabor, FRS, Sir Geoffrey Vickers, Prof. J. Hawthorn, Dr J. P. Lester
No. 4 April '72	Michael Allaby Raymond Anderton W. Ferguson Anderson Shirley Keith	Why not ban DDT? Who are the Dartmoor Vandals? Affluence and the elderly The Amerindian Tragedy A Blueprint for Survival: Comments from Sir Eric Ashby, FRS, The Rt. Reverend Hugh Montefiore, I. W. Hill, Dr Michael Altman, B. Guy.

THE ECOLOGIST, 73 Kew Green, Richmond, Surrey



# Wild deer in Britain

by Peter Delap

The fate of wild deer in Britain may seem a triviality, but their fortunes mirror in miniature universal problems of suburban man's ecology. We eliminated all their natural predators so long ago that their status has depended directly upon us alone for nearly a millennium.

Victorian romantics reintroduced native and alien deer into a social and ecological vacuum, and those of us who became "hooked" on wild deer between the wars found the British countryside widely repopulated with wild animals whose habits and distribution were as uncharted as even their presence was ignored.

The survival of a rare mammal is aided by the rapidity with which it drops out of folk-memory (c.f. the Lakeland badger in the 19th century and the suburban fox of yesteryear). Deer were casually shot and snared, but their status was that of vagrant meat on the hoof: it has been a major task for the British Deer Society\* and allied conservationists to bring some general enlightenment.

Nowadays it is well known that six species are at large and the proliferating wildlife parks may bring further surprises. Red and Roe are native to us, but many English colonies stem from Continental stocks. Fallow are an ancient introduction, but Sika and Muntjac were brought in less than a century ago: their adaptive capacities deserve further consideration, but we can ignore the Chinese Water Deer which has achieved mere survival in a few Midland haunts.

The big three (Red, Fallow, Sika) are hierarchical species which build up a complex social network within a shared home range and which adapt readily to park life. The Roe and Muntjac, climax forest dwellers, are funda-

mentally asocial and territorial (they cannot afford to eat-out their vulnerable habitat); theirs has been the big success story of our century, but they cannot be readily exploited as a visual asset for tourists.

As they relentlessly supplant our native woodlands, the cover supplied by the new conifer thickets has helped all our wild deer, but especially the two smallest species. In the decade before the canopy closes and the food-supply drops disastrously, they will have built up to an almost intolerable density (to themselves, if not the forester!) thereupon they explode across the countryside; only if suitable outlets are lacking does a population crash occur.

Muntjac and Roe have leapfrogged across England over the past fifty years, few suitable areas remaining unoccupied. Muntjac have not yet reached northern England, and both species seem poised to invade Wales: the dynamics of their advance could provide a fascinating study.

Red deer have been so intensively studied in their simplified Highland habitat that their remarkable versatility has been overlooked. They are not woodland animals as commonly recorded but a marginal species of the treeline. Indeed, their capacity to convert woodland to grassland is an important part of their social system. Such habitat manipulation enables greater numbers to be supported in safe harbours which become monopolized by the hind groups: the stag parties occupying the peripheral areas. Pioneering of new ground is largely a male activity and many can be lost in the process without detriment to a polygamous species. The home range of Red deer may be as great as one hundred square miles. Adaptable, enduring, far-ranging though it is, the life-pattern of this great beast is fundamentally still geared to the 20th century BC. Its survival in nearly a dozen areas of England is near miraculous.

Its smaller cousin, the Sika deer, survives in over a score of British

colonies maintaining a similar social network, but is notably less adventurous. Within a home range of perhaps ten square miles, a very high density will develop, inevitably outgrowing the tolerance of its human neighbours and producing a pattern of recurrent build-up and cut-back.

The Fallow is perhaps the most accommodating of all the social deer, enduring alike the dense crowding and human interference of urban parks and solitary life in some remote spinney. Docile and polymorphous it has been the commonest park deer since Norman times. Most wild colonies stem from park escapes rather than deliberate introductions.

Almost any permutation of symbiosis between these five species can be met somewhere in Britain, without overt rivalry, but usually without social contact. Only the Red and Sika can hybridise successfully: emphatically this is a rare phenomenon, occurring solely when both species lose their normal interspecific inhibitions as a result of intense human persecution.

Where overlap of species occurs, the Roe is likeliest to play Judas, when human intervention is incurred. Dramatic fraying of saplings by the buck at the periphery of his territory during the summer rut brings retribution in winter drives during which its larger cousins become casualties; eventually only the elusive little roe survives to repopulate the vacuum when the killings become unprofitable.

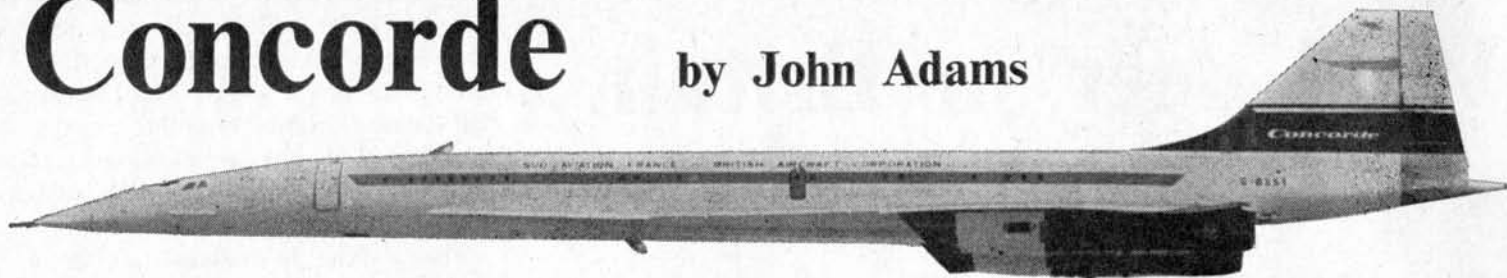
Although the come-back of our wild deer owes little to human help, this cannot be withheld much longer. Victims of all the perils that beset wildlife (traffic casualties particularly), they are increasingly shot on a commercial scale for venison by gangs of car-borne poachers. Unfortunately they are not covered by the Game acts, only the Deer Act of 1963 which gives some very limited protection. The conifer revolution, as well as degrading their habitat, involves inevitably the construction of metalled roads and easy access for their killers.

For a million years we have been minor parasites of the deer. Today many are prepared to forego the bloody finale, but to stalk wild deer through the hills and woods of Britain produces an archaic sense of tranquil vigilance infinitely worthier of preservation for our children than most modern amenities.

\* 43 Brunswick Square, Hove 2, Sussex BN3 1EE.

# Concorde

by John Adams



Professor Richard Scorer of Imperial College has recently emerged as one of Concorde's most articulate and academically respectable supporters. Few who have seen him in action on television or at public lectures, or have read his arguments in print, would deny him credit for a most impressive debating style. But seldom has such a style been so unsupported by fact.

The essence of Professor Scorer's case can be put very simply: first, Concorde will not be a *significant* polluter of the environment or consumer of scarce resources, and, second, Concorde will bring *significant* benefits. Let us begin by looking at the way he argues the first part of this case.

One of his most important "arguments" ignores completely one of the most prominent features of the international air transport industry, namely its extremely rapid growth. At a recent lecture at Imperial College, Prof. Scorer ventured the guess that it would take at least 1,000 Concorde to make a significant impact on the ozone balance of the upper atmosphere, and dismissed as alarmist the concern of those who were worried about the impact of only thirty.<sup>1</sup> But given the ambitions of Concorde's salesmen and recent forecasts by airport planners which indicate a doubling of air traffic every seven or eight years for the rest of this century, 1,000 is not a reassuring number. Sir George Edwards, chairman of B.A.C., said recently "that the replacement of the ageing subsonic jets used on ranges above 2,000 miles, plus an annual growth rate of about 5 per cent, could well require 1,500 Concorde and Concorde development aircraft to be in service by the end of the century."<sup>2</sup> Thus Prof. Scorer's accusations of alarmism will only be substantiated if

## They said the same thing about the H-Bomb

Concorde fails to become the "success" he advocates.

He deals with another problem, the sonic boom, by asserting blandly that something important is not important; the sonic boom, he says, is not a serious problem because it will only be made where it does not matter. But, there are no prospective routes that would not involve the booming of *some* people, if only sailors, islanders, or the inhabitants of "sparsely populated areas." The only way he can reconcile this fact with his assertion about the boom is to argue either that these people do not matter or that they are less sensitive than people living in densely populated areas who, it is acknowledged on all sides, should not have the boom inflicted upon them.

A third "argument" is that because A is worse than B we need not concern ourselves with B—because cars in their millions produce more pollution than a few Concorde, and because ocean liners consume more fuel per passenger mile than Concorde, we need not be concerned about the pollution and fuel consumption of Concorde. This is a usefully flexible device which can also take the form—because B is not much worse than C—we need not concern ourselves with B. In this form it is used to argue that, because it is optimistically expected that the engine noise of production Concorde will not be much worse than that of VC 10s and Boeing 707s, we need not worry about it. This argument helps to sustain the useful but misleading impression that the noise of VC 10s and 707s is not excessive. And it helps to obscure the awkward fact that Concorde will greatly exceed the noise certification standards for new types of subsonic aircraft coming into service at the same time as Concorde, standards set in recognition of the fact

that VC 10s and 707s make a noise that a great many people find intolerable.

Yet another well known device frequently employed in place of argument is the knocking down of straw men. Perhaps the most famous of the transport technologist's straw men, and one who crops up frequently in debates about Concorde, is the man who once predicted that if a steam train went into a tunnel over 70 mph all the passengers would suffocate. The evidence that sensible people believed this prediction at the time is rather shaky, but in any event it is an analogy that is totally irrelevant to the argument about the environmental consequences of Concorde. In the train case a few test pilots could settle the matter; in the upper atmosphere pollution case, to forge ahead bravely in the face of enormous uncertainties would be to use the whole of mankind as guinea pigs.

Professor Scorer's favourite straw men are those who predicted that the H-bomb would alter the weather. In an article in *Engineering*,<sup>3</sup> by way of illuminating the misconceptions of those who doubt his optimism he says "Another scare, widely believed, was that H-Bombs would alter the weather." But this is not an argument at all. Firstly, it remains debatable whether an uninhibited series of tests, such as advocated by Dr Teller, would have affected the climate or not. Secondly, even if it would not have, this hardly constitutes support for the argument that Concorde would not either. And finally, neither this "argument", nor any of the other "arguments" discussed above, constitute positive support for Concorde. This would be too obvious to deserve saying were it not for the fact that Professor Scorer leaves the impression that he thinks they do. It is perhaps his complete lack of a real case for Concorde that leads him, in his advocacy of the plane, into such an oddly negative stance.

Let us now look at what the Concorde lobby believes to constitute a case for Concorde. Since Professor Scorer



himself has suggested the idea, it will be informative to compare this case with the arguments advanced in the early 1950's in support of the American H-Bomb project. The cases are remarkably similar. They both contain elements of chauvinism, an obsessive enthusiasm for technology and a spurious altruism. In both cases the national interest was (is) seen to demand the achievement of global superiority—in nuclear weaponry in the one case and in aviation technology in the other. In both cases the chief rival was (is) Russia.

In the case of the bomb, Oppenheimer identified the obsession with esoteric technical problem solving as the fatal character flaw that led him and his fellow atomic scientists to do "the devil's work":

"It is my judgement in these things that when you see something that is technically sweet you go ahead and do it, and you argue about what to do about it only after you have had your technical success."<sup>4</sup>

Professor Scorer admires Concorde as a great technical achievement and argues that countries should do what they can do well. Lord Beswick, another friend of Concorde, provides a useful insight into the operation of the technological chauvinism that permeates the Concorde cause:

"It is inescapable that in any progressive industrial society there must be a pioneering spearhead technology. It is not simply a matter of establishing the facts, or finding out what can or cannot be done. There is a psychological spin-off, a constructive feeling of pride, a stimulating sense of prestige, if one's own society can claim to lead in any given field. Concorde, the RB.211 and Harrier can reasonably be said to afford this constructive stimulation."<sup>5</sup>

It is no doubt true that pride and prestige are conducive to pleasurable and stimulating states of mind, but these states are crucially dependent upon public recognition of one's "achievement". There are many "fields" whose leadership no one can take pride in. In the absence of any criteria for distinguishing technological achievements from technological follies, "psychological spin-off" is likely to be very difficult to sustain. Such criteria cannot be found within the tautology that

asserts that something is good because it makes one proud because it is good.

Both Dr Teller and Professor Scorer dress their arguments, for the Bomb and Concorde respectively, in a global scale altruism. Dr Teller earned his title "Father of the H-Bomb" not primarily through his contribution to the scientific development of the Bomb, but through his role as the pre-eminent scientific advocate of the Bomb. Professor Scorer, in a remarkably similar way, appears to be aspiring to the title "Father of the Concorde". Dr Teller argued that a vigorous American programme to develop an arsenal of atomic weapons would promote world peace: "for peace we need weapons... I believe I am contributing to a peaceful world."<sup>6</sup> As a piece of reasoning this is on a par with Professor Scorer's proposition that Concorde will alleviate the lot of the illiterate poverty stricken masses of Latin America or that, by improving communications, it will hasten the end of the war in Vietnam.

Dr Teller called his science "beautiful" and Professor Scorer calls his plane "beautiful"; but the parallel between the two arguments goes further than their common vacuity and peculiar aesthetic priorities. Both Professor Scorer and Dr Teller espouse theories of social cause and effect which, coming from the mouths of eminent scientists who berate their opponents for a lack of scientific rigour, are embarrassingly naïve. That a programme to develop nuclear superiority could not do other than provoke a proliferation of counter programmes designed to overcome this superiority is hardly surprising. The belief that the rest of the world would be, and should be, content to remain militarily subservient to a power whose pursuit of its own self interest was so naked, was tragically mistaken.

Subservience to the rich and powerful is a characteristic of the poor everywhere. Professor Scorer's appreciation of the consequences of his pet project for the subservient peoples of the world is, I submit, as naïve and as disastrously wrong as Dr Teller's. Developments in transport technology which make the subservient more accessible to the dominant, without at the same time increasing the mobility of the subservient, can only widen the gulf between them. Historically the potential in such developments for diffusing the "benefits of civilisation" has almost invariably been outweighed by the

parallel opportunities they afforded for exploitation.

Changes that increase the disparity in levels of mobility between the dominant and the subservient can only reinforce the latter's subservience. The devastation and demoralisation of the indigenous societies of North America and Australia, the slave trade and subsequent colonisation in Africa, the residual genocide still practised in Latin America, and the daily 5,000 mile bombing runs from Guam to Vietnam are but a few examples. In America, the widespread distrust of those in authority, the breakdown in communications between social classes, races and generations, and the squalor of the lives of the immobile poor living in the ghettos of the world's most mobile society, are but a few of the reasons for doubting Professor Scorer's optimism that supersonic mobility for a privileged elite will make the world a better place.

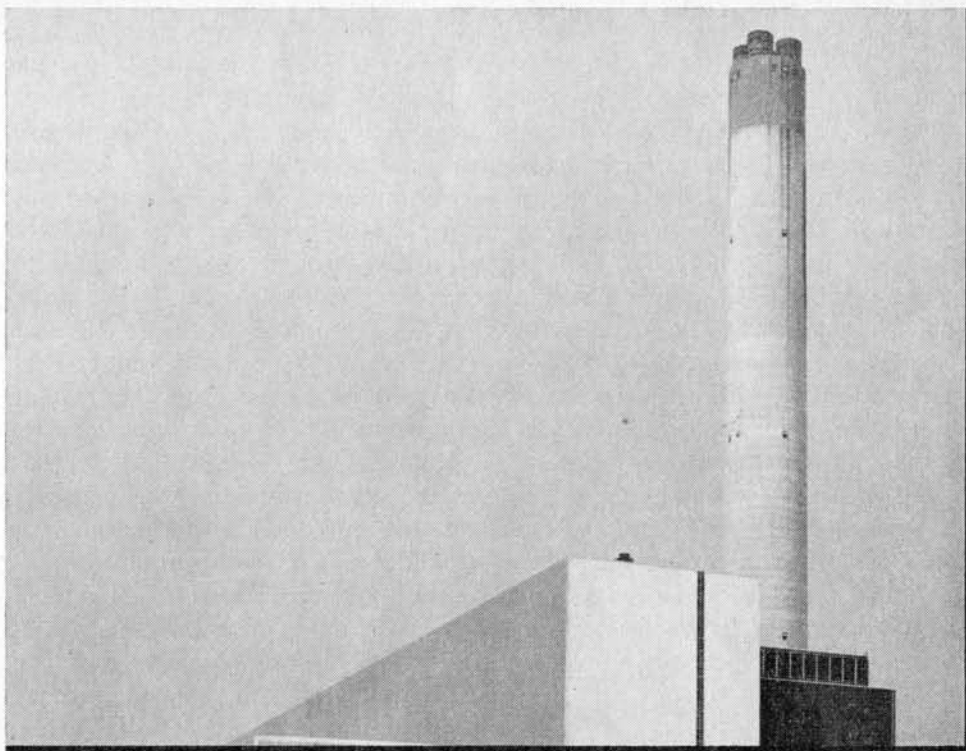
But let us go further. Professor Scorer declares himself a technological optimist. Technology has produced impressive advances in aircraft design in the recent past and he is confident that such progress will continue. Let us grant Professor Scorer *all* the assumptions about technological progress that he might wish to make. Let us assume that it will be possible to make Concorde pollution free, noise free, boom free, and extremely efficient and cheap to run—so cheap that even the poorest could afford to fly in it. What then? Professor Scorer says, "When you make travel easier more people want to go". The Roskill Commission forecast a fifteen-fold increase in the volume of traffic passing through London airports in the next thirty five years. Professor Scorer concedes that the consequences of such growth would be terrible and has said "We mustn't allow it to happen." Yet it is precisely the sort of technological "progress" that he advocates in his support of Concorde that would make these forecasts come true.

#### References

1. At a debate sponsored by the Imperial College Branch of BSSRS, at Imperial College, June 22, 1972.
2. In *Flight International*, December 23, 1971, p. 997.
3. *Engineering*, August 1971, p. 532.
4. Quoted in R. Jungk, *Brighter Than a Thousand Suns*, Pelican, reprinted 1970, p. 266.
5. In *Flight International*, January 27, 1972, p. 130.

# SO<sub>2</sub>: acid in the sky

by R. T. Briggs\*



Each year, Britain's chimneys pour into the atmosphere approximately one million tons of smoke, over half a million tons of grit and dust, and six million tons of sulphur dioxide. In addition to these main groups of pollutants, there are the fumes and odours from internal combustion products and refuse burning. The estimated quantities of carbon monoxide discharged into the air in 1965 from petrol engines was five million tons. This compares with a total (from other sources of fuels) of 12 million tons. In 1967 the estimates of pollutants in millions of tons from petrol engines was as follows: carbon monoxide 5.7, hydrocarbons 0.28, aldehydes 0.01, oxides of nitrogen 0.19, sulphur dioxide 0.02. In Great Britain it has also been estimated that by 1980 vehicles generally will increase nearly three-fold with a large increase in light motor traffic in urban areas.

\* R. T. Briggs, MSc, MInstF, CEng, MCorrT, LRIC, AMBIM, is Senior Lecturer in the Science and Maths Department of the Doncaster College of Technology, lecturing in Chemistry, Fuel and Corrosion Technology, and an environment course from September of this year.

The conclusion of a paper given at the Clean Air Conference on 23 September, 1970, by P. J. Lawther (Director of the Air Pollution Unit of the Medical Research Council) and B. T. Cummins (member of the Scientific staff of the Medical Research Council) is worthy of consideration. "There is little sound evidence by which pollution of the common air by motor vehicles can be shown to be especially harmful but this lack of evidence must not be used to excuse pollution or excuse idleness in research. There is an urgent need to proceed with our investigations at the same time as our engineering colleagues are striving to reduce pollution. But it would be foolish to panic and we must always remember that cigarette smoking leads to a far greater exposure to CO and oxides of nitrogen than that caused by motor vehicles. A sense of proportion is much needed in this field."

In contrast, emissions of oxides of sulphur (the generic term which must include sulphur dioxide, sulphur trioxide and sulphuric acid mist) present a more intricate and intriguing facet of air pollution, which appears to have been largely neglected and treated in a dangerously complacent manner. An important feature of air pollution control in Great Britain is the major progress which has occurred through the 1956 and 1968 Clean Air Acts, and the work of the Public Health Inspectorate relating chiefly to the reduction of low level smoke pollution. The trend in reduction of smoke pollution is shown in diagram I. The National survey shows

that in the last fifteen years there has been an approximate overall 55 per cent drop in smoke emission, the reduction in the south being greater than in the north. The regional distribution of the annual average smoke concentrations in the United Kingdom in 1969 show that in towns in the south the concentration of smoke is approximately one third to one half of the concentration that existed in towns in the north. By the application of efficient combustion techniques, and with the installation of more efficient arrestors, emissions of grit and dust from industrial processes can be minimised, although emissions of fine particulate matter (below approximately 30 m $\mu$ ) from certain industries, frequently presents local pollution problems.

In the establishment and development of new towns and new industries there are many opportunities at the planning stage, for the avoidance of air pollution. If insufficient thought is given to the total environment and particularly the situation of new industries with respect to other sociological developments, the complete industrial structure of an area can be seriously impoverished. Environmental planning and air pollution control are important factors in the long term development of many of our towns, and in the attraction of new industries to development areas.

The total emission of sulphur dioxide is an important factor in dealing with any new proposal. The extensive deleterious effects of atmospheric pollution,



particularly sulphur dioxide emissions, are not always equally shared by the community. There are those living under the cloud of constant sources of air pollution who must bear the burden of the deleterious effects, in order that the inhabitants of other areas can benefit from living and working in a healthy and unpolluted environment.

### Hot and high!

The trend in reduction of pollution due to sulphur dioxide is far less satisfactory than that due to smoke. Over the period 1938 to 1965, with an increase in the use of fuels containing sulphur, the amount of sulphur dioxide emitted each year into the atmosphere in this country increased by about 50 per cent to reach a peak during the years 1963 to 1965 of almost 6.5 million tons.

According to the White Paper of 1970 (cmd 4376. *The Protection of the Environment*) and the 106th Annual Report on Alkali Works 1969, the estimated amount for 1970 was 5.9 million tons. The documents "predict" future sulphur dioxide emissions of 5.54 million tons in 1975 and 5.16 million tons in 1985!! The "predictions" in the 106th Annual Report assume the average sulphur content of fuel burned remaining constant!! This assumption must be given more detailed consideration. Will there be an adequate supply of low sulphur content fuel oil? The other factor which seems to have been forgotten is the nature in fuel policy. Coal still remains the major source of fuel used by the power plants, and the sulphur content can vary considerably. When large amounts of coal are being consumed daily, even a small increase in the sulphur content of the coal consumed can result in a significant increase in emissions of sulphur dioxide. The "average" content of sulphur in British coals has been given as 1.6 per cent, but the sulphur content can vary widely, and can be much higher, with average values of 2.0 to 2.4 per cent.

With a reduction in the amount of sulphur dioxide discharged by domestic chimneys, coupled with the trend towards higher chimneys, there has been a claim that concentrations at low level have fallen. There are some conflicting views of the "downward trend". The 106th Annual Report states that "Over the last decade, sulphur dioxide concentrations at ground level have fallen by an average of 40 per cent in this country, excluding London". The White

Paper states "...over the past decade, the average concentration in towns has fallen by some 33 per cent". There is no mention of a percentage reduction in low level concentrations of sulphur dioxide in the Report of the Royal Commission (February, 1971, cmd 4585), but the diagram on page 18 indicates an increase in "average sulphur dioxide concentrations near ground level in the UK since 1967".

Diagram II indicates the estimated emissions of sulphur dioxide in the United Kingdom, the decline of about 6 per cent since 1963 can hardly be regarded as enlightening, and the predicted trend is not particularly encouraging. Diagram III indicating the trend in concentrations at ground level no doubt enables the pundits to breathe easier, but closer analysis of these trends and their precise meaning presents food for thought, particularly in our technological age.

Emphasis seems to be given to "averages" and there is little or no attention given to dangerous peak levels, frequently hidden by these averages, that may occur at various times during the day. There are limitations of some of the pollution data. The standard method of measurement on a daily basis (mean of 24 hours collectively assessed) for smoke and sulphur dioxide often conceals important variations in the diurnal cycle, and is not always accurate. There are errors due to the smoke filter, the gas meter, ammonia in the atmosphere, and to titration inaccuracies. The cumulative error can be high. Improvements in detection and measuring emissions of sulphur oxides are essential. Where more precise data is required, accurate automatic continuous detection and measuring instruments are necessary for monitoring dangerous emissions. Apart from acting as an early warning system, a more accurate assessment of the impact of new sources of pollutants could be made.

Investigation for 12 regional averages in England in 1968-69 showed that for 10 of the regions, the "average concentrations" of sulphur dioxide was well above the average concentration of smoke for these regions. It has been reported that since 1966 (approximately  $106 \mu\text{g}/\text{m}^3$ ) there has been a steady increase in observed concentration of sulphur dioxide, confirmed by National Survey figures for 1969 (approximately  $114 \mu\text{g}/\text{m}^3$ ). The "downward trend"

concept is also clouded, and becomes unrealistic when consideration is given to the various forms and combinations that sulphur dioxide may take in the atmosphere, and by other variables such as human factors, the operation of industrial processes, meteorological and topographical conditions that influence the concentration and deleterious effects of the pollutants. In the complete assessment of the impact of emissions of oxides of sulphur such factors cannot be ignored. The use of high stacks (even if they are designed to puff vortex rings!!) largely dependent on dispersion and dilution, is not the answer to the problem, it is a palliative only, for pollution of this nature knows no frontiers.

### Dangerous aerosols

Apart from sulphur dioxide, sulphur exists in the atmosphere in many forms such as sulphates, hydrogen sulphide, and sulphuric acid, and circulates between land, air and water masses in millions of tons each year. Pollutant sources amount to approximately  $72 \times 10^6$  tons of sulphur, while natural sources amount to approximately  $142 \times 10^6$  tons. It has been estimated that one third of the sulphur reaching the atmosphere comes from pollutant sources, chiefly as sulphur dioxide. There is a net transfer of sulphur from land to ocean areas, with pollutant sources contributing a significant part. More than two thirds of the natural and pollutant sulphur emissions occur in the northern hemisphere, and 93 per cent of pollution sources are in the northern hemisphere.

The precise mechanisms for the behaviour of sulphur dioxide in the atmosphere are not clearly understood, possibly because of the variety of chemical changes that may take place in the atmosphere. The average life of a sulphur dioxide molecule has been estimated as from one half to one quarter of that of a smoke particle—i.e. of from two to three days duration. Oxidation plays an important part in the formation of sulphur trioxide. Solar radiation between 2,900 and 4,000 Å is absorbed by sulphur dioxide. The gas also reacts very slowly in sunlight to form sulphur trioxide. The latter gas dissolves in water droplets to form sulphuric acid, which may react further to form sulphate salts. The primary oxidation process may take several different routes, and can proceed

rapidly in polluted atmospheres. In air that contains nitrogen dioxide and certain hydrocarbons, sulphur dioxide is oxidised in a photochemical light stimulated reaction process that produces aerosols containing sulphuric acid. Also sulphur dioxide can be oxidised in water droplets that contain ammonia, the end product being the ammonium sulphate aerosol. Both the sulphuric acid and sulphate salts thus formed exist in the air as aerosols, and here lies the danger.

Aerosols are particles in more or less permanent suspension (sulphuric acid mist may have diameter 0.8 to 5  $\mu$ ) they are removed by precipitation and, to a lesser extent by gravitational settling. A given volume of sulphur dioxide that enters the air will be removed by these mechanisms, as acid or salt, in a time estimated at five days to two weeks. Russian observations have indicated that approximately 30 per cent of sulphur dioxide in the air is converted into sulphuric acid. In addition, the amount of droplet growth is sensitive to humidity, and there is the catalytic oxidation processes of sulphur dioxide by particles present in effluent dust. The deleterious effects of sulphur dioxide become enhanced by these processes. The small nuclei of sulphuric acid together with any fine dust particles in the air stabilises the suspensions of moisture in the air. The contribution of pollution due to aerosols could be a critical factor in the rate of formation and duration of fogs. The results of a survey on Teesside have indicated that ammonium sulphate

plays a significant part in the visibility problem in that area.

### Dominant destroyer

Corrosion may be defined as the destruction or deterioration of a material because of its reaction with its environment. The recent report on *Corrosion and Protection* (Department of Trade and Industry) has assessed the cost of corrosion in the United Kingdom as being of the order of £1,300,000,000 per annum. In 1661 Evelyn indicated the importance of the corrosive effects of sulphur compounds on iron works. In the early part of the present century Vernon underlined the important role of sulphur dioxide in promoting the corrosion of metals. He distinguished between "promoting factors" (responsible for the initiation of attack) and "controlling factors" which determined the rate of corrosion. In atmospheric corrosion, the outstanding promoting factor in the atmosphere is the presence of the oxides and oxyacids of sulphur. Ammonium sulphate aerosols are also effective in promoting corrosion. The principal controlling factors are the relative humidity of the environment, and the properties of the film of the reaction product.

Other workers such as Hudson, March and Burdick have supported Vernon in concluding that sulphur dioxide is the main culprit in promoting atmospheric corrosion. Another significant factor is the proportion of time during which the relative humidity exceeds the critical value of about 70 per

cent. More recent work indicates that single environmental factors cannot be considered in complete isolation from others.

In a survey of corrosion and atmospheric pollution in and around Sheffield, the following conclusions were reached. "Atmospheric pollution as represented by sulphur dioxide and smoke, has a major influence on the corrosion rate of steel and accounts for about 50 per cent of the variations found at different sites. Smoke intensity proved to be as important as sulphur dioxide in determining the corrosion rate and improvement in corrosion rate was obtained by increasing the allowing conditions".

Researchers in the British Steel Corporation have indicated that the incidence of rusting is associated with the total environment and that humidity and atmospheric pollution must be taken into account in predicting the performance of individual sites. Clearly the combination of high humidity and atmospheric pollution with sulphurous gases is particularly harmful to some of our more important industrial developments.

### Invisible killer

The toxicity of sulphur dioxide to man varies, depending on the physical condition of the individual and on many other factors. In the well documented disasters such as those in London (1952, 1956, 1962), the Meuse Valley, and Donora USA, the acute toxicological effects of pollutants in the atmosphere were clearly demonstrated, and fairly well comprehended. The slower, more subtle effects of mixtures of pollu-

Diagram I: Estimated smoke emission in the UK.

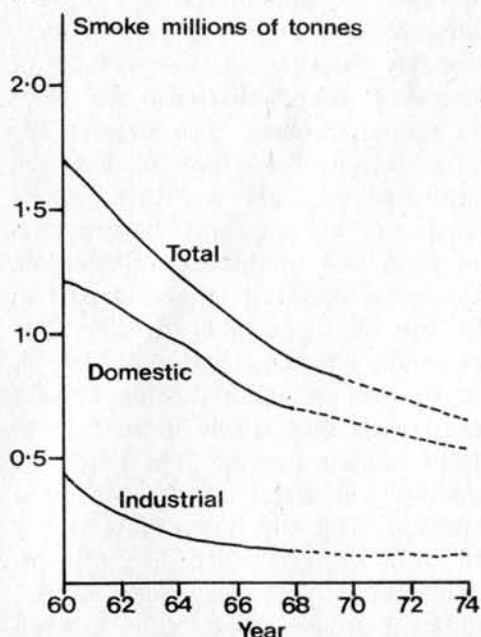


Diagram II: Estimated UK SO<sub>2</sub> emissions.

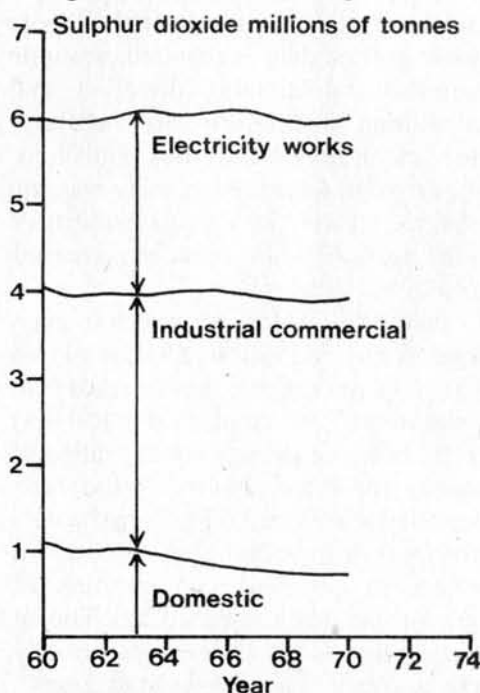
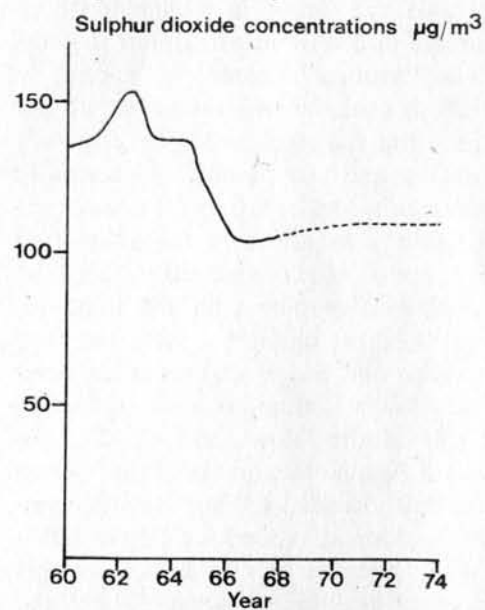


Diagram III: UK SO<sub>2</sub> concentrations.





tants under varying conditions present a more difficult problem. Sulphur dioxide is always implicated, and the rate of formation of sulphuric acid droplets, and their dispersion could prove to be a vital factor in its deleterious effects. It is difficult to provide the fatal atmospheric chemistry for experimental research purposes that actually exists during smog disasters.

Although chronic bronchitis is regarded as a multifactorial disease from the standpoint of causation, the evidence indicates that atmospheric pollution appears to be a promoting or aggravating factor. Smoke and sulphur dioxide acting alone and together are thought to be involved. It is difficult to separate their individual effects, since they usually occur together. The situation is further complicated by factors which affect the severity of atmospheric pollution, such as human and economic factors and meteorological and topographical features. The lines of evidence seem to suggest that the effects on health result from "air pollution" rather than from "air pollutants" and that the whole is greater than the sum of its parts in the production of adverse health effects. Rees has indicated that the use of high chimneys alone to reduce the concentration of sulphur dioxide at ground level is not adequate under certain weather conditions.

Investigations by Professor P. J. Lawther have indicated that the health of patients with chronic bronchitis undergoes deterioration when the daily mean concentrations of smoke and sulphur dioxide exceed about 300  $\mu\text{g}/\text{m}^3$  and 600  $\mu\text{g}/\text{m}^3$  respectively). In the National Survey report of Smoke and Sulphur Dioxide in Northern Ireland (SCCB72/6, 2 June 1969) Lawther has also expressed the view that "... if the concentration of smoke were low he would be inclined to accept peak concentrations of up to 1,000  $\mu\text{g}/\text{m}^3$  of  $\text{SO}_2$ , but would consider anything in excess of this to be potentially harmful, at least to some people. This would mean aiming at a limit of some 100 to 150  $\mu\text{g}/\text{m}^3$  for the average winter concentration."

Martin and Bradley (1960) found increases in mortality in association with small increases in atmospheric pollution of about 100  $\mu\text{g}/\text{m}^3$  of black suspended matter and 71  $\mu\text{g}/\text{m}^3$  of sulphur dioxide above the previous day's measurements. The significance which should be attached to variations in the



*Esso Refinery, Fawley, at night (Esso photograph).*

concentrations of individual pollutants is not clear. Many other workers have given evidence with reference to the relation between respiratory diseases and atmospheric pollution, frequently supported by varying ranges of dangerous levels. Some extracts from the conclusions of "Air quality criteria" for oxides of sulphur are worthy of consideration. "At concentrations of about 120  $\mu\text{g}/\text{m}^3$  of sulphur dioxide (annual mean) accompanied by smoke concentrations of about 100  $\mu\text{g}/\text{m}^3$ , increased frequency and severity of respiratory diseases in school children may occur. (British data). At concentrations of about 115  $\mu\text{g}/\text{m}^3$  of sulphur dioxide (annual mean) accompanied by smoke concentrations of 160  $\mu\text{g}/\text{m}^3$ , 'increase in mortality' from bronchitis and from lung cancer may occur. (British data)." The general conclusions indicate that for sulphur dioxide as far as medical effects are concerned, if the concentration of smoke were low, "a limit of 75 to 100  $\mu\text{g}/\text{m}^3$  would be desirable for the average annual concentration."

Clearly the evidence does not exonerate sulphur dioxide completely and it may have a particularly harmful effect in association with other pollutants on sensitive individuals. Maximum acceptable concentrations of pollution have not yet been precisely defined in this country. There are no

UK standards set for concentrations of sulphur dioxide. No one can define exactly what is the acceptable limit of a pollutant such as sulphur dioxide. The question arises as to what limit is acceptable by whom?

The USSR has pioneered the introduction of legislation laying down the maximum permissible concentrations of harmful substances in the atmosphere of urban areas. Standards have been given in Sweden, West Germany, Poland and Holland. US standards are being set in urban areas with particular reference to sulphur dioxide. The California state department adopts standards defining three different levels of pollution (adverse, serious and emergency). The Alkali Act of 1906, concerned with emissions from specified industrial processes, applies "the best practicable means" of preventing pollution!! Clearly further consideration should be given to control and legislation, preferably on an International basis.

From British, American and Russian publications it is known that sulphur dioxide irritates the respiratory organs and the eyes. Carnow and Shapiro have also referred to its possible dangers to human health. It would appear that there are two schools of thought, and both reasonings of these schools require careful consideration. We should err on the side of caution.



*Esso Refinery, Fawley, by day (Esso photograph).*

The Royal College of Physicians has recently reported that chronic bronchitis is one of the major causes of disablement and death in Great Britain, particularly among middle-aged and elderly men. Cassell has co-ordinated relationships between certain selected symptoms in a normal population and pollution variables, and has derived five main factors to account for the variability. He has stated "The acute air pollution disasters yielded clear-cut evidence of an effect of air pollution on health...the epidemiology of chronic obstructive pulmonary disease, as well as pulmonary function studies in adults and children have clearly shown a relationship between the environment and some measure of the health of the study individuals."

Like so many pollution problems the question of choice and willingness to pay rears its head. This resolves itself into human values and how we look at "the balance". The deleterious costs of atmospheric pollution, particularly from the corrosion and health standpoints, are worthy of consideration. It has been estimated that "the annual contribution of atmospheric pollution to the cost of bronchitis in England and Wales may be about 5,000 in deaths, 6,500,000 in working days, £3,500,000

in sickness benefit and also £3,500,000 in hospital, general medical and pharmaceutical services". (Clean Air—The Health Balance Sheet. C. R. Lowe, MD, PhD, MRCP, Professor of Social and Occupational Medicine, Welsh National School of Medicine). P. 83, Clean Air Conference, Southport, 20-23 October 1970. Part I, Pre-prints of Papers.

### **Control and prevention of emissions**

Emissions of oxides of sulphur can be controlled by three basic methods:

- (i) Burning a low sulphur fuel,
- (ii) Desulphurising existing fuel, or
- (iii) The removal of oxides of sulphur from the gas.

Low sulphur fuels are in limited supply, but should be considered where appropriate. Without doubt the most effective form of legislation would be to limit the sulphur content of fuels in particular situations.

Removal or reduction of sulphur before combustion is practically difficult. Sulphur in coal can be partly reduced by efficient cleaning methods, but finely divided sulphur and combined organic sulphur are not removed. Fuel oil is more amenable to desulphurising by

hydrogenation. Sulphur containing oil may also be desulphurised during the process of combustion when this occurs within a fluidised bed of lime particles. In this process the sulphur is fixed as calcium sulphide or calcium sulphate, the latter compounds may be decomposed to regenerate lime, and to yield sulphur dioxide for use in the chemical industry.

There are many processes available for the removal of sulphur dioxide from flue gases. Methods to recover sulphur dioxide in one or more marketable forms such as sulphuric acid, sulphur or ammonium sulphate present an apparent ideal solution but there are economic and engineering difficulties. Pilot plant studies associated with catalytic conversion, wet and dry absorption, and injection methods have been made in order to ascertain the most efficient and economically viable process. The low cost of limestone coupled with its availability and affinity for sulphur dioxide makes it an appealing scheme for injection in a pulverised form into hot flue gas. The sulphate formed will be removed with the fly ash. Absorbents capturing the oxides of sulphur physically or chemically (the alkalis alumina process) have also been considered. Pilot plant studies using wet



alkali scrubbing systems have also been proposed. Various combinations and modifications of the processes mentioned have been suggested being either regenerative or non-regenerative.

Some of the many factors which must be considered in the selection of a process are: the initial and final sulphur dioxide concentrations in stack gases, the recovered form of sulphur, oxidation, temperature of absorption, liquid flows, steam and power requirements. The ultimate analysis of the atmospheric pollution problem due to oxides of sulphur appears to resolve itself into a question of choice and economics. The cost of the adverse effects in terms of human life and total environment cannot be precisely assessed, but the general nature of the cost is too great. The balance weighs heavily in favour of prevention of pollution at source.

### **The paucity of precise knowledge**

A characteristic feature of the study of atmospheric pollution is the lack of precise scientific and technical knowledge regarding some of the basic fundamental principles. The flow and dispersion of air contaminants, health and synergistic effects (the results of reactions between pollutants in the atmosphere that could produce more harmful products), the presence and effects of trace elements, all present areas of uncertainty, and clearly require more research. The fragmentary and interdisciplinary nature of the subject necessitates a co-ordinated effort by scientists, engineers, architects, staffs

of local authorities, and those concerned with industrial management.

The greatest need is for a reassessment and reappraisal of the content and method of our educational system at all levels, in order to include the essential science and technology relating to the environment. There is still a tendency to regard the various aspects of science as separate subjects in water-tight compartments. In contrast the environment is a global system of almost infinite complexity and is not compartmentalised.

The view of Heracleitus of Ephesus (c540-475 BC), one of the great Ionian philosophers, that "everything is in a state of flux, there's nothing is and nothing was, but everything's becoming" is applicable to the changing nature of science, and this change has increased in tempo during the twentieth century. No doubt many adverse effects of this rapid change could have been prevented, or, at least, minimised by consideration of the words of Claude Bernard, the French biologist. "True science teaches us to doubt, and in ignorance to refrain." J. G. Crowther associated science with environment. "Science is a system of behaviour by which man acquires mastery of his environment."

The language of science depends on the conditions prevailing in the universe, and this language changes according to social, political and economic forces. The true scientist is increasingly aware of the limitations of science, and, although he strives for the

acquisition of more accurate knowledge, he regards science as a continuous and essential part of human activity involving the development of an attitude of mind necessary for a more precise understanding of universal ecological processes and relationships. The dichotomy of science and technology, demands a new approach, and the development of a new attitude of mind. The approach may well be found in the process of hybridisation of various subjects and more adequate attention to interdisciplinary science. This must involve a more flexible and co-ordinated education system at all stages, with no gulfs of separation between the stages, and where the study of environmental science and technology becomes as important as other disciplines.

It would be unfair to say that no efforts have been made towards these essential objectives. It is encouraging to see the development of a course at Ordinary General Certificate of Education level (AEB), the contribution of the National Foundation for Education and Research, towards the construction of an Advanced Level Syllabus, the establishment of the Institute of Environmental Sciences, and the Society of Environmental Engineers, and the appearance of a few courses at higher levels. These developments are chiefly due to the efforts of enthusiastic groups of individuals. The bell has been gently sounded but there are very many deaf ears and response to the various efforts is often disappointing.

## **INFORMATION FOR SURVIVAL DIGEST**

The first issue of the Information for Survival Digest is now available. Information for Survival is the data storage and retrieval service that covers every aspect of man's relationship with his environment. It is based on abstracts obtained by volunteers and fed into a data bank. The Digest, which abstracters receive free of charge, consists of selected abstracts.

Copies are obtainable now from **Dr. K. E. Barlow, The Old Forge, Great Finborough, Stowmarket, Suffolk, price 13p post paid.**

## **WE ARE MOVING**

### **Who?**

The Ecology Bookshop

### **When?**

November 1st

### **Where?**

Robinson & Watkins  
19/21 Cecil Court  
Charing Cross Road  
London WC2N 4HB  
01-836-2182/3778

# Sanitation for Conservation

by Lawrence D. Hills

The Clivus is the world's first ecological lavatory. A Swedish invention, it converts human wastes into compost, avoiding the need for sewers or large amounts of water.

To the conservationist, sewage is pollution. It contaminates the seas with toxic metals and seabird-killing PCB, poisons our lakes into premature old age and turns rivers green with algae that literally "drown" the fish by robbing the water of oxygen when they decay. Yet the 30 gallons of water every one of us pours down the drain every day of our lives, plus another 30 as our share of what industry uses (and pollutes with mercury, lead, cadmium and the other problem chemicals of an age of three letter names) has another long term problem, as important as the fuel for freeze desalination or the irreplaceable species drowned by new reservoirs.

In the 11 gallons a day we average for lavatory flushing, there is about 7 lb of phosphorus a year, or 171,875 tons, and 5 lb of potash which is 122,767 tons for the 55 million of us. Compare this with the totals of the plant foods in the sludge from our sewage treatment works, (of which about half is used on the land) which are 14,000 tons a year of phosphorus and 3,500 tons of potash, and there is obviously something wrong.

Though the only available figures are from the Agricultural Research Council Report in 1948, they are still used by those who belittle the value of the plant foods in sludge. Even if the population had doubled since 1948, the figures would still not add up, and the answer lies in our sewage treatment methods.

Part of the difference lies in the 37 million gallons a day of untreated sewage discharged into the Tyne, the 500 separate outfalls pouring filth into the Tees ("filth" is a good word for sewage plus chemicals) and the 200 sea-

side resorts where visitors can go paddling among toilet paper. The major discrepancy, however, is in the effluent—the 30 million odd gallons a day that leaves the mighty Rickmansworth plant of the West Herts. Main Drainage Authority with its plant foods in solution, compared with the 150,000 gallons a day of liquid digested sludge they return to the land through their highly effective and popular tanker service for farmers within a 45 mile radius.

There is not only the phosphorus that feeds the algae, but the potash, for even the best sewage sludges or municipal composts contain only a trace, because we pass the potash in our food with our urine, and this is liquid and goes straight into the river, and down to the sea in the effluent, saving only 3,500 tons out of 122,767. We import 350,000 tons a year of rock phosphates, mainly from North Africa, and another 350,000 of potash, from the Dead Sea mostly, but even the new potash deposits that the ICI will start working when the conservationists can be persuaded to agree to the devastation and pollution involved, are as exhaustible as petrol.

The Soil Association, after running a "Closed Circuit" farm at Haughley for thirty years, returning all manure and organic matter to the soil, found that the milk, eggs, meat and grain going off the farm produced a steady fall in yields. The cycle of return was broken, and however well the legumes are managed to fix nitrogen with their root bacteria, however high the humus, if men break the cycle by pouring their bodily wastes into the sea, they will end by making deserts.

Had the Chinese discovered the water closet (invented by Thomas Crapper about 1870) instead of gunpowder in 350 B.C., they would have wrecked their soil from potassium shortage. Not necessarily from exhausting the reserves in the subsoil, but by taking it away faster in crops than roots and bacteria could make it available, just as at

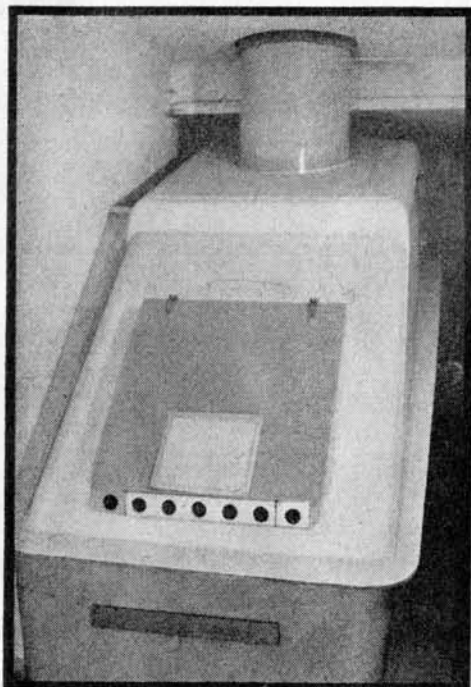
Haughley. They farmed for forty centuries by inventing the compost heap, and maintained the highest population for longest of any country by purely conservationist methods. Red China still farms on these principles, and, as far as can be discovered, a number of sewage plants rather like Melbourne's Warribee Delta scheme that uses the plant foods in the effluent, show that Chairman Mao is giving some thought to the tapeworm problem.

Tapeworms, hookworms, bilharzia, bacillary and amoebic dysentery, cholera and typhoid are the leading problems of conservationist sanitation, which the whole world used before Thomas Crapper, and we owe to the fear of tapeworms of all types the tremendous prejudice against the use of human excreta on the land. The Japanese market gardeners round Nairobi used raw human fertilizer and spread amoebic dysentery, and wherever "native" vegetables cannot be trusted, this is the usual reason. Water sanitation conquered the waterborne diseases in Europe and defeated the tapeworm, but without our fertilizer and food imports by now our soil would be in dire distress. Before we spread our destructive technique to still more countries, it is time we forgot our prejudices and considered the only ecologically sound sanitation system.

## The Clivus

This is the Clivus, named by Rikart Lindstrom, a Swedish engineer, who invented it in 1939, for the "declivity" or slope which is the ingeniously simple key to the process. It has been fully patented in all countries, but is not yet made under licence anywhere, though over a thousand have been installed in Norway and Sweden since 1964, with the full approval of the health authorities. The special value of the Clivus here is that no water is required, so there is nothing to freeze in winter, and it ends the problem of the cost of connecting ratepayers to a central sewage





The Clivus lavatory is a kind of one-family municipal compost plant.

system when this can involve blasting and drilling through five miles of solid rock. The old solution to this problem of weekend commuters' cottages was to send everything untreated into lakes, fjords, rivers, or the tideless Baltic which is now among the worst polluted seas. The new one is the Clivus.

It consists of a fibreglass compost container about ten feet long, three feet wide and fitting into five feet of height. In Sweden this goes under the house, with the garage, the log store, the central heating boiler and the family sauna bathroom. The builder allows space at the side to get round to the inspection window, and in front for the removal of approximately 1 cwt a year of high potash fertilizer for a family of three. So the Clivus needs a chamber approximately eight feet wide, six high and 14 long, which need not be underground, though the kitchen and lavatory must be above it, if it is inside the house.

The lavatory pedestal looks normal, except that it is wider at the bottom than the top so there is no risk of fouling the sides, and in the kitchen next door there is an opening in the sink unit, covered with a plastic bowl that tilts sideways to shoot the kitchen wastes into the compost box below. Between the two there is the ventilation shaft that in Sweden goes up beside the chimney to keep it warm, a plastic pipe with a snow and rain excluding cap. This produces a powerful draught that sucks in air through a row of holes along the front of the box, with a slid-

ing damper to control ventilation, and through fibre glass channels, like the brick rows under a good compost heap, for rapid bacterial breakdown. If the sink chute or lavatory pedestal are left uncovered, there is a strong down draught which prevents the escape of any odours.

When a Clivus is started, the owner must go right inside through the raised front flap, and spread a 4-5 inch layer of peat on the bottom, followed by two inches of garden soil (not clay or raw subsoil, for its function is to provide a starting stock of bacteria) and another two inches of lawn mowings, dead

	Rochdale nightsoil %	London sludge %	Clivus compost %	Dano compost %	Indore compost %	Farmyard manure %
Water	13.9	10.0	19.32	36.40	76.0	76.0
Nitrogen	6.74	3.0	2.13	1.13	0.50	0.64
Phosphorus	3.12	2.0	0.36	0.62	0.27	0.23
Potash	2.16	Trace	1.04	0.38	0.81	0.32
Organic matter	63.7	50.0	24.49	33.0	—	—
Ash	3.45	35.09	52.66	30.60	—	—

leaves, or garden rubbish normally composted. Then normal usage of the lavatory and dumping of kitchen waste down the chute can continue indefinitely, with the removal of finished fertilizer the only attention required.

The peat soaks up the urine and its ammonia filtering through the soil and rubbish layers will build up a vast population of de-nitrifying bacteria, especially *Nitrosomonas europaeus*, and species specializing in the breakdown of organic matter in the soil. The bacteria favoured are not the selection that produces up to 160°F in a good garden compost heap, but soil bacteria that can be killed at temperatures above 90°F so the damper should be used to keep down the heat.

### Energy from waste

The normal compostable kitchen wastes average about  $\frac{1}{2}$  lb. a head per day, including potato and vegetable peelings, fruit cores and peel, tea leaves, coffee grounds, fish bones, egg shells (but not crab or oyster), and about five per cent paper—exactly what any organic gardener puts in his compost bucket. Amazing though it may seem to those who have never made compost, there is energy food enough in the kitchen wastes, and the faecal matter (most good sewage treatment plants use this via the methane gas from the digestors to make their process self supporting in power) to convert all the liquid to water vapour and send it up the chimney with the gaseous nitrogen and carbon-dioxide from the decay process.

The end product is a dry, dark grey, odourless substance like a well made compost, with a quality that depends on how careful the owner was to keep out milk bottle tops, cooking foil, glass, plastics, bones, nylon and anything that would not rot in a garden compost heap. The slope of the Clivus keeps the contents draining and sliding down as its bulk constantly reduces by the bacterial action that operates this unique "deep litter system", and the finished compost builds up at the bottom in the final compartment. Some owners clear once a year, but keen gardeners fetch a bucketful whenever they need one.

The Rochdale Nightsoil was collected by cart and dried in the 1900's and is the only organic manure of this class to beat the Clivus compost on potash because it also contains the urine, but is no longer available. The London sludge is *Morganic*, from *Mogden*, one of the many first-class products that unfortunately contain only a trace of potash, like the Dano Municipal Composts from Edinburgh. All have the problem of transport to the gardener, but the Clivus is made where it is used, though a mere hundred-weight a year is far from enough for a keen gardener, and in the future research may reveal ways of increasing the output and stepping up the quality.

The sample analysed here contained 111 parts per million of lead, and figures from Eye in Suffolk where cess-pool pumpings are processed from an entirely rural area show 2 ppm, but 480 ppm when this is composted with dustbin refuse. The rise is from the milk bottle tops which are a lead-aluminium alloy (containing 115.9 ppm) like cooking and bottle stopper covering foil, for the acid decay releases some of the lead. The compost is as good as the material that goes into it, and as a high potash organic fertilizer in the seaweed meal class, the average Clivus user is producing about £6 worth a year as a by-product.

In Sweden the main problems are letting cottages by the lovely Baltic to summer visitors, who insist on pouring disinfectant down the lavatory, which can slow the process till the bacteria

catch up, or stop it completely, which means a complete clear out and refill. The fibreglass compost box needs no painting, there is no upkeep, and once a Clivus is started it appears to run indefinitely.

### Bath and washing water

A separate treatment is required for bath and washing water, and one is made by Messrs. Electrolux of Sweden, which produces drinkable water, for there is so relatively little to take out. The two together should cost no more than a septic tank for a single house, bringing down costs below the £400, the present price of a single Clivus delivered in Britain.

Messrs. Electrolux also make the Sanivac pneumatic sanitary system, which uses only a litre of water for each small, cleansing flush, before the contents of an ordinary looking lavatory pan go snorting and snarling on their way, with a 75 per cent saving of water compared with 100 per cent and no need for electric power to run the vacuum pump. This can be combined with a Clivus, so up to six lavatories can be connected to one large compost box, which must have a circulating pump to keep the 25 per cent of flushing water moving till the bacteria powered by extra compost material can send it up the chimney as water vapour. These large installations, used on holiday camps, have a separate building, and one of the staff has to empty the swill bins from a large chute, plus shredded paper for extra evaporation energy.

The strong approval for the Clivus by the Swedish Ministry of Health is not only because isolating the sanitation of every household banishes waterborne diseases, killing bacteria not by heat, as with a municipal compost plant, but by keeping them for up to a year under highly unfavourable conditions. They have the Continental fear of tapeworms which is at its strongest in Germany and Austria and even the heated digestion process used by most large authorities can fail to kill *Taenia saginata* (the beef tapeworm, carried in undercooked meat) eggs and cysts. The Clivus destroys these as effectively as it does all other human parasites. It seems that though eggs and cysts can survive 14 days at 90°F in a sludge digester, 365 or even 100 in a Clivus at this temperature kills them and composts the remains.



*Rikart Lindstrom, the inventor, puffs smoke to show the powerful downdraught.*

### Hidden advantages

Though this new system cannot compete on capital cost with the £45 a person for a treatment plant serving 250 people, or the £12 a head for the optimum size to fit half a million, it has a number of hidden advantages. First and foremost it cuts domestic water consumption by a third, and if the bath and washing water filter were connected to a tank with a pump to return it for reuse, it would reduce the remaining twenty gallons a day to perhaps the single gallon we use for cooking and drinking, for rainwater catchment could cover gardening and car washing.

If every citizen in a community of 250 is running his own Clivus, he has paid for his own sanitation with his house, and the Council is spared the interest on capital on the £12,000 for the plant. It is also saved the cost of laying the sewers, the upkeep and running costs of the whole system, including repairs, and, as fibreglass lasts indefinitely, the eventual cost of replacing the sewage works at the inflated prices certain in the future.

From the Swedish experience there is also a saving on refuse collection, because all the material that can breed flies and produce smells goes in the Clivus. The remainder which is plastics, tins, bottles, bones and paper, etc, can be collected once every three weeks instead of every week. An isolated community that turns over to the Clivus system, deserves a heavy reduction in rates, and an experimental Council

Estate could well be justified to find the savings, and any hidden disadvantages, there may be. It would also be possible to try out a block of flats with an existing rubbish chute system, and Sanivacs connected to a central Clivus controlled by the caretaker who would probably sell the compost locally, or it could be collected by the local authority as a far superior product to any municipal compost. There are now plastic recycling systems (see "Ecotechnics", April number) and the removal of kitchen wastes would make both these and paper salvage easier and cleaner.

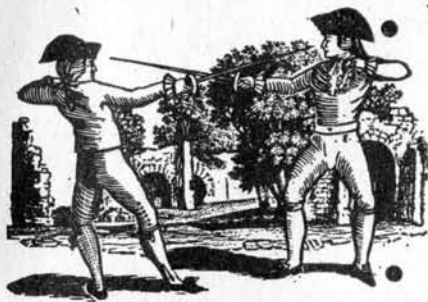
The Clivus may well be the most important invention of the present decade, just as composting city wastes was the most vital Chinese discovery before 500 B.C., for gunpowder, printing and bank notes were later contributions from this country of conservationists. It now needs research on its applications, especially in the field of waste water recycling which is a vastly cheaper prospect than desalination, or reservoirs and barrages to conserve more water in order to waste it.

At its present stage it is possible to contract your home out of the pollution race for the price of a new car. It needs only a few people with the courage to contract for tank space, pumps, filter and Clivus, to provide the data that Councils need before they experiment with the public money.

Further information about the Clivus is obtainable from Low Impact Technology Ltd., c/o Faull, Best and Knight, 16a St James's Street London SW1.



# Letters



## One dimensional ecology

Sir,

May I congratulate you on publishing, in the August issue, the "One-Dimensional Ecology" article by Ehrlich and Holdren. Hopefully, your bringing it to the attention of a much wider audience than would have read it in the *Bulletin of the Atomic Scientists* will have helped to dispel, not only the myths spread abroad in Commoner's book, *The Closing Circle*, but also the impression being forced on us by the "ecology backlash" lobby of *Nature* et al., that Ehrlich is a woolly thinking alarmist. It was in fact a masterpiece of analysis and warning as to how one can be fooled by the misuse of figures, and how issues concerning environment must be seen in their full complexity.

Unfortunately, your printer had a field day with Ehrlich's own figures and formulae, thus introducing not only some unwarranted complexities for the reader, but also some more spurious statistics! For the record these must be corrected. Unless I have been fooled too, the necessary amendments are as follows:

p. 14 line 3 should read: pollution =  
(population . (production/capita) .  
(pollution emission/production)  
(It would be helpful if either "." or  
"x" was used consistently as a multi-  
plication sign in the text.)

line 49 should read:

$$\Delta P, \Delta A \text{ and } \Delta T$$

column 2 line 46 should read:

$$1 + \frac{\Delta I}{I} = 1.42 \times 1.59 \times 1.33 = 3.00$$

column 3 line 31 should read:

$$1 + \frac{\Delta I}{I} = 5.00 = P \quad A \quad T$$

$$\quad \quad \quad \underbrace{1.42 \times 1.59}_{= 2.26} \times 2.22$$

p. 18 column 3 line 46 should read:

$$P \times A = 2.9, T = 2.4, (\text{for}) I = 2.9 \times 2.4 = 7.0$$

Finally, your printer denied us completely the all-important Table 3 which was referred to on p. 17; and indeed, there may be other slips, as I only checked out the more obvious and crucial calculations.

Yours sincerely,

Ian Vine.

## Atomic waste

Sir,

Reading your editorial in the August issue (*The Ecologist* Vol. 2 No. 8), I find one aspect of atomic waste disposal was not covered. That of the energy balance sheet for useful energy generated by the material in the atomic reactor, various energy expenditure to maintain the safety of the waste throughout its danger period.

In other words, does technology win or lose in the long run. The fact that surface storage requires continuous cooling perhaps for 25,000 years I suspect the energy balance would be negative. If the energy gained is greater than future generations have to pay to look after our waste then we are only guilty of depriving future generations of the consumed raw material, but, if we put an energy burden in excess of our gain on future generations, then we are guilty of stealing energy from the future.

This is all the more dastardly when we realise that said future generations may be hard put to it to meet their own energy needs without having to spend energy looking after our rubbish.

Perhaps you could commission an expert to do the necessary sums and report the results in *The Ecologist*.

Yours sincerely,

B. H. Beeston,  
38 Abbey Road,  
Bush Hill Park,  
Enfield,  
Middlesex.

## Education and Environment

Dear Sir,

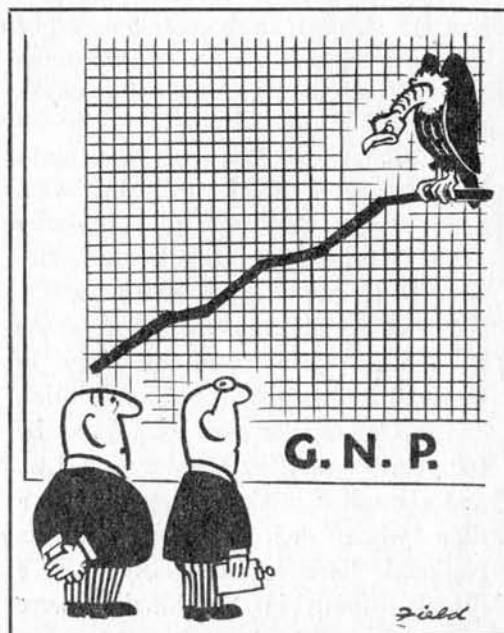
The article by Walter P. Fenwick (August 1972) mentions a GCE Advanced Level syllabus in Environmental Studies developed in Wiltshire. The Associated Examining Board has been involved in the development of this

syllabus over the last four years and your readers will be pleased to learn that the syllabus was approved earlier this year by both the Board and the Schools Council for trials in twelve schools in Wiltshire where examinations leading to certification at "A" Level will first be offered in 1974.

If I might add a comment on another section of the article, Mr. Fenwick apparently subscribes to the views upon GCE Boards expressed in the quotation in his penultimate paragraph, despite the fact that he notes earlier in his article how rapidly these Boards responded to the emerging need for particular new syllabuses. The Associated Examining Board takes great care to ensure that it offers syllabuses and examinations which meet the current needs of educational development and in some spheres leads rather than being "inevitably far behind" curriculum development. Course work assessment for example, which receives particular mention in the quotation, has formed part of the examining procedures in many subjects for several years now and teacher assessment of project and/or course work is allocated a substantial portion of the total marks available in all examinations offered by the Board in Environmental Studies.

Yours faithfully,

P. D. Neale,  
Senior Assistant Secretary,  
Associated Examination Board  
for the General Certificate of  
Education,  
Wellington House,  
Station Road, Aldershot, Hants.



# It's a bird It's a plane It's Zuckerman!

by Graham Searle

It would have been nice, would it not, to have been able to record in the style almost of an American comic, the way in which Zuckerman and Boy Longland swooped into the fray scattering all before them and saved British highlands and the countrymen who live in them from the attentions of the notorious Duncan mob? It would have been nice, would it not, to have reported the way in which that most modern of weapons, the Zuckerman Emmission had all of its debilitating force turned on the mining companies rather than being used to stifle for over a year the complaints of those who preferred to climb hills rather than to flatten them? But, like all dreams, this one too was to fade into nothingness in the cold light of day.

When the Zuckerman Commission on Mining and the Environment did report in September 1972 to an audience of Pressmen and mining company representatives (from which had been excluded conservation organisations — even those which gave evidence to the Commission), they were to prove right those amenity bodies (like CPRE) which refused from the outset to have anything to do with what they saw as a body designed to facilitate the destruction rather than the conservation of Britain's National Parks. The Commission proved ill-placed even the modicum of faith invested in them by organisations like FOE and the Ramblers who spent time, effort, and what little money they had in submitting evidence for consideration by the somewhat better-heeled Commissioners.

Let us recall, then, the origin of the Commission itself and the way in which it discharged its responsibilities.

The Commission was established by the Rio Tinto Zinc Corporation Ltd. and six other mining companies at a time when their activities in the National Parks (particularly RTZ's illegal drilling in Snowdonia) were

coming under fire. Radio, television, the Press and hundreds of local and national amenity bodies focused their attention on what to them appeared to constitute yet another, and perhaps the ultimate threat to Britain's vulnerable uplands. Such was the embarrassment caused by widespread public criticism that the mining consortia recognised the need to erect what proved to be a screen behind which they were able to conceal their intentions and with which they could confuse their critics. Not surprisingly, Land Use Consultants Ltd., who had advised on the screening of RTZ's Aluminium plant in Anglesey (and who have yet to come up with a tree big enough to hide the 400 ft smokestack) were called in to administer the Commission on Mining. Indeed Max Nicholson, Chairman of Land Use Consultants was one of the six commissioners appointed without consultation with the other interested parties by the mining companies themselves.

The terms of reference given to the Commission—and which later were to cause such consternation—were as follows:

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

Environmental groups took this brief to mean that the Commission was re-

quired (1) to investigate the ways in which environmental disruption caused by future mining might be minimised and (2) to examine the merits of conflicting demands made by different national policies as exemplified for instance by the government's financial assistance for mineral exploration programmes and the setting aside for the benefit of future generations of certain intensely beautiful but extensively mineralized areas of the United Kingdom. The public at large was led to expect the Commission to recommend either that fair-sized bits of our National Parks should be dug up, or that they should not be. The three Directors of RTZ who (to my knowledge) made public statements about what the Commission was called on to do, all made it clear that it was to tell them whether they should be allowed to mine in areas like Snowdonia. In the last year, all inquiries to representatives of that company about whether they were really going into the Parks met with the response: "We're waiting for the Zuckerman Report. The matter is *sub-judice*." But the Zuckerman Commission in its wordy report carefully avoided the crucial issue—whether to mine or not to mine. And its recommendations of any substance can be boiled down into the following:

- 1 That mining companies should not have to apply for planning permission before embarking upon the first stage of any drilling programme whether it be inside or outside Parks or other designated areas. The companies should inform the appropriate local authority but since permission will not be required, need not inform the public.
- 2 Later on, before the next lot of drilling, permission should be sought from the Minister responsible and at this stage the public will be informed that something's up.
- 3 There should be no pollution, noise,



road congestion, dirt or dust caused by mining. Control, particularly of poisoning by heavy metals like copper, was assumed to be possible. Indeed when tackled on this point, Sir Frederick Warner—a member of the Commission—went as far as saying “there is a possibility of a solution at the present time”. More detailed information was not forthcoming, and nowhere does the Report deal with the question of heavy metal poisoning.

- 4 Areas mined should be “rehabilitated” the cost being met from a Renewal Trust to which mining companies should contribute on a voluntary basis. Donations would not be taxed.
- 5 Finally, Recommendation (9) of the Commission reads: “Mining interests should, during the period when a mineral deposit is being evaluated, provide local inhabitants and environmental groups with information relevant to their concern and interests, subject to normal commercial practice.”

And that was what we had all waited a year for.

At the end of the Zuckerman Press Conference, Commissioners were asked in the spirit of free competition to award gold, silver and bronze medals to their top three Recommendations. Lord Zuckerman gave the gold to number 2 above; Sir Jack Longland gave silver to number 4; and Lord Arbuthnot awarded bronze to number 1. When the murmurs of approval died away, the audience was left with the feeling that really the one about telling local people what's going on, subject of course to “normal commercial practice” should have got the verdict. And anyone who has attempted to discover what, for instance, Rio Tinto Zinc are going to do to the farms and hills of Capel Hermon will have seen exactly what normal commercial practice entails. It includes trespass, refusal on the part of the trespasser to divulge his identity (and the identity of the company which sent him), and refusal on the part of the company to impart to local people what plans have been made for them. That recommendation really deserved a special medal.

As it was, when the Olympian presentation ceremony was conducted on 13 September, Britain was literally nowhere in sight.



## Friends of the Earth Newsletter

### Friends in need

FOE needs money, not to line its pockets but to fight its battles.

Friends of the Earth has a staff of eight, and Reserves of £600. For the past year we have lived and fought all our campaigns on less than £1,000 per month. We have taken on Schweppes, RTZ, furriers and supermarkets.

You know our campaigns.

And now we are broke.

We need money to help whales, big cats, crocs, Snowdonia and Refuse Disposal engineers.

We need money to help our local groups in their many local campaigns.

So if you have a pound or two (or more—or less) please send it to FOE, 9 Poland Street, London W1.

Sorry to have to ask.

*Angela King*

## The Institution of Environmental Sciences

The Aims of the Institution are:

- (a) To establish and control an Institution for all persons concerned with and interested in Environmental Sciences.
- (b) To act as a learned body for the purposes of consultation and co-ordination on matters of public and professional interest touching and concerning environmental sciences.
- (c) To promote disciplinary and in particular interdisciplinary studies of the environment.
- (d) To promote, organise and sponsor education and research in environmental sciences.
- (e) To promote nationally and internationally public interest, awareness and involvement in the problems of the world environment, the causes and effects of such problems, and possible solutions, and to liaise and co-operate with individual persons, national or international agencies, or statutory authorities for the purpose of achieving the said objects.
- (f) The said Institution may diffuse information on all matters relating to environmental sciences and may establish, print, publish, issue and circulate such papers, journals, magazines, books, periodicals and publications.
- (g) The said Institution is empowered to hold meetings, conferences and instructional courses as may be thought necessary or advisable to

further or attain the objects of the Institution.

- (h) To do all such other things as are incidental or conducive to the attainment of the objects as set forth in the preceding clauses, both nationally and internationally.

The annual membership fee is £5 (subject to review). Companies and Institutions may apply for **Collective Membership** of the Institution, fee £25 (p.a.) Only British subjects or companies may be considered. Enquiries to: The Institution of Environmental Sciences, 14 Princes Gate, Hyde Park, London SW7 1PU.

## Classified Adverts

**DO YOU REALISE** that animals deliberately bred in their millions compete with man for many scarce resources? Write for free information from the Vegan Society Dept. R, 47 Highlands Road, Leatherhead, Surrey, and learn how this unjustifiable exploitation can be avoided. (Stamp appreciated.)

**EFFECTIVE PARTICIPATION.** Self supporting person with phone and time needed to help organise Ring Ins for the Environment—a proven action technique with unlimited potential. McNeil, 12 The Ridgeway, Golders Green, N.W.11.

**WE ARE GOING** to cross the Atlantic Ocean in a seaworthy Inca-raft. Purpose. to learn more about the pollution of the sea. Voyage will last almost three months. Crew will live in very close relationship with the sea. Universities, scientists, institutes, factories, governments, what can we do for you? Can we do tests, take samples, collect waste, do survival tests or carry out experiments you may suggest? May 1973. Write to: Alfons Oerlemans Holleweg, 46, 2180 Kalmthout Belgium.

# How to fight a road

by The Conservation Society (South Yorks. Branch)

## Steps in the campaign

1 Form a Roads and Transportation Sub-Committee.

2 Write a letter to the Chief Executive of the Local Authority (usually the Town Clerk) requesting detailed information about future road proposals and general transport policy.

Ask for the existing modal split and what it is predicted to be in 15 years time. Insist on detailed information. You are entitled to it. Raise Cain if it is not forthcoming.

## How to raise Cain

Write to the following:

Local paper  
Department of the Environment  
Leader of Majority Party  
Local M.P.s.

Stress the need for public participation in planning and state how it is being frustrated by the local officials (Mention the Skeffington Report which advocated public participation).

3 Request permission to study the Town Map and ask for copies of local plans.

4 Write to the Chief Engineer and Planner, asking them to outline their philosophy for transportation. Try to interview them personally.

5 Ask for all future road proposals however tentative. This can often be done by making a surprise visit to the Department.

6 When you have obtained sufficient information, which should take about one month, prepare your own detailed analysis of the road proposals and the transport needs of the area. This should take the form of both criticism and constructive alternatives and an attempt to put the issue into wider context. (The document *People or Cars: The Choice Before Us* prepared for the Sheffield area is a useful model.)

While preparing this document begin at once a vigorous press campaign. This involves three main processes:

a Letters to the Editor from as many different people as possible.

b Select a spokesman to make direct statements to reporters in response to relevant news items; i.e. "Leading Conservationist Attacks New Road Proposals". This is done simply by 'phoning the newspaper offices and asking to speak to the reporter who was responsible for the story.

c Try to make direct contact with the municipal correspondent (or equivalent) and develop a personal relationship with him.

The aim of the press campaign in the first instance should be to raise the wider issues and alert the public to the dangers of current policies.

8 Contact other letter writers to the paper who express the right sentiments. Ask them to join your sub-committee. They need not join the Conservation Society. That usually comes later.

9 When you have prepared your policy statement, send it to all the Councillors and various officials. Also, M.P.s, D.o.E., and the local amenity groups. Hold a press conference and launch it with a splash. Bring in radio and television too. Always make sure that the politicians get the policy statement before this publicity. It is only courtesy to do so. Public relations is a vital part of the campaign.

10 Keep a constant eye on the Planning Register and the statutory notices in the local papers. Object on principle to all road improvements. Objections may take two forms:

a Detailed objections on local environmental grounds, i.e. noise, pollution, loss of housing, open space, etc.

b General objection to official policy for favouring private car over public transport. In cities and towns the commuter problem is the most fruitful source of attack, because this is usually the main reason for more roads.

11 Recruit people with professional expertise on to your committee, i.e. disaffected traffic engineers, etc. They are bound to turn up if you follow every

possible lead. It is surprising how often people who would not make the contact themselves become enthusiastic assistants when approached directly.

An ideal committee consists of:

a road engineer  
an economist  
a computer analyst  
a conflict sociologist  
a town planner  
an expert in public transport.

This is in addition to as many enthusiastic amateurs as possible. It has been possible to assemble just such a team in South Yorkshire.

## Political action

Britain is a democratic nation with a party political system. It is a system which works very effectively if people take the trouble to use it. It is a great mistake to ignore the ordinary political channels. Not only does this lead to alienation of the politicians but also closes many potentially valuable means of access to the corridors of power. Thus political action must take place on two fronts.

### a The traditional Party set-up

i Find a councillor who is sympathetic to your point of view and keep him supplied with ammunition.

ii Join the party of your choice, particularly if it is the one in power, and try to exert influence at grass-roots (ward) level. *The importance of this cannot be over-stressed.* In the end it is the politicians who will make the vital decisions and, contrary to widely held beliefs, the party machine is open to influence from below. As a member of the party you will find yourself recognised as an expert in the transport field and will be asked to address various bodies within the party structure. Debate can thus be initiated, and propaganda disseminated.

### b Local action groups

i Contact all existing groups and suggest co-operation.



- ii Make sure that an action group exists in every sensitive area.
- iii Try to get them to take more than a purely parochial view of the problem. The tendency to suggest alternative routes should be avoided at all costs.
- iv Suggest to the action groups that the Conservation Society should have an observer (technical adviser) on their committee.
- v Do not organise public meetings or petitions yourself. This is the job of the Local Action Group. Always make sure that you are represented however, and be ready to ask questions of officials, etc.

### Vital points

- vi Follow up every lead relentlessly. The apparently smallest thing—a letter of complaint to the paper—may have far-reaching consequences.
- vii USE THE LOCAL PRESS TO THE FULL.

### Public Enquiries

All this work carries the assumption that specific proposals will be fought at public enquiries. A document is in preparation laying down guidelines of this.

The lack of funds for the briefing of counsel should on no account deter appearance at a public enquiry. A member of the group is quite capable of being an effective advocate and cross-examiner of official witnesses.

### QUESTIONS CONCERNING THE PROPOSED ROAD DEVELOPMENT TO BE PUT TO THE ROAD ENGINEERS BEFORE PREPARATION OF THE CASE

#### 1. Management of the Scheme

- i What is the time schedule for the proposed development?
- ii When was it first planned?
- iii When was it modified?
- iv What were the reasons for these modifications?

#### 2. Rationale of the Scheme

- i What is the overall purpose of the Scheme?
- ii Which sections of the community will benefit from the scheme, and which sections will suffer?
- iii How soon after completion would the scheme itself become congested?
- iv On what figures is the need for the road based? When were these figures calculated? Give exact dates of original surveys etc.

### 3. Data on which Scheme might have been justified

- i What will be the estimated peak hour traffic flow in p.c.u.'s per hour?
- ii What is the analysis of point of origin and destination of this traffic?
- iii How much of this traffic will be existing traffic diverted from other roads?
- iv How much of this traffic will be accounted for by the predicted increase in traffic densities?
- v How many of the peak hour journeys originate from outside the city boundaries?
- vi How much of the traffic will result from a switch from public transport?
- vii On what modal split assumptions is this based?
- viii To what extent will the proposal lead to the need for additional parking in the central and industrial zones?
- ix How much increased capacity for city centre roads will be necessitated by the additional traffic that this scheme will generate?
- x What will the off-peak traffic flow be?

### 4. Questions concerning costs and benefits

- i Could we be provided with details of a cost benefit analysis of the proposal?  
Failing this:
- ii Could we have details of:
  - a the value of the property to be destroyed.
  - b an estimate of the compensation payable to those displaced.
  - c the number of people to be displaced.
  - d the number of hectares of land that will be used by the road.
  - e the burden on the rates of the capital cost of this scheme.
  - f the estimated cost of relocation of essential services (gas, electricity, etc.)
  - h the basic cost of the roadworks themselves.
  - i the loss of revenue of the Public Transport Undertaking that will occur because of changes in the modal split.
- iii What will be the width of the noise and pollution penumbra on either side of the new main road? How many people will live with 60 dba? With 70 dba? Average, peak hour, early morning (5–8 a.m.)?

- iv Will compensation be paid to those whose environment will be downgraded (other than c above)? What is the estimated amount?

### 5. Land use problems

- i How many people could have been housed in the area if the road was abandoned?
- ii What is the estimated loss to the rates of:
  - a Houses demolished
  - b Houses which could have been built
  - c Businesses destroyed?
- iii In the case of agricultural land—may we have an estimate of loss of crop production?

### 6. Consultation

- i Have local people been informed about the proposal?
- ii Have they been consulted?
- iii How much time elapsed before the proposal was first made officially and the public announcement?

## Coming events

**8-22 November**—At OSAC, Oxford Students' Arts Council, 5 Worcester Place (off Walton Street, above Ken Johnstone's Garage), Oxford. The exhibition **SLAVE OR DEAD** for a fortnight. Mon.-Sat. 10.0 a.m.-5.0 p.m., Sundays 2.30-6 p.m.

**20 November**—At Oxford Information Centre, St. Aldates, Oxford. Conservation Society. Oxford Branch: exhibition in which **SURVIVAL INTERNATIONAL** and others are taking part, for 3 weeks ending 9 December. Mon.-Sat. 9.0 a.m.-5.30 p.m.

**29 November**—Is non-growth socially and politically possible? Lecture by Edward Goldsmith, 8 p.m., lecture theatre A, School of Physics, University of St Andrews.

**11 December**—Royal Geographical Society, 1 Kensington Gore, S.W.7. 8.15 p.m. Lecture by Robin Hanbury-Tenison and Dr P. J. K. Burton **SHOULD THE DARIEN GAP BE CLOSED?**

**16 December**—At the Horniman Museum, London Road, Forest Hill, S.E.23., 3.30 p.m., **KINGDOM IN THE JUNGLE** and **SURVIVAL** lecture.

### THE ECOLOGIST IS MOVING . . .

The offices of the *Ecologist* are moving to Cornwall. From the 1st December all correspondence to the editorial, production and subscription departments as well as general enquiries should be addressed to The Ecologist, "Catesby", Molesworth Street, Wadebridge, Cornwall. Display and classified advertising should be sent to 69 Kew Green, Richmond, Surrey.

# SPECIAL OFFER TO ALL READERS OF THE Ecologist

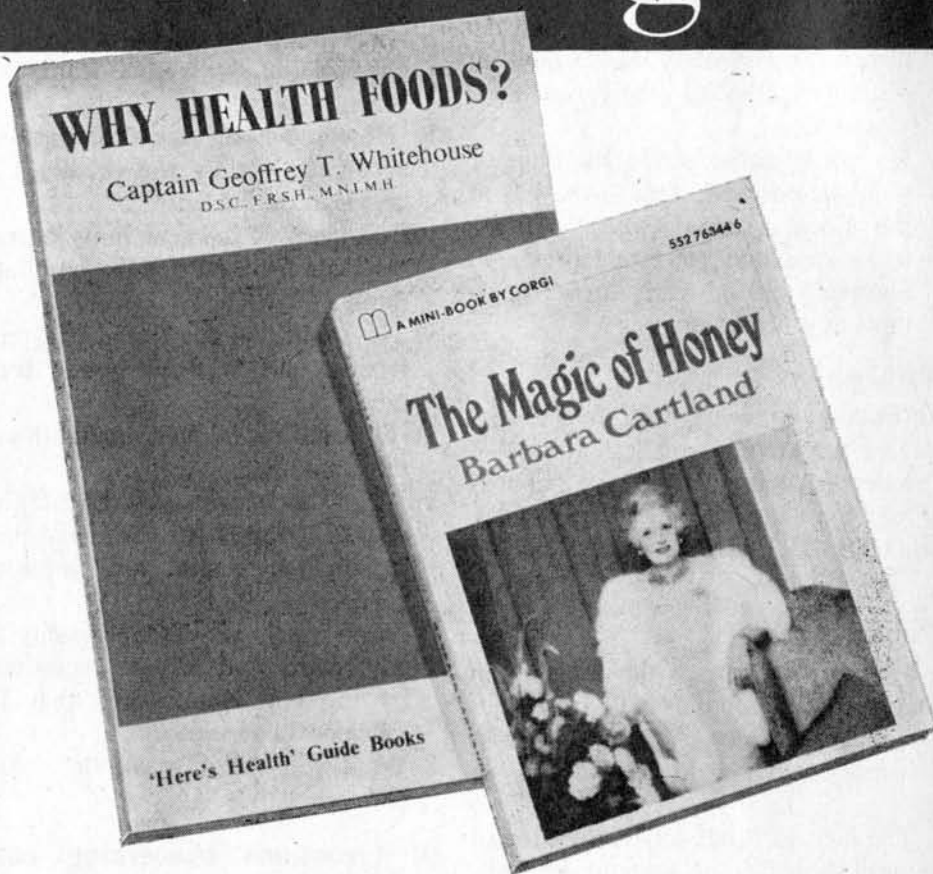
## FREE! TWO BOOKS

By those leading Health Experts Mrs Barbara Cartland and Captain Geoffrey Whitehouse

+

## FREE!

A BACK NUMBER OF "HERE'S HEALTH"



## PLUS

12 issues of "Here's Health", Europe's leading health journal, for only £1.97

Two superb books "Why Health Foods?" and "The Magic of Honey". Over 250 pages of constant source of reference for all the family. Free when you take advantage of this offer. All you have to do is take out a subscription to "Here's Health" and the books and back number will be yours **FREE!**

To:  
"Here's Health"  
(Dept. E)

Seymour House,  
79/81 High Street,  
GODALMING  
Surrey

(Please tick here) ☐ YES

I want to take advantage of your special offer and enclose £1.97 for a year's subscription to 'HERE'S HEALTH'

**ALSO**

rush entirely Free of charge, my two health books plus a back number of "Here's Health".

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_





## Prosecuting for noise abatement

As every environmentalist knows, the problem of noise is one of the important social problems of our time. From the pneumatic drill through the automobile exhaust to factory noises, the decibel count affects us all.

A recent case has given a pointer to any local authority or private person instituting a prosecution for non-compliance with a notice requiring abatement of a certain noise. The facts concerned a notice issued to the appellants (Northern Ireland Trailers Ltd) to abate a statutory nuisance caused by excessive noise from their site. The respondent corporation brought an action in the Preston magistrates' court and secured a "nuisance order" ordering the appellants to abate this noise.

The technical points for any potential prosecutor to remember are the ones

made by the Divisional Court on appeal by Northern Ireland Trailers Ltd. The appeal was on two grounds:

(i) that the nuisance order (under s.94 Public Health Act 1936) could only be made by way of complaint and not by way of information. On this ground it was found that the proper course to take despite the literal wording of s.94, which speaks of the hearing of a complaint, is to lay an information against any potential defendant. In other words such a procedure will be a criminal one and the penalty will be a fine, although the court only went as far as to say that failure to comply with a noise abatement notice is "an offence for present purposes." The net result, however, is that any potential prosecutor must lay an information in

the criminal style.

(ii) that the relevant date for assessing the nuisance value of the noise was at the time of the appeal. This point was also dismissed by the court. Anyone who appeals against a nuisance order made on the grounds of excessive noise would do well henceforth to note that the relevant time for assessing the nuisance value of the noise is at the time of the original magistrates' court hearing. This will be so even if the appeal goes first to a Crown Court and subsequently to the Divisional Court.

By their judgements in this case the Divisional Court have interpreted the relevant statutes in favour of the noise abater. Luckily, it seems, therefore, that the courts will not seek to remove the effectiveness of such acts as the Public Order Act 1936 and the Noise Abatement Act 1960 by opening technical loopholes.

## Towards a stable Metropolis

The Greater London Development Plan Inquiry is now over after nearly two years. The largest and most comprehensive Inquiry of its kind is complete and London must await the report of Mr Frank Layfield, Q.C. and his Panel, and the eventual decisions of the Secretary of State for the Environment. But can the subject ever be closed? Has all that should have been said, really been said?

There could be no more damning condemnation of the London Plan, or any other, than to say in ten or twenty years' time there must be another one. In this new Plan there will be the following words:

"No aspect of the environment so concerns the people of London as its streets. They think that they are not only too dirty, they think that they are too dangerous. Many will not walk out after nightfall: reports of assaults are a key topic of neighbourhood talk, and there is a widespread belief that the situation is getting worse. Whether or not this fear is exaggerated, it is itself a reality and is one of the chief obstacles to a decent sense of community.

Obviously, more police on the streets is a first order of business. London is making a major effort to

deploy more police and to deploy them more efficiently.

But such methods will not be enough to combat crime. London's programme must get to the roots of it, and these roots lie deep. Crime is a product of the way housing is programmed, of the way schools are run, of the jobs that are denied . . ."

This extract is from the New York Plan (Vol. 1. Critical Issues). Only the place name has been altered to London.

Fear, in the context of the above, is perhaps the most effective catalyst in the process of social disintegration. There are definite warning signals in comparisons between the escalating crime figures in the United Kingdom and those of American cities.

In England and Wales, 1969/70, 23,445 persons were found guilty of violence against the person. In New York alone, in 1967, there were 31,040 convictions for these offences. The population of New York and London approximate. Although crime in London does not resemble the proportions of New York, our crime rate has risen by a steady average of  $6\frac{1}{2}$  per cent every year for four years. There appears to be neither a way nor a plan to halt this increase. London is respon-

sible for one-third of the crime in the United Kingdom with a population of less than one-fifth of the total. How much longer will this be tolerated? Will we see a virtual breakdown of our Metropolitan Society, as we know it today, and as is evidenced in some American cities?

London has 23,000 police to maintain law and order. The ratio of police to population is comparable with any other city in the British Isles. In Paris, the police number 54,000 in a city of five million, and Paris is not as law-abiding as London. It has been suggested the strength of the Metropolitan Police Force might have to be raised to the level of the Paris Police to contain crime at even the present undesirable level. The increased cost to the ratepayer would be no less than £70 million per annum.

London's planners, like others elsewhere, ignore this problem and make no mention of it in their plans, as though it did not exist. The GLC gaily licenses betting shops, gaming clubs, strip shows and clip joints. Some may think this an odd way to care for the Londoner's moral welfare and promote for him a healthy Metropolitan environment.

The incidence of woundings, assaults with intent to rob, etc. is five times higher in the Inner London Boroughs

than in the Outer ones. In these central and traditional housing areas, conditions of high population density, multi-occupancy, overcrowding and bad housing are at their worst. It is, nevertheless, difficult to isolate any one of these conditions as a direct cause of crime. It is here, where all these are present, that crime abounds. Development Plans are needed, which attack the social injustice of all these constituent elements vigorously. This might well prove a better solution than doubling the size of our urban police forces.

The anti-motorway and environment lobbies, the Homes Before Roads movement, etc. are accused of adopting purely obstructionist attitudes to present urban planning methods. They say the London Plan, like so many others, contains no certain priorities for urgent urban renewal or necessary investment in housing and public transport. It con-

tains only priority for urban motorways. There are no analyses of the present nor prognostications of the future Metropolitan Society. It is consideration of these matters that the opposition lobby would like to see.

Apart from a lack of cohesion by which new communities might evolve, there seems to have been little critical study as to the nature of the environment in which a stable society can persist or develop. Too often we think of environment in terms of concrete pots with geraniums, grass, trees, and Georgian houses. Environment has a sociological connotation, which is all too often forgotten. A stable society can survive only in an environment with which each member of the community can identify and within which he can develop his individual personality. The natural prerequisite is a social environment from which stress and

fear, largely the result of crime, are eliminated.

The tragedy of most plans is that they do not propose necessary conditions in which new communities can germinate. Instead they contain the planning parameters for the destruction of existing communities.

First, we must set aside the more obvious technical arguments that urban motorways may or may not solve traffic problems, or create other problems for existing communities.

Second, surely we must consider the inevitable sociological consequences of Development Plans which do not pretend to cure any of the malaise in our Metropolitan life. This becomes the more urgent since some of these plans may yet do it further irreparable damage, such as may be witnessed in cities throughout the United States.

*Derrick Beecham*

## Breast-fed babies are healthier

Though they must put up with raised eyebrows, embarrassed glances, and being hustled out of restaurants if they do it in public, women who want to breast-feed should carry on breast-feeding. For science is at last well and truly on their side.

The latest facts show that not only is there no complete substitute for human milk, but that bottle-fed infants are much more likely to succumb to disease both in early life and years later. A strong plea for breast-feeding comes from Professor Derrick Jelliffe, director of the Caribbean Food and Nutrition Institute at Kingston, Jamaica, who together with the Joint FAO/WHO Expert Committee on Nutrition, deplores the universal trend towards early weaning.

"Despite the many modifications introduced," he says in the *WHO Chronicle* (December 1971), "cow's milk formulas remain imperfect imitations of human milk and cannot be considered as complete substitutes."

It does seem that when you compare them with human milk, bottle-feed-substitutes come off rather badly. Bottle-fed infants are more likely to have low levels of calcium in the blood, trouble with their kidneys, diarrhoea, and undernourishment, as well as suffering a variety of infections. There is also increasing evidence that people

who have been bottle-fed as infants are more likely to succumb to heart disease later in life.

A surprising fact is that poorly nourished mothers usually lactate extraordinarily well. Indeed they produce milk of normal protein content and in sufficient quantities, says Dr Jelliffe, "to ensure growth in the exclusively breast-fed infant for four to six months." Nevertheless he admits that women in poorer communities need to be well fed in pregnancy and lactation, "both to prevent cumulative maternal depletion and because the levels of vitamins in the milk and the mother's ability to sustain her output depend on her nutritional reserves."

Human milk is probably not sterile when the baby suckles, and that includes colostrum, a highly proteinaceous milk that flows for the first 48 hours or so after the infant's birth. Tests done on breast milk from Guatemalan Indian women indicate that it contains bacteria from the skin as well as bacteria normally found inside the body. But human milk has now been shown to contain substances which prevent harmful bacteria growing. It contains lysozymes which break down the cellular structure of bacteria, and also immunoglobulins, giant protein molecules that mop up and effectively neutralize infective agents. Colostrum

has been found to contain large white cells called macrophages which ingest bacteria and other foreign bodies.

"The inherent anti-infective properties of human milk are probably responsible for protection against enteric infection leading to diarrhoea," says Professor Jelliffe. He points out that diarrhoea in newborn babies who are being bottle-fed is often treated by giving them human milk. But human milk also seems to protect infants from other important diseases, such as respiratory infections, from septicaemia caused by staphylococcus, and from polio virus.

Because of its nutritional value and its protective properties breast-feeding is particularly important in impoverished communities where education is lacking and hygiene non-existent, the WHO expert says. But women should also breast-feed in developed nations, for there has been ample evidence that bottle-fed babies are more likely to develop diarrhoea and to die from disease than are breast-fed babies. "Indeed," Professor Jelliffe says, "there is evidence that infantile diarrhoea may be more common in some industrialized countries than is generally realized."

Breast-feeding has obvious advantages: it is cheaper, it has a proven contraceptive effect during the first few months after delivery, and it might help



the mother to stay slim. But in spite of these arguments, Professor Jelliffe points out, the trend in the industrialized nations and the developing countries is towards bottle-feeding. In fact many regard breast-feeding, he says, "as unrealistic, unnecessary, faddist, and out of touch with scientific trends and technical developments. That this is not the case becomes evident as new biochemical, anti-infective, and other advantages of human milk continue to be brought to light by modern research."

But what about the claim that bottle-fed infants are more likely to succumb to heart disease later in life? Some of the evidence comes from studies of young United States marines killed in action in the Vietnam war, and of young motor cycle victims. The finding is that many young men, when looked at by the pathologist, already showed signs of "hardening of the arteries", or arteriosclerotic disease. Tracing back the early history of those young men, to the time when they were still infants, shows that nearly all those with evidence of degeneration in the arteries had been bottle-fed right from the start. In striking contrast, the arteries of those who had been breast-fed were remarkably free of arterial degeneration.

Dr D. F. Davies of the Department of Pathology, the West Wales Hospital, Carmarthen, has worked out a highly plausible mechanism for the development of arteriosclerotic disease in

bottle-fed infants (see *World Medicine*, January 5, page 36). The process starts simply enough, he says, and depends on the fact that the intestine of the young infant is much leakier to food taken into it than the intestine of the older child or adult. Some of the protein contained in the substitute cow's milk gets through the intestine wall in the bottle-fed newborn baby and into the blood circulation. Once in the circulation the foreign protein stimulates an immunological reaction against it and antibodies are formed.

How much antibody is produced depends first and foremost on individual sensitivity, but it also depends on the kind of preparation given. Heat-dried cow's milk protein gives the strongest stimulus to antibody production, and unheated, unprocessed cow's milk gives the least. Most important of all, says Dr Davies, breast-feeding somehow protects the infant, and should the mother resort to bottle-feeding at a later date, the cow's milk proves less of an antigenic stimulus than if ingested right from birth.

The first clue to the proposed mechanism came three years ago when Dr Davies and his colleagues discovered an immunoglobulin in patients with coronary heart disease. This immunoglobulin, Dr Davies suggests in the *American Heart Journal* (1971, 81, 289) is composed of antibodies which have been produced in response to such dietary proteins as cow's milk.

Once formed, the immunoglobulin

tends to stick to the red blood cells and to blood platelets. The result is that the red blood cells and the platelets aggregate and form a clot. In time the clots become bigger and other substances such as fat also tend to clump in the arteries. The arteries thus gradually become "furred up" and degenerate, including the coronary arteries which keep the heart supplied with oxygenated blood.

But as with all disease processes, different people have different sensitivities. Sensitivity to cow's milk may be inherited, Dr Davies suggests. He has studied one family with a very high incidence of coronary heart disease, and discovered that all six members examined so far have a milk antibody level some eight times what he considers normal.

Coronary heart disease is now such a serious problem that any method of reducing its toll must be considered, says Dr Davies. He has suggested screening individuals for milk antibody levels in the blood. People with abnormal sensitivity could then be advised to drink something else. But might it be better to tackle the disease-process at a much earlier stage? Through being breast-fed even those with abnormal sensitivities to cow's milk will probably be able to consume as much in later life as they want. And that way they can be sure of being well nourished and protected from disease during their infancy.

Peter Bunyard

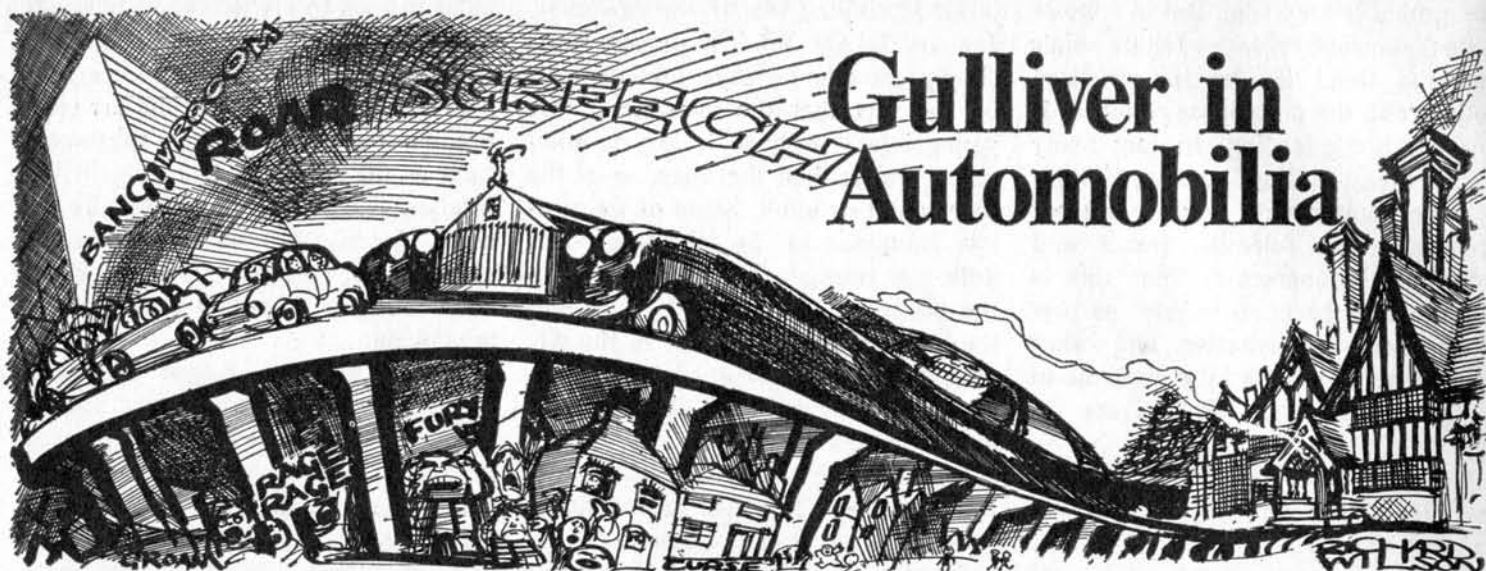
## ORGANIC FARMING COURSE

Following on the successful one-week course entitled 'A BIOLOGICAL APPROACH TO SOIL HUSBANDRY' held at Ewell Technical College in July this year, THE SOIL ASSOCIATION in conjunction with Ewell Technical College intends to hold a further two one-week courses in 1973. The first will be held from APRIL 9th-13th 1973, and the second during the middle of July 1973.

It is hoped to cover the PRINCIPLES, VARIETIES OF PRACTICE CONSISTENT WITH PRINCIPLES; AND ECONOMIC FACTORS of this method of husbandry. The course will take the form of lectures, discussions, and a visit to an organic farm and/or market garden.

Further information will be sent to those who have expressed interest by writing to:

**HEAD OF DEPARTMENT, DEPARTMENT OF BIOLOGICAL SCIENCES,  
Ewell County Technical College, Reigate Road, Ewell, Surrey.  
Telephone: 01-394 1730/9**



# Gulliver in Automobilia

## The author discovereth the evil consequences of an unsettled state of society

When first I came to Automobilia, I was by nothing more surprised than by the Expense and Effort the People bestow on shifting their Persons and their Chattels from Place to Place. This is indeed a Custom so characteristick of them, that the very Name of their Nation is deriv'd from the self-moving or horseless Carriages they employ, which are to them as his Camel to the Arab, or his Steed to the Tartar. Indeed, the Automobilians bear no little Resemblance to those barbarous and nomadick Peoples: and a great Part of the Ills which afflict them derives from their inconstant and errattick Mode of Life, for the Arts of Civilisation cannot flourish where Men have no fixed Place of Habitation.

I have mentioned elsewhere the Straits to which they are reduced by their Determination to dwell many Miles distant from their Place of Work. I met some, indeed, who each Morning would journey twenty Leagues or more, and as many back again of an Evening; and yet they were so far from bemoaning these interminable Peregrinations, as to hold them a signal Proof of their high Station in Society. For in Automobilia the more a man wastes, whether of Money, Goods or Time, the more he is esteem'd. But in addition to their daily Oscillations, they are wont many Times to alter their Place of Residence: it is a rare Thing with them and accounted most noteworthy, should a Man die in the District, still more the House, wherein he spent his Childhood: such a happy Fate being here the Prerogative of those who have escaped worldly Preferment and lived in humble Obscu-

rity. These Persons are often berated by Politicians as Traitors to the most cherished Ideals of their Fatherland, and Subverters of its Oeconomy, which chiefly dependeth upon the *Mobility of Labour* (by which they mean the Homelessness of Labouring Men).

The happiest Man, I doubt not, is he who standeth set fast as an Oak in his own native Soil: the Automobilians, by contrast, are like the drifting Wrack of the Ocean, that nowhere takes Root. It is not to be thought that a People so unsettled will care overmuch for their ephemeral Seats: rather, like Gypsies, they cheerfully foul their successive Encampments in the Knowledge that they will not long dwell amid the Squalor which they have created. The Citizen, lacking a native Pride in his City, sees with Indifference her Beauties ravished and the Temples of Mammon erected in her holy Places; old Customs perish in Obscurity (unless perchance the dry Bones thereof be trickt out, for Profit, with some Semblance of Life), Varieties of Dialect are eradicated like so many Heresies, Neighbours live in mutual Ignorance and Dissociation. The Husbandman exhausts for immediate Gain the Fields he knows his Son will never till; the Landowner plants no Trees, for, if he did, *his* Children would never enjoy their Shade.

Exile is among us a Penalty reserv'd for the most incorrigible Lawbreakers (those deserving of Death alone excepted): for to exile a Man is to deprive him of the Society of all those most dear to him. But the Automobilians suffer such Pains by free Choice, and few can boast that all their Acquaintance dwell within a single County, still less a single Parish. Therefore, having scattered their Families and Friends

throughout the Kingdom, they must needs waste their Substance and their vacant Hours in journeying to renew those Bonds of Affection which Distance hath weakened. I had it many times seriously put to me, what great Benefits were conferred by their mechanical Carriages, seeing that thereby Friends far sunder'd might be reunited; my Interlocutors failing altogether to observe, that without such unnatural Facility of Migration these Friends would in all Probability never have been parted in the first Place.

One of their Sages in former Times observed that "to travel hopefully is a better Thing than to arrive", an apt Motto enough for so restless a Folk. And indeed, in Automobilia a Man must be hopeful to travel at all, seeing that his Arrival seldom affords such Pleasure as would justify the Pains of achieving it. For the Satisfaction we derive from Travel principally resides in the Opportunities it gives us to view the diverse Manners and Customs of Mankind, the surviving Productions of past Ages, and the Variety with which Nature hath adorned the Face of the Earth. But in Automobilia, Manners are everywhere alike, while the Relicks of the Past and the Ornaments of Nature are held so cheap that any Man may destroy them for present Gain. It is therefore vain for the Inhabitants to try to flee from the Squalor and Wretchedness which surround them; for the Contagion spreads as fast as they strive to outrun it. They will never find Contentment until they learn to make their Promised Land at Home, not seek it forever abroad; for a Man doth not escape his own Stink by running, but by *washing*.

Nicholas Gould



# Towards a unified science

## Vital Force

The Jivaro Indians of Ecuador are (or were) notorious headhunters. They are responsible for the shrunken heads imitations of which are for sale in all the souvenir shops of Quito and Guayaquil. Heads are not hunted just for the fun of it, but because of the power or vital force their possession confers on the possessor. The Jivaro have two souls, the Aroutam and the Muisak, and it is only by headhunting that one can renew the former which appears to be the most important since it confers upon one invulnerability in war.<sup>1</sup>

*This notion that power can be acquired or lost, increased or decreased, in accordance with a set of carefully formulated cultural rules, appears to be common to most cultures. Among the Polynesians it is referred to as mana, among the African tribes it appears to go under a variety of names: muntu among the Baluba, nyama among the Dogon, etc. Placide Tempels writes in his study of Bantu philosophy:*<sup>2</sup>

"The central theme of Bantu philosophy is that of a vital force: the object of all efforts among the Bantu can only be to intensify this vital force. To maintain and to increase it is the key, the profound meaning of all their customs. . . . It is the only thing for which they are ready to suffer and make sacrifices."

All illnesses, depressions, failures in any field of activity, are taken as a reduction in this vital force. The only way to avoid them is to increase one's stock of it. When a Baluba prays, it is to obtain from the ancestral spirits or other deities an increase in *muntu*. The rituals he performs are designed to increase this vital force. Those performed at birth, circumcision, marriage, etc., involve such important increases that, on each occasion, new names are acquired, corresponding to the type of *muntu* thereby obtained. Each time, the old name must no longer be pro-

nounced, for fear of reducing his *muntu*. Taboos are observed for the same reason, as their transgression always involves a reduction of *muntu*, to an extent proportional to their importance.

Schebesta points to the same notion among the Pygmies of the Ituri forests:

"The Pygmies believe in that impersonal force which specialists call *mana*, but which they refer to as *megbe*. *Megbe* is to be found everywhere but it doesn't make itself felt everywhere in the same intensity or in the same way. Certain animals are richly endowed with it: humans possess a considerable amount of some types of *megbe*, less of others. Able men are distinguished precisely by the amount of *megbe* that they have succeeded in accumulating; witch doctors also possess a lot of *megbe*."<sup>3</sup>

A similar notion of vital force is reported by Monteil among the Bambara of the Mali Republic.<sup>4</sup> Griaule and Dieterlen report a similar concept among the Dogons.<sup>5</sup> Driberg considers that this notion of a universal power or energy is at the basis of the religious beliefs and philosophy of the Africans in general. He writes:

"This spiritual force consists of an abstract power or natural potency, all-pervasive and definitely never regarded anthropomorphically."<sup>6</sup>

He complains that the tribal term used to designate this force has often been confounded with the notion of a high god:

"In point of fact, the 'high god' does not exist in Africa."

Kardiner explains the behaviour pattern of the Comanche Indians in the same way. They appear to have . . .

"the most ingenious concept of power which can be borrowed, lent, pooled, and freely dispersed among the entire group."<sup>7</sup>

They regard all the constituents of the environment as possessing some sort of power. The greatest is personified by the eagle, the earth, the sky and the sun. The highest force is God. After him come the first fathers who founded various clans, and next comes the head of the tribe; the living who also form a hierarchy in accordance with their vital power. Animals, plants and minerals are organised in the same way. However, since their role is to satisfy the need of the humans, they have less vital power. Sorcerers and witches are considered to be capable of manipulating vital power in people and objects, to the detriment and death of their fellows.

The possession of power was double-edged, in the sense that its possession subjected one to corresponding taboos, whose violation automatically reduced the power involved. It appears that all Comanche ritual could be explained in terms of obtaining, getting rid of, increasing or reducing all these different powers. Thus a specific ritual permitted middle-aged men to get rid of warrior powers in order to free themselves from corresponding taboos, which were growing increasingly irksome. Other rituals, such as the sun-ceremony, had the object of obtaining specific powers from the medicine-man in charge.

*In the case of both the African and the Amerindian cultures referred to, belief in this vital force, or power, provided them with a complete goal-structure, in terms of which their entire social behaviour pattern could be interpreted.*

Since a society's goal-structure can only be culturally determined, it is probable that the notion of a "vital-force" or one fulfilling a similar function must be a feature of the worldview of stable societies in general.

Edward Goldsmith

## References

1. Harner, M. J. *Jivaro Souls* in *American Anthropologist* Vol. 64, No. 2 April 1966, pp. 262-264.
2. Placide Tempels, R. P. *La Philosophie Bantoue* p. 114.
3. Schebesta, Paul, *Les Pygmées*.
4. Monteil, C. *Djenne*, p. 135. Quoted by Edwin W. Smith, *African Ideas of God*, p. 19.
5. Dieterlen, G. *Les Ames des Dogon*, p. 73 ff. 246 ff. Quoted by Smith, *ibid.* p. 20.
6. Driberg, J. H. "The Secular Aspect of Ancestor Worship in Africa" in *Supplement to the Journal of the Royal African Society*, Jan. 1936, Vol. XXXV, No. 138. Quoted by Smith, *ibid.* p. 21.
7. Kardiner, *The Psychological Frontiers of Society*, Columbia U.P., pp. 63-7.

# Feedback

## **1 Plankton declines**

Plankton surveys by the Institute for Marine Environmental Research involving computer analyses of data from thousands of samples picked up by towing recorders behind ships have shown a marked decline in plankton abundance over wide areas of the Atlantic. Anxiety is being expressed about the future of fish stocks, and the US Marine Fisheries Service has offered support for the survey, currently funded by the Natural Environment Research Council and the National Institute for Oceanography. *The Times*, 13.10.72.

## **2 Bombing for beauty**

When we started the *Ecologist* we knew that however radical we thought we were, eventually we would be regarded by environmentalists as fuddy-duddy reactionaries. This looks like occurring sooner than we thought: an Italian anti-pollution organisation calling itself "group for the Defence of National Nature" has claimed responsibility for bomb explosions in Lecco and Bergamo. The group left notes stating: "United with all those who want to solve the problem of pollution, we are opening our campaign. We no longer believe in words. We want deeds". *Guardian*, 13.10.72.

## **3 The Foulness Monster**

Mr Eldon Griffiths is still defending London's fourth (sorry, third) airport at Foulness (sorry, Maplin Sands) as "the world's first environmental airport", which suggests that the phrase is rich in public relations value and will crop up in other contexts. Look out then for an open-cast copper mine in Snowdonia, "the world's first environmental mine", and for firsts in "environmental" motorways, "environmental" nuclear power stations, and "environmental" clap-trap.

Mr Griffiths told the Essex branch of the Council for the Protection of Rural England that suggestions that motorway links with

the proposed new airport would destroy thousands of houses were "utter moonshine". He promised the fullest public debate on access routes and on the siting of the "airport city". *The Times*, 13.10.72, and editorial astonishment.

## **4 A planner for people**

The planners are coming round. Manchester's city planning officer, Mr John Millar, recently gave his presidential address to the Royal Town Planning Institute, and criticised the proposed value added tax (VAT): "In a situation of potential surplus labour displaced by mechanisation, I wonder if we are right to go on with the introduction of a taxation system related to the value added by human effort", he said.

"Should we instead of thinking of some way of emphasising economy in the use of basic raw materials to encourage the salvage of waste and the production of higher quality long-lived articles with a greater workmanship content?"

Mr Millar went on to say that "we are failing to provide for the good life, as evidenced by continuing social deprivation, loneliness and the increase in vandalism and anti-social behaviour."

"The discontent that sometimes surfaces in terms of criticism of planning is often, in my view, just the tip of an iceberg that represents an increasing human uneasiness with many of the values of present society; it is a reaction against the uncritical worship of technology, the dehumanisation of man in the interests of keeping machines fully occupied, and against production, consumption and economic expansion for its own sake."

He added that this problem will grow "unless the aim of continuous expansion is tempered by constantly reviewing its relevance to basic human needs and satisfaction, while sooner or later account will have to be taken of regional imbalance." *Guardian* and *The Times*, both 10.12.72.

## **5 Hedge removal grants go**

The Ministry of Agriculture has now dropped the grant for hedge removal from lowland farms. Grants for sheep

and cattle grids, fencing, land clearance and reclamation, ploughing, destruction of cover for rabbits, and claying and marling also go. Unfortunately, this clean sweep has proved so heady an experience for the Ministry that it has also got rid of the grant for shelter belts.

Next year is the Department of the Environment's Tree Planting Year. It is going to have a tough time persuading farmers to join in.

*CPRE Bulletin*, 7 (3/4).

## **6 Don't talk rubbish**

Secretary of State for the Environment Peter Walker told exhibitors at London's international packaging exhibition that he needed magistrates who would be "the Judge Jeffreys of the litter world" to impose fines of £100 on people causing litter.

Mr John Briggs, president of the Institute of Packaging, said that waste disposal was the chief difficulty in pollution and that this was "surely the problem of the local authorities . . . Money must be invested by the local authorities in order that all packages can be disposed of without pollution".

It seems to have occurred to neither gentleman that a more efficient way of preventing litter and reducing package pollution would be to have less packaging (much of which is unnecessary) in the first place.

No doubt Mr Briggs thinks suggestions like that will stop progress. "The standard of living within a country", he said, "can be fairly well judged by the expenditure per head on packaging." *The Times*, 10.10.72, and editorial comment.

Feedback will be back to three pages from next month.

## **Mr. John Maddox**

In the August issue of the *Ecologist* on the contents page, the following words appeared:—"Public Relations John Maddox". It has been pointed out that these words indicate that he is an employee of the *Ecologist* and has responsibility for its promotion. We wish to make it plain that this is not so. Mr. Maddox is, of course, the Editor of the well-known journal *Nature*, and has no connection whatsoever with the *Ecologist*. We express our sincere apologies to Mr. Maddox if we have given any other impression.



# Books



## Made to measure

**FIGURING OUT SOCIETY** by Ronald Meek, a Fontana book, 45p.

Written, as the author avows "by a mathematical simpleton, for mathematical simpletons", this book offers a working and critical knowledge for an area all too often hopelessly opaque.

As the *Blueprint for Survival* testifies, the environmentalist argument is inevitably tied up with the numbers game. We need our writers of fine polemic prose, but we need equally to have a feel for figures, and to be alert to the numerical slight of hand which (as with RTZ's Anglesey smelter) may be among the weapons levelled against us. So Meek's book renders good service in showing us the easy way round that mental block, erected at or before O-level, which says "I've no head for figures".

The fear of falling foul of a correlation coefficient or being laid low by a passing linear programme is something akin to a new higher form of illiteracy; it affects many of us in differing degrees as the body of social science, from anthropology to politics, moves, often with good effect, towards the use of quantitative methods. There is no doubting that numbers are turning up in some unexpected places these days; terms like "optimisation" and "expected payoff", once confined to business schools, now occur in sociology texts. Meek's forte lies in leading the lay reader gently, amusingly, into an understanding of our current use (and occasional abuse) of quantitative investigation. He has made social statistics manageable.

The book is not a catalogue or dictionary, but a careful sequence of topics, building up one on another, from the problems of fair sampling (the chapter headed "Are Students Revolting?"), via play-with-the-author

strategy games as an introduction to a model of the Cold War, no less, and on to the cons and pros of Cost-Benefit Analysis. Based upon a successful series of lectures to first-year social science students at Leicester University, where the author is head of the Economics Department, one can well see how such an imaginative effort, replete with anecdote and rhyme, footnote and fable, might become almost an institution.

I especially appreciated the use made of italics in the body of the text which serve almost as a new form of punctuation, so that one can all but hear Professor Meek lecturing. The illustrations are finely drawn, both the typographical diagrams and the choice stories and yarns. There is the one about the man who "proved" that milk was the cause of cancer; the one about the perfect correlation between the salaries of Methodist ministers in Massachusetts and the price of rum in Havana; and to warm the heart of every anthropologist is retold the Strange Case of the Jamaican Fishermen, who appear to have an intuitive understanding of Game Theory—the book's most difficult topic!

This is all good, clean, instructive fun. But why should the citizen tax himself with comprehending such matters? Meek quotes Plato, who wrote in *The Republic* of persuading "those who are to share in the highest affairs of the city to take to calculation, and embrace it in no amateur spirit." Plato might have objected to its being used quite as calculatedly as is the case today, where commercial ends predominate. Many of us too, while expressing concern at social problems, are perplexed and repulsed by these new quantitative methods; we should remember though that many of these same techniques are, at least in principle, just as valuable to Countdown and FOE as they are to Courtaulds and ICI. There is nothing fundamentally sinister or inhumane in the use of

figures, so long as the understanding of them and their limitations is broadly based.

Thus what *is* sinister is society's frequent deference, according the figure, any figure, a spurious precision and gravity all its own. The defeat of Roskill's Machiavellian maths by Buchanan's flighty prose is not typical; far too much important decision-making is conducted on a plane of statistical obscurantism far removed from proper public scrutiny. The excuse, of course, has been that the public wouldn't know a functional relationship from a hole in the ground.

Quite painlessly Meek has shown that this need no longer be the case; in 230 paperback pages, without straining our intellectual or financial resources, he has clarified, perhaps even popularised, a very awkward area. It must be hoped that such widely available explanatory texts will be agents for spanning the void between the researchers and the researched, the planned-for and the planned-with.

With books like this we may yet democratise the future.

*Philip Brachi*

## Man the rainmaker

**MAN'S IMPACT ON THE CLIMATE**, edited by William H. Matthews, William W. Kellogg, and G. D. Robinson. MIT Press, \$25.00.

During its doom and gloom phase the environmental movement made much of man's capacity for altering the climate. Several possibilities were discussed. The combustion of fossil fuels releases carbon dioxide into the atmosphere and it was feared that because of its property of absorbing reflected, long wave radiation, an accumulation of CO<sub>2</sub> might lead to a general warming. On the other hand, the release of particles from industry and from atmospheric nuclear testing might increase the planetary albedo, so leading to a cooling. Are we growing warmer or colder? In fact, the mean surface temperature of the planet increased a little during the first half of the century and now it is decreasing, but neither increase nor decrease has occurred more rapidly than can be explained by natural climatic cycles.

The planet's atmosphere and its behaviour are complex and delicate and

the problems are made no easier by the fact that many of the substances released by man are also released by natural processes. *Man's Impact on the Climate* provides few unequivocal answers, but it does give indications and it shows very clearly what further work is needed. The book itself is part of the MIT's Study of Critical Environmental Problems, the summaries and findings of which were published as *Man's Impact on the Global Environment*. A major part of SCEP was devoted to climate and this book contains all the SCEP material, adding descriptions of the techniques and details of the results that led to the work group's conclusions, together with a number of background papers.

There are a few surprises, some reassurances and some reasons for concern. Overall there is a need for caution. Man has altered climates locally and he does have the power to alter them globally. Until we know precisely what we are doing we should take care. An ice age is not ruled out (although the book exonerates man from any blame for the last one!) nor is the melting of the icecaps, but there is no reason to believe either of these processes has begun yet. Nor is there any ground for the fear that a combination of forest clearance and industry might deplete seriously the planet's oxygen. The biggest surprise comes from the discovery that increases in particulate matter are more likely to warm the atmosphere by absorbing radiation than they are to cool it by reflecting radiation. Instead of counteracting the "greenhouse" effect of CO<sub>2</sub> they complement it. It was found, too, that beyond a certain point increases in condensation nuclei, which lead to cloud formation, stabilise clouds and inhibit precipitation.

Like the other MIT studies, this one uses its assembled data to construct mathematical models using the large MIT computers. One of the most interesting sections of the book describes the modelling techniques used. They leave something to be desired. Some of the climate models could not allow for cloud formation and movement, but had to assume precipitation as soon as saturation was reached. Thus predictions are unlikely to be reliable. What is important is the approach to the large amounts of data and the vast and intricate relationships involved in a study of something so

complex as the global climate.

The need, then, is for improved and more extensive monitoring and for improved modelling. The implications of major climatic changes are so great that we cannot afford to remain ignorant.

Michael Allaby

## Why care about whales?

LOST LEVIATHAN: WHALES AND WHALING, by J. D. Ommanney. Hutchinson, £3.

Man has hunted whales for centuries. One species, the Greenland Right Whale, so named because it was the "right" one to catch, was brought close to extinction and has been protected for several decades. It may survive. Others may be less fortunate, for although the high cost of modern whaling demands numerous catches, this may offer less protection to the more profitable species than the simple operation of market economics would suggest. Were there only Blue Whales, or Humpbacks, diminishing returns might bankrupt the whalers before stocks were exhausted, leaving a residual population which might recover. However, there are other, more common species, so the Blues and Humpbacks may be exterminated by an industry whose main business is with Fin Whales and, when they are gone, with the Sei. The last to go would be the Sperm.

Whales have always been valuable. At first it was the blubber that was sought, then their spermaceti—for cosmetics—their meat and, in the case of the whalebone whales, their "baleens"—the long, narrow strips of horny material with which they filter their food and with which we used to stiffen corsets. Even the skin of the penis of bulls was once used—for golfing bags.

Today there are substitutes for all the commodities the whale provides. We could survive the ending of the whaling industry. Indeed, we might not notice it. They are a resource, but not an essential one.

In any case, whales are probably on their way to extinction from natural causes. Gigantism often precedes extinction and whales were much smaller within recent geological time. An extreme degree of specialisation

does not make for high survival value, either, and the baleen whales are so specialised that they can feed only on one species of small, albeit plentiful, crustacean. Should we hunt them from the face of the earth we may be merely anticipating nature. So why should we care about them?

We should care, for their true importance lies elsewhere. In the history of whaling is writ small the history of our relationship with this planet. Economically, whales are expendable, but they are not a renewable resource. We know the annual sustainable yield of each species and each year we exceed it. We know that the Blue and the Humpback are threatened and we continue to hunt them. If, at this late hour, we can learn to restrain our rapacity and permit them to survive, there may be hope for us. If we hunt them to extinction, because it is profitable to do so, we will do no great damage to the planet, but dare we hope that we will learn in time to control our consumption of more vital, and thus more pressured, resources—of petroleum, of scarce metals, of land, of fresh water?

Whales are so large and so far removed from the mammals we understand and with which we can identify that we treat them as we would not treat a horse, or a tiger. They are killed by a harpoon whose explosive head is detonated inside the animal's body. In one area of Norway whales used to be trapped in a fjord and wounded with infected lances, so they died from gangrene. In the Orkneys schools of whales used to be driven aground to die, helpless because of their great weight, from asphyxiation. Their muscles could not move their immense rib cages.

Dr Ommanney is a marine biologist who spent many years studying whales and whaling in Antarctica, South Africa and New Zealand. His book is a subtle mixture of folklore, personal adventure and biology. Scientifically, he describes the evolution of whales, their physiology and their behaviour. Historically he describes the methods by which they have been hunted. His book is well illustrated and immensely readable. It is also, and Dr Ommanney is well aware of this, a profound indictment of the behaviour of man toward the largest and probably the most inoffensive animals on the planet.

Michael Allaby





# ***Zambia***

Where wild life  
stays that way.

Nowhere else in Africa is conservation taken so seriously as in Zambia. To us, conservation means protecting our fauna from that most dangerous of predators—man—whilst preserving their natural habitat and maintaining the ecological balance.

Zambian wild life is completely free, uniquely unspoilt, staggeringly profuse and diverse. The vast game parks which keep it that way are a naturalist's paradise.

Come and see them.

**ZAMBIA NATIONAL TOURIST BUREAU** 163 Piccadilly, London, W.1. Tel: 01-493 5552

*FLY BY ZAMBIA AIRWAYS - RING 01-491 7521*

# THE CHRISTMAS WILDLIFE RALLY

To be held at the

ROYAL ALBERT HALL

TUESDAY, DECEMBER 19th, at 7.30 p.m. (Doors open at 7.00 p.m.)

TICKETS 30p Obtainable from the Box Office  
ROYAL ALBERT HALL, 01-589 8212

ALL LOVERS OF WILD ANIMALS — CONSERVATIONISTS  
NATURE LOVERS — ECOLOGISTS — ARE ASKED TO ATTEND

The Speakers are  
JOHN ASPINALL  
EDWARD GOLDSMITH  
GRAHAM SEARLE

PROCEEDS TO BE SHARED BY OPERATION  
TIGER AND THE FRIENDS OF  
THE EARTH

YOUR SUPPORT IS NEEDED