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Notes by Rear Admiral P. G. Sharp, Director, National Society for Clean Air















Out of the fog of economic uncertainty that pervades modern British life there has emerged a new landed gentleman who bids fair to rivalling the medieval barons.

Ronald Lyons, at 44 a property tycoon, multi-millionaire and director of more than 35 companies, has invested between  $\pounds 7\frac{1}{2}$  and  $\pounds 8$  million of his private fortune in land. He has bought 10,500 acres of Hampshire for English Farms Ltd., a company formed in 1948 and which he has dominated since 1972.

Mr Lyons bought the land as a protection against inflation but then decided to farm it as well as he could when he found the returns could compare with his other investments. He visits his estates from time to time, arriving in his private helicopter and spending an hour or so on a tour of inspection by Range Rover. He plans to build, behind the gateway to a ruined 19th century mock-Tudor mansion, the rest of which will be demolished, what may be the largest private house to be built in Europe since the war.

New English Farms owns two estates, Longwood and Brown Candover, 10 miles apart, and four farms. The farms add up to 4,300 acres and Longwood Estate, site of Mr Lyons's proposed home and the head office for the company, is itself nearly 4,000 acres. Out of the total area about 900 acres is woodland, which will be preserved and managed, and there are two tenanted farms. The land is graded by the Ministry of Agriculture as "B4: well drained, naturally calcareous, medium or heavy textured soil, often shallow over chalk or limestone". It

Ronald Lyons plans to build behind the arch. The remainder of the 19th century ruin will be demolished. Below. The farmer of the 70s? Estate manager John Roantree in his office.



A \* \*

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C Ecologist, May 1973

is chalky downland soil and it cost an average of £800 an acre.

The estates are managed by John Roantree, an agricultural chemist turned economist, who was born and brought up on a Derbyshire hill farm. He has great sympathy for the undercapitalised small farmer and a deep concern for the effect of large-scale farming on local communities. English Farms owns an entire village-Brown Candover. The estates had been running down for thirty years and this is evident from the condition of the houses. Morale among the workers fell and those that could left to find other jobs. Roantree believes that farm workers must be given the best tools, the best working conditions and the best houses. The existing houses will be repaired and new ones built, but he believes the days of the tied cottage are numbered. From now on, farmers will build houses and sell them to their workers. He believes, too, that the wage disparity between agricultural and industrial workers will disappear by 1978, with a 93 per cent increase in farm wages.

The farms employ about 80 workers and the number tends to rise. There are three managers, three livestock managers, an estate manager, an accountant and a surveyor, John Mills, who draws plans for the farm buildings and supervises the contracting out of large jobs. Repairs and small jobs are done by the company itself, but some of the work is too extensive. There will be four covered cattle yards, 210 by 60 feet each, intensive pig units and 11, 250-cow dairy units, one to be built on the site of a derelict Wesleyan chapel. The Lyons group owns Atcost, the agricultural building company, but Atcost would have to devote one of its factories, at full production (600 tons of concrete a week) for months to meet the farms' requirements.

The farming will be monitored by the ICI computer at Billingham, but managers will be allowed considerable freedom to experiment. The plan is to devote most of the land to dairying, with a rotation of four years grass and one year arable, and put the remainder down to permanent grass to raise two 1,000 head beef herds. They have rejected intensive livestock rearing as uneconomic. At present they use large quantities of artificial fertiliser, but once the farms are fully operational all



When fully operational the farms will have about 2,500 dairy cattle and two 1,000 head beef herds.

the manure will be returned to the land and the fertiliser bill will be reduced considerably. Since all water is abstracted within their own territory, they have a vested interest in not polluting rivers. The farms use a great deal of water: the dairy units will require 3,000 gallons a day.

The farms are highly mechanised, with at least 25 tractors, including three large Fiat crawlers. A neighbour still ploughs with horses and John Roantree is sad at the thought that soon non-mechanised farming will disappear completely.

The pigs are reared intensively, although the conditions for some 2,000 animals are better than on many "factory farms".

So far there is little to see. There are sheep eating the surplus grass at Longwood and there is a pedigree herd of Friesians, the woods are being brought into good order and planning applications are filed as quickly as John Mills can get the drawings off his



new, expensive board. Everything is new—the offices, the furniture, the electric typewriters. All are the best that money can buy and the executive secretaries are there to use it. Soon, though, the estates will begin to live again and there will be a level of activity that has not been seen for many years.

Perhaps Longwood is lucky, in that its managers care for the welfare of their workers, and for the land. Certainly the ownership of such a large area by one person is not a trend to be encouraged. Yet it is interesting that some of the shrewdest brains and hardest heads in the business have concluded that intensive farming is relatively uneconomic.

But perhaps, after all, Ronald Lyons is displaying the sagacity which brought him his fortune, by preparing for a return to feudalism?

> Michael Allaby Photographs: Tim Clarke

The pigs are reared intensively, but in general John Roantree does not favour intensive indoor livestock rearing. This is the farrowing house. Below. John Mills is fully employed preparing plans and submitting applications



## Falmouth flattened?







A great many people go all the way to the Mediterranean to stay in towns like Falmouth. The steep drop from the High Street to the sea is a delightful maze of alleys and steps that twist among 18th and 19th century waterfront buildings. The local stone and the traditional ways it has been laid are strikingly attractive, and the entire quarter possesses a charm and interest rare outside the hill harbour towns of Yugoslavia, Italy, and France.

Sadly, the local authority proposes to destroy all this by building a new road along the waterfront (known as the Harbour Road) and a block of holiday flats (known as the Kivel block). The road will eliminate the beautifully constructed jetties and quay walls, demolish about a dozen buildings, and isolate the rest of the quarter —a -conservation area—from the waterfront. The block of flats will destroy still more buildings, will conflict utterly with the character of the area, and will obstruct the finest views.

Both developments are short-sighted and unnecessary. The Harbour Road will probably generate as much traffic in the town as it is intended to siphon off. It is quite the most destructive alternative available, and gives the local authority least room for manoeuvre. The Falmouth Civic Society has proposed instead a new system of one-way streets (including pedestrianisation of the High Street), which is just as likely to relieve congestion, without sacrificing one of Falmouth's greatest assets—a quarter which, sensibly developed, could bring pleasure to residents and tourists alike, as well as revenue to the town.

It is much easier to provide an alternative transport system than it is to recreate an environment such as the waterfront conservation area. Indeed, an alternative system will probably be needed anyway. Only 50 per cent of the households in the South West own a car (compared with 44 per cent in the UK as a whole)1. Should they all own one, and double the present volume of traffic wished to enter the town, the destruction required to accommodate it would make present plans seem preservationist. A policy of controlling the private car, in order to conserve an environment worth driving to, is inevitable. In the meantime, a wise authority will take care not to close its options in the medium to long term by adopting destructive policies of dubious short term advantage. Besides, at about the end of this century oil production is likely to peak2,



Top left, model of part of waterfront quarter; top right, same model showing Kivel block in position (real one will have windows!); middle left, typical alley from sea to High Street (Harbour Road will cover steps); bottom left, view to be halfblocked by Kivel building; middle right, part of quayside to be obliterated by Harbour Road; bottom right, boat shed, showing traditional stonework. Photographs by Falmouth Art College.

making an efficient and flexible public transport system economically as well as socially desirable.

The Kivel block (named after a company which once owned the site) is offensive not only aesthetically but socially. The flats are to be let to the wealthier type of tourist, who will contribute little to the life of the community. Throughout Cornwall there is a housing shortage, and if anything should be built in the waterfront area it is homes. The buildings fronting the High Street could be repaired, while the rest of the guarter could be converted into a residential, commercial, and holiday area. The best examples of waterfront architecture should be conserved, and the other buildings adapted or replaced with mixed income housing, cafes, bars, small shops, and so on. There are still local craftsmen skilled in the local stonework for which Cornwall is so well known, and their expertise should be employed on all such redevelopment. If local stonework were used, the best waterfront



buildings retained, and the new buildings built to a pattern which retained the 19 public access ways not yet destroyed, Falmouth at one and the same time would have helped alleviate the housing problem, rescued its heritage, and provided tourists with somewhere they will want to stay in and explore, rather than exploit and pass by.

#### Robert Allen

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☆ What were those big metal things used for in the olden days, Grandpa ?

### Comment

#### The energy crisis

With crippling strikes taking place all within a year of each other in the power stations, the coalmines and in the gas industry it has become vividly apparent that our industrial society would come to a grinding standstill should it be unable to lay its hands on adequate supplies of energy. But strikes can be negotiated and once over, the wheels of industry pick up again and the government can return to its practice of predicting growth.

The unthinkable would be if the situation prevailing during an energy strike were to become a permanent feature-not because of men refusing to work but because supplies of energy no longer matched demand. The Americans have already tasted such energy crises. First in 1965 during the electricity blackout along the eastern seaboard, and more recently, when during a particularly nasty December and January, supplies of the oil fraction which is used both as heating oil and as aviation fuel ran short in some areas. Schools and other public buildings had to close down and some passenger aircraft on their way from New York to the West coast had to make unscheduled stops for refuelling.

According to some energy experts, such crises-coming as they do during periods of peak demand-have less to do with actual shortages than with poor planning. It is pointed out for example that the recent oil shortage in the US was a result of quotas having been imposed on imports, and of environmental pressure groups having brought about a ban on the burning of oils with a high sulphur content. "What America faces", said Dr Joseph Barnea, director of the United Nations resource department, "is not a crisis of resources, but a lack of planned development".

In view of well known predictions as to how long oil and natural gas are likely to last at anticipated rates of consumption is Dr Barnea's statement strictly true? Or could it be that the remorseless demands for more and more energy imposed by a growthoriented society are leading to a fundamental gulf between supply and demand?

In theory there is unlimited energy in the world. All man has to do is to build breeder reactors and to achieve thermo-nuclear fusion on a commercial scale. But it is a dangerous pipedream to look to nuclear power as a means of pulling man out of his present predicament. Dangerous because it assumes that man has overcome the problems associated with reactor safety, and with the disposal of radioactive waste and dangerous because it implies that energy is the key to man's problems and that all that is necessary "is a sufficiency of energy properly applied". Indeed the reverse is more likely true, and instead of being a stabilising factor an excess of energy is probably the factor contributing most to the breakdown of human societies throughout the world.

The fact is that the light water reactors now in use in the US have failed to meet acceptable safety requirements. At recent hearings in Washington the US Atomic Energy Commission was unable to refute evidence that the emergency core cooling systems of both the boiling water reactor and the pressurised water reactor would fail in just those emergencies for which they had been designed. Indeed the AEC admitted that there was likely to be an accidental release of radioactive waste on at least one occasion per year per 1000 nuclear reactors. By the year 2000 the US anticipates it will have just about that number of reactors in operation.

The gas-cooled, graphite moderated reactors used in Britain are intrinsically safer than the light water reactors of the US (and at present being installed at Fessenheim on the Rhine). But Britain's nuclear industry is undergoing drastic reorganisation with the formation of one monopolistic construction company, and aside from the breeder reactor, it has not yet decided which line of reactors to pursue. Nevertheless New Systems Forum of the UK Atomic Energy Authority, believes Britain now imperative that it embark on a large scale nuclear programme so as to provide a firm power base by the turn of the century.

The Forum has suggested that by the year 2000 Britain should have 150,000 to 200,000 MW of generating capacity—90 per cent of it nuclear compared with 49,300 MW generating capacity in 1970. What the Forum fears is that the rapidly rising costs of fossil fuels will lead to a fall in demand for electricity, even below the low growth rate of 2 per cent per year, and consequently that the economy will take a turn for the worst. According to New Systems Forum, nuclear power could, if based on the breeder reactor, reduce electricity generating costs to about half what they are today.

But is cheap electricity sufficient to revive a flagging economy? For one thing Britain is not yet geared to running on electricity, and like the other EEC countries and to a large extent the US, is committed to oil and increasingly to natural gas. Thus the US sees its needs for oil leaping from 5.4 billion barrels in 1971 to more than 10 billion barrels in 1985 and Britain, which has increased its oil production 10-fold since 1950, expects to double it again by 1980. All the OECD countries, including the US, the EEC countries and Japan, will have to increase their imports of fossil fuels by substantial amounts despite finds of oil and natural gas in the North Sea, Alaska and the frozen wastelands of Canada. Indeed by 1985 the US will be importing as much oil and natural gas as it consumed throughout the whole of 1970, and one can make similar predictions for the other OECD countries.

In the face of rising prices of primary energy and of other raw materials, and in view of the unlikelihood of nuclear power proving a viable alternative in time, it is hard to escape the conclusion that the West is heading for the most colossal economic crisis of all time. The question has to be asked, and urgently, whether it is not exceedingly foolish to push on with concepts of growth when the outcome of such a policy is likely to be so disastrous as to lead to that very situation which it is aimed at avoiding-namely economic depression on a scale far exceeding that of the 1930s.

Surely it is now time to seek alternatives which lead to reductions in energy use and yet which will not necessarily lead to any diminution in the so-called standard of living. Indeed if man could settle for a simpler way of life the chances are that the standard of living could well be enhanced.



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### Gremlin

#### Nature abhors a vacuum

Mr John Madox has ended his distinguished career as editor of *Nature*. To Gremlin's great regret, he and *Nature*'s publishers have agreed to part.

Mr Madox is to edit The Environment This Month, which is published by his wife.

He is also anxious to allow a larger readership the benefit of his acute grasp of world affairs. Until recently his writings were largely confined to editorials in *Nature*, and thus were read only by Gremlin's lackeys, whenever he remembered to pay them.

Mr Madox has therefore approached *The Times.* This newspaper rather churlishly refused his services. He has now asked the *Guardian* for some of its space.

Gremlin begs the editor of the *Guardian* to acept Mr Madox's kind offer. It would be too unkind to force Mr Madox to apply for a job with the *Ecologist*.

#### Sign of the F. Times

Well there's a shame. The good old Financial Times organises a conference "Pollution-the Challenge on to Industry", solves all those niggling little environmental things, and Gremlin has to miss it. Good speakers, too. Eldon Griffiths was allowed over half an hour to state the British Policy for the Environment, and Roy Wright of RTZ, in a strange reversal of roles, was there to fill in any holes he left. And Anthony Grant, who once nearly banned the importation of tiger skin coats, was marked down for the closing speech. And it all happened under the watchful eye of Mr A. C. Davies, Executive Director of-you guessed it -Rio Tinto Zinc. Almost too good to miss.

Now conferences like this are no bad thing, especially when they are thrown open to the likes of little Gremlin. Grass roots involvement and all that. In fact they are a very good way of ironing out differences. But at the London Hilton, and at £60 a time, between whom.

#### **Jiggery Popery**

At last the Pope's done the decent thing and put one of his boys in charge of the world's environment. The appointment was announced in February and put an end to centuries of spiritual speculation and clerical cut and thrust. The job went to St Anthony Toni to his friends, largely on the strength of his tree-planting record. Frankie-boy, the Assisi animal trainer and the favourite, was reported to be "dead choked". When asked what immediate improvements we could expect in the global environment after St Anthony's appointment, a spokesman felt bound to point out that the good saint is not quite the man he was. After all, he has been dead for over 1,600 years. You can hardly expect miracles.

#### **Bombs for peace**

"In a recent issue we had much to say about agriculture in relation to conservation. It was a very wide subject to survey in a few pages and there were, inevitably, some important omissions. One of these related to pesticides....

"But agricultural chemicals as ecological tools: is this just an empty phrase? Emphatically not. Pesticides have always been instruments of ecological change—blunt maybe and sometimes ineffective and even dangerous, but their very survival implies that they have found a role in the regulation of the human ecosystem".

(From "Agricultural chemicals as ecological tools", the editorial in *Outlook on Agriculture*, 7, 1, 1972. Published by ICI.)

#### New grub club

Young broiler chickens tasting as good as mature free-range ones will soon be in the shops. *The Times* of 14.2.73 reports that the White Tomkins company of Reigate has developed a process whereby "balancing" amino acids, yeast, butter, and herbs are injected into the birds as soon as possible after slaughter. What now tastes as if it were crossed with a fish finger, will soon be as appetising as the traditional *coq au vin*.

The company hopes to extend the process to ducks, turkeys, guinea fowl, and rabbits, and is planning another process which gives the colour and flavouring of smoking to meat and fish wihout the apparent carcinogenic effects of wood-smoke.

Both processes have been warmly welcomed by Dr Idi Amino-Acid, director of the newly formed Pyke Advanced Institute of Nutritional Science (PAINS). Named after Dr Dr Magnus Pyke, Britain's foremost nutritionist until he died after inadvertently consuming a wholemeal loaf, PAINS is intended to promote a rigorously scientific approach to nutrition. "Progress in nutrition has been held up for far too long by an unscientific attachment to so-called natural foods", said Dr Amino-Acid. "Yet natural foods are likely to be far less nutritious than synthetic foods, since they were developed without the benefit of modern scientific knowledge."

Dr Amino-Acid went on to announce that the Institute's research section was working on the perfect egg. He pointed out that the average chicken has no idea of a human being's dietary requirements and is therefore incapable of laying completely nourishing eggs. PAINS hopes to develop a do-it-yourself kit for synthesising eggs with a perfect balance of all necessary amino acids, fatty acids, vitamins, and minerals, from spent tea-leaves and engine oil.

Inspired by the work of White Tomkins, the Institute has already developed a toast flavour for injection into bread, so that the housewife has only to allow the loaf to go stale for her to have as much toast as she likes.

#### Heinz henz meanz has-beenz

H. J. Heinz & Co. Ltd. make a lot of chicken soup. One day they tried claiming it was made from free-range birds. They said it on a TV commercial.

The Farm and Food Society thought it rather unlikely that so much soup was made from so few birds. They asked Heinz one or two knowledgeable questions.

Heinz admitted that "our demands for chicken meat are indeed very large and the supply from free-range birds is simply not available in the quantities we require... We would like to express our regret that our TV commercial—unintentionally but understandably—led some of your members to draw the wrong conclusions about our use of free-range chickens".

Hope they take more care with the soup.

## Canada and the US energy crisis

#### by Geoff Mains

Energy consumption in the industrial world is rising at 4.5 per cent per year. Without this continued growth, the exchange of goods and services that are symbolised by a rising GNP would slow down, and the developed world would plunge into a crisis of inflation, unemployment and depression. Energy is a key factor in the economic growth of the industrial world: it is thus a key factor in the environmental crisis. A basic aspect of that crisis is the incompatible nature of continued economic. technological and population growth within a finite biosphere. In Canada the environmental movement has focused on these issues for several reasons.

First, in a nation that is less populated than the USA to our south, we are faced with fewer urban and socio-environmental problems, though by no means are we free of them. Second, being a nation that is economically and culturally dominated by the USA, there are forces within Canada searching for new styles of existence. The ecological alternative, therefore, becomes a cultural possibility.

Geoff Mains is completing a Ph.D in biochemistry at the University of Toronto. He is a member of Pollution Probe at the same university and is the author of *The Oxygen Revolution* (published by David & Charles Ltd. 1972). Third, in a land that is supposedly inexhaustible in both biological and non-renewable resources, environmentalists are conscious of the responsibility that we bear in safeguarding these resources and in halting their reckless exploitation.

Canada is fairly rich in mineral and energy resources. And many nations, like the USA and Japan, are facing resource shortages that are critical and that will continue to be critical for the next century at least. These nations look to Canada for a continued supply of many of these resources. That the majority of foreign-controlled corporations in Canada are in the resource sectors of the economy and US-owned. and that the US Government has already made studies of Canadian resources as a means of helping to meet demand over the next fifty years, may hardly be a coincidence. The USA appears to be trying for unlimited access to Canadian resources. And the Canadian Government, while playing quietly into American hands (and their own pockets) has been pretending publicly to do the opposite. At stake is a unique possibility for Canada to take actions on a national scale that would have global ecological significance, and would influence the very life of Canada as an independent nation.

In the United States the exponential growth of energy consumption has reached truly phenomenal rates. The number of operating nuclear reactors, for example, is expected to climb from 40 today to 900 in the year 1990. From 1980 onwards, a new 100 megawatt reactor is expected to come onstream every two weeks. It is no coincidence then that American fuel supplies are showing signs of strain. Oil and gas reserves in the continental United States (excluding Alaska) have levelled off and begun to decline. Many of the potential hydro-electric sites have been harnessed. And known reserves of uranium-235 (without the aid of the breeder reactor-which is still very much a hypothetical technology) will be depleted by about 1990 with expected growth trends in the nuclear industry. Although coal is plentiful in the US, it is a dirty fuel both to mine and to use.

A short term crisis in energy availability has focused US public attendtion on these issues. Urban and federal air pollution legislation has created a tremendous demand for natural gas which cannot be met. In anticipation of these changes, coal mining operations have phased out domestic production and shifted to production for export-this has created great shortages of fuel at the power plants. The nuclear industry, plagued by technological set-backs and opposition from environmentalists, has been unable to live up to projected growth patterns. All over the nation new power projects are meeting stiff opposition from environmental groups and the native peoples. Finally, insufficient grid systems are unable to distribute the massive requirements for electricity that have been artificially boosted by advertising campaigns.

The United States Government has, therefore, been taking a careful look

#### Now that we've nursed the hungry Monster through its gas pains, what will we feed it next?

The United States is a very hungry country. Not so much for food. But for resources and energy. The kind of things that we have here in Canada and should do our best to control. The U.S. currently consumes 40 to 50% of the world's non-renewable resources with only 6% of the world's population. By 1980, the same country will increase its demand to 80% with only 5% of the population. Obviously this kind of voraciousness must be halted.

#### The gas pains.

When the U.S. recently admitted it was experiencing a lack of natural gas but no lack of money, our Federal government was there to offer, through the Hon. J. J. Greene, 6.3 trillion cubic feet of gas to the sickly Monster in return for 2 billion dollars over the next 15 to 20 years.

W. Roleman

This is only the first demand due to the rapidly depleting resources of the U.S. It also is another of our major ecological blunders. Instead of bargaining (for resource control or population programs etc.) we sold. Instead of confronting growth, we contributed. And we have put ourself in the position of some kind of North American resource supermarket.

#### The November Talks.

This month, there will be talks in Ottawa about Continental Energy Policy. It should be a rather interesting gathering since Canada has no Energy and Resource Policy. And without one, we're at everyone's mercy. The Monster is hungry and comes with money. Policies after the fact can be rationalized very easily when there is a profit shown. We need you to help us urge our government to make no commitment in these negotiations until a policy is formulated and made public.

CHOMP

#### Energy and Resources as a lever.

Before we get muscled right off the Continent, we should realize that with our natural resources we are no longer a poor cousin but a very welcome neighbor. And before we do any more visiting, we should have clearly in mind just what we want in return for cooperation. Money isn't everything. Ecological balance. Population controls. The control of blind growth are but a few of the things

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Ottawa

at the various sources of energy and the political implications in their supply. The most recent study was that appointed by Nixon to examine the availability of oil. A committee, under Secretary of Labour George Schulz, made its report in 1969. Looking south to Venezuela and east to the Arab States, the committee concluded that while the US would continue to use oil from these areas, only northwards in Canada was there promise of militarily secure oil. They stated that the US should work diligently with Canada to attain a Continental Energy Policy that "assures our mutual security, and that such a policy would cover energy broadly and should deal not only with oil, but natural gas, coal, hydroelectric and nuclear sources." They also concluded that the uninterrupted flow of oil to the US economy and armed forces was essential to the maintenance of her position of world pre-eminence.

It is clear then that there is nothing the United States would like more than a common-market type arrangement with Canada over energy resources. While the advantages that might be accrued by the US from such a deal are many, there are few obvious ones for Canada. A continental Energy Treaty would only tie Canada even closer to the United States and to political and cultural union. More important, it would inevitably seal the fate of Canada to a short future of rapid exponential growth along the American design. But let us see how the Canadian politicians feel about it all.

#### Ottawa's response

Until about a year ago, the Federal Minister of Energy, Mines and Resources in Canada was the Honourable J. J. Greene, a go-getter who travelled the world from Japan to the US to Europe to sell Canada's resources. Mr Greene has been noted for his elusive nature, particularly since the spectre of a Continental Energy Policy appeared on the horizon.

It all began, it seems, in the fall of 1969 following the release of the Schulz report. Mr Greene visited Washington in order to confer with Walter Hickel, Secretary of the Interior, on energy matters. On leaving this meeting, Mr Greene told the press that he saw a great future for Canada in an impending energy-sharing agreement with the United States. But Mr Greene could have hardly said anything worse. What was this agreement, demanded the opposition parties in Ottawa? Fed by a tide of rising nationalism in Canada, the press followed with a highly negative stand.

Thus, when Mr Greene returned to Canada, the cabinet quickly held a meeting to cover up his actions. Suddenly the Government claimed that there never had or ever would be any such thing as a Continental Energy Pact and that no one had ever said or considered such a thing. Mr Greene was sent to Denver to publicly address the oil companies with what was jingoistic whitewash. He raved about Canadian nationalism. He claimed that Canadians were so sick of American broadcasting that they were considering jamming the air waves. But he also told the oil executives that there was an assured future for their investment in Canada and that, as always, the way was wide open for them.

Despite all of this, oil exports to the United States were stepped up 50 per cent in September of 1970. Early that year the US had imposed a quota on oil imports from Canada: this, according to a letter to a US senator from the White House, was to strengthen the American bargaining position with Canada.

To publicly lend support to the US demand for Canadian oil and gas and justify further exports from to Canada, Mr Greene and the oil companies concocted an estimate of Canadian reserves that can only be described as an attempt to intentionally delude the Canadian public. These estimates. known as the CPA Petroleum Association) (Canadian figures, are based on the assumption that every cubic foot of every sedimentary basin in Canada-even those basins in which oil has been looked for but not found-is as petroliferous as the world's richest basins. Consequently, these figures give grossly inflated values of Canadian reserves. The Western Canadian Basin (in Alberta), for example, is credited by these estimates with reserves of 45 billion barrels of oil. Yet, after 50 years of exploration, with an expenditure of \$10 billion, with the use of 250 drilling rigs and 100-150 seismic crews, 88 per cent of the basin has been explored to the basement. And

only 12 billion barrels of oil have been located. One wonders what will be necessary to locate the other 33 billion barrels.

Mr Greene has used these fantasies to assure Canadians that their oil and gas reserves will last hundreds of years. He claims that it costs us millions of dollars annually to allow these to remain in the ground, and that we had better sell them now, and fast, while we can. For otherwise, Mr Greene claims, in the year 2000 we shall be burdened with a useless commodity while the rest of the world runs on solar power. The true facts of the situation are sobering, however. Canada's known reserves of oil and gas are only 9 billion barrels and 50 trillion cubic feet respectively. Alone, at present rates of consumption, these would last us 18 and 37 years. But under a continental energy sharing pact, they would be gone in little more than a decade.

In reality, Canada does not have a great deal to offer US demand. With the advent of new discoveries, Canada might be able to meet 10 per cent of US demand until the turn of the century. What the US is asking for is only a small part of its total needs-but an important part because of the military security involved. In November of 1971, following the 13th Annual meeting of the Joint Committee on Trade and Economic Affairs, oil imports were stepped up again. The Canadian government refused to concede that energy matters were discussed at that meeting. But if there is any doubt of the direction in which things are going, one has only to look at the US Information Service report of that meeting:

"Cabinet members of *both* governments recognised the necessity and desirability of a future role for Canada as a supplier of petroleum to the United States and looked forward to *full* and *unimpeded* access for Canadian oil to US markets as soon as arrangements are worked out to ensure continuity in times of emergency." (italics mine)

#### Continuity in times of emergency

North of the Brook's Range in Alaska is the North Slope, and to the north of that, Prudhoe Bay—Klondike of the 1970's and black gold for the giant oil interests. With the rediscovery of oil there in the late 1960's, a consortium

of oil companies was formed to plan and to build TAPS- the Trans-Alaska Pipeline System that would carry oil across the fragile tundra from the North Slope to Valdez on the Pacific. From that point, a fleet of giant tankers was planned to carry the oil along the beautiful British Columbia Coast to Seattle. Here, oil pipelines would carry the oil east and south. Within half a year of its inception, TAPS had fraudulently gained access to surface rights from the native peoples, had ordered thousands of miles of steel pipe which were shipped to Valdez, and had let contracts for receiving facilities and refineries in the state of Washington.

Fast action on the part of the Sierra Club, Friends of the Earth and the native peoples of Alaska put a stop to these plans through a series of carefully planned court injunctions. Recent legislation in the United States has delayed TAPS further still with the requirement for an extensive environmental impact statement. Thus, while the project was delayed, the oil companies lost millions of dollars, the US government began to consider other routes and the steel pipe rusted in Valdez.

A pipeline through Canada, for example, could carry oil directly to Chicago and the industrialised midwest. And such a pipeline could also carry Canadian oil to American markets as that oil was discoveredand later a gas pipeline that would have to be continental could follow the oil line. This proposal also fitted closely to the American idea of a continental energy policy. Thus, when the US Government met secretly with Canadian officials in Montreal in the fall of 1970, they pulled these two proposals into one. The US Government offered to help Canada finance a MacKenzie Valley pipeline on three conditions. First, Canada and the US would participate in a free access common market for gas and oil. Secondly, Canada would give up its right to tax these shipments to the US. and thirdly, in case of emergency, this pipeline would be constructed to be always one-third above demand capacity. The Liberal Government said nothing of this meeting to the Canadian people, for to do so would raise the spectre of continentalism.

Rather, in the spring of 1971, the cabinet made its move by proposing

somewhat the same thing, although on different grounds. At that time, David Anderson, MP for a British Columbia riding, was raising the fear of oil spills down the west coast.

The obvious alternative to the TAPS route, therefore, the Honourable Mr Greene and other cabinet members claimed, was a MacKenzie Valley pipeline. This pipeline could be the nucleus of a transportation corridor to begin the much-needed opening up of the Canadian North. Indeed, Mr Greene and his cabinet colleagues claimed, ecological studies were already under way. (As it turned out later, these studies were either proposed, barely under way, or grossly superficial in their scope.) Mr Greene invited the executives of the major oil companies to come immediately to Ottawa to begin discussion of the project. Unfortunately for Mr Greene he was unable to guarantee an immediate approval of the project, so the oil executives maintained allegiance to TAPS. And, although a brief flurry of opposition arose against the Mac-Kenzie Valley project, the Government pushed ahead at full speed. During 1972, studies of the terrain were initiated and telemetry of the route begun. And the National Energy Board has announced that it expects a gas pipeline application by the end of 1972. And, in April of this year, Trudeau himself brought this matter into the limelight with a sketchy outline of the Government's multibillion dollar programme for developing the North.

On the ecological side of the coin, there are many fundamental issues that link up with a MacKenzie Valley pipeline development. Should we even be considering the development of the North? And, if so, do we yet have the technology or the ecological understanding to be able to carry out such a project in a rational manner? Have we adequately satisfied the rights of the native peoples to the lands of the North? One of the most fundamental issues, however, I believe, is the relationship of this pipeline to the ecology of the North American continent and to the continuing pattern of economic growth and continentalism that pervades the whole. As yet, few Canadians have drawn any connection between the two issues. Perhaps, because the Canadian Government took the initiative in announcing the project, and perhaps because the project might offer protection to Canada's west coasts, few have doubted the Government's sincerity. Yet, projects of this magnitude require money and investors, and these will not be found in Canada. Where the money comes from, the energy will go. And once the energy flows southward, it will be near impossible to turn it off.

#### An alternative for Canada

To slow or to reverse current political economic and environmental trends in Canada will require a massive reorientation of political thought and action; without this change, Canada will slowly sink into integration with



the rest of the continent. But with this change, and through the inherent relationship between Canada, her biological and non-renewable resources, and the world environment, this nation could play a major role in the shift to global equilibrium. Here are six ways in which some of this could be brought about.

- 1. The Canadian North and Arctic are some of the world's last undeveloped areas. At present, there is too little meaningful ecological knowledge and research of the fragile arctic environment. Therefore, a freeze should be placed on all new Arctic oil and gas extraction, transportation and northern exploration, and these activities should be scaled down for at least two years—and until we have enough knowledge of the environment to even consider development.
- 2. The rights and claims of the native peoples of Canada, particularly in the North, go ignored by the federal Government. These must be considered and their due rights acknowledged. Many of the native peoples do not want economic development of the type that our society espouses; this means that inevitably we must relinquish claim to vast areas of land. These people want the opportunity to live in their own fashion off the indigenous ecosystems-not to operate hot dog stands for the southern tourists.
- 3. The Canadian Government must place controls on foreign enterprise in Canada. New investments could be controlled by a screening agency and by modifications in the Bank Act that would limit the amount of Canadian capital available to foreign enterprises in Canada.
- 4. Canada must initiate a broad study of the relationship of resource availability and usage to population, economic and technological growth on a world scale. This study should view these resources in both long and short term contexts and should attempt to rationalise their use in terms of an eventual global equilibrium. The policy arising from this study should strive for a reduction of resource and energy consumption through a greater efficiency of usage and a curtailment of demand. Simultaneously, Canada must adopt a population

policy. Tax incentives and loans for the research, development and initiation of recycling industries should be encouraged. Exports of resources from Canada should be frozen at present levels until a broad and rational resources policy has been initiated and its political implications determined.

- 5. The future sale of Canadian energy and resources should be tied to environmental considerations. Canadian resources have been contributing to the deterioration of the biosphere-to the growth that has contaminated the globe with DDT, and that has poisoned the people of Canadian Minamata. environmental groups question strongly the right of our governments to sell resources in ways that will eventually be our own destruction. The sale of our resources should be coupled with demands for their use in ways which are ecologically sane and for controls in population growth, economic growth, and pollution. This is no precedent: Canada already demands that nuclear materials sold abroad should not be used for the construction of warheads.
- 6. In recognition of the environmental crisis, the Canadian government should encourage new directions for society and for industry that lead to environmentally sound cultural alternatives. It is questionable whether conventional economic growth-which is aimed almost solely at maximising profits-is a solution to our present problems of social and economic poverty; indeed, a growth that espouses such absurdities as bigger and better cars, vaginal deodorants and floralpatterned toilet paper. There must be alternative means of providing society with a quality of life that is measured in human happiness and the richness of human experience rather than the quantity of material wealth. One of the predominant features of Canadian culture is its close association with the natural world. Painters like Emily Carr and Lauren Harris, for example, speak in their works of a human the powerful symbiosis with physical and biological forces of the environment. Although Canada is not without environmental destruction, it is blessed with a biological richness which is still relatively

intact and from which human society can learn a good deal about living with the rest of life. Here then is an alternative future that Canadian environmentalists see for their nation. Not a flag-waving nationalism but a cultural existence that is distinct in its respect for the biosphere. It is our hope, that Canada, through the judicious use of resources-both at home and abroad, can set an example as well as encourage the rest of the world to undertake the most crucial of all changes-the transition from growth to global equilibrium.

#### Postscript

On October 31, 1972, the Canadian electorate voted the Liberal Party into office again, but this time with a bare plurality of only two seats over the Conservatives. Dissatisfaction with Trudeau's government however, was not expressed on issues of national sovereignty, corporate rip-offs or environmental problems, but because of rising unemployment and mismanagement of government funds. The continued arrogance of Trudeau and his cabinet to the Canadian public was no doubt an important factor as well. The Conservative Party that wished to replace Trudeau. however, stands no better off environmentally, particularly in terms of controlling the powerful corporate and foreign interests that dominate Canada. Only the minority New Democratic Party raised the issues of Continentalism, the MacKenzie Valley Pipeline, energy sales to the USA and the future of Canadian independence. Even this labour-dominated party has yet to tie these issues and environmental perspectives together. But the October election results left the NDP with 30 seats and in a powerful position in the Commons. The NDP has the power to make or break the present Government at any point that it desires. With the Liberals fearful of another election-in which they would probably lose-the NDP may be able to push the Trudeau bureaucracy towards greater honesty and openness and towards the environmental and national perspectives that are so crucial a part of our future. And if the Speech from the Throne given this January at the opening of Parliament is any indication, this might, to some extent, take place.

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## In search of bonanza

#### by Peter Bunyard

The publicity boys and the media have done their job well and everyone in Britain now knows that BP, Shell and the other oil giants have landed something pretty big up in those tempestuous waters of the North Sea. Big enough anyway for Britain to contemplate the pleasure of telling the oil producing countries of the Middle East, and in particular Libya, just where to get off. Once the oil starts pouring in, Britain can begin to make a substantial dent in satisfying that growing monster-its primary energy requirements-and save a few thousand million pounds sterling to boot. Or can it?

While Britain has yet to see North Sea oil, natural gas is already a reality with nearly 2,000 miles of a national grid system completed and the British Gas Corporation, which has just taken over from the Gas Council and the Area Boards, well on its way to meeting its production target of 4,000 million cubic feet a day by the mid seventies. The future seems rosy; for in addition to the gas fields in the southern part of the North Sea, which are already supplying households in the home counties, there are all those large, as yet untapped reserves of gas to be discovered along with oil further north, even as far north as Rockall.

One can hardly expect the industry to look too far ahead: Ten years for sure, even twenty years, but beyond thirty years? That would be asking too much, even of the Gas Corporation which has had to invest many hundreds of millions to make natural gas accessible throughout the United Kingdom. So what then does one make of the warning put out recently by the National Union of Mineworkers which claimed that at the present rate of use natural gas will last Britain little beyond 1990? And Britain has a long way to go before its *per capita* consumption of natural gas is anything like that of the United States or indeed of France.

Before one comes charging valiantly to the rescue of the Gas Corporation with cries of "discoveries of vast extent are about to be made" and "offshore-drilling techniques together with the technology of extraction are improving all the time"-both perfectly correct and reasonable statements-it is worthwhile to take a look at Canadian experience, for if anywhere in the world has vast, untapped reserves of natural gas and is determined to extract them at minimal cost to the environment, it is Canada, especially up in the frozen arctic wastelands to the north of the 60th parallel.

In 1971 Canadians consumed 2,720 million cubic feet of natural gas a day and their total requirements over the year, including sales to the United States and other exports, came to 1.28 trillion cubic feet (a trillion is one million million or 1012). Even though Canada's present demands are a little lower than the 4,000 million cubic feet per day expected in Britain just three years hence, Canada too is expecting its demands to grow at a fairly substantial rate over the next thirty years. According to Donald S. MacDonald, a member of Trudeau's government and minister for the Department of Energy, Mines and Resources, the total energy demand in Canada is expected to double within the next fifteen years and double again by the year 2000. Natural gas consumption, says the minister, could reach an annual level of as much as 4 trillion cubic feet by the year 2000 or four times its present rate and nearly three times the rate expected in Britain by 1975.

#### Has Canada the resources?

In November 1971 the National Energy Board of Canada turned down applications of the Alberta and Southern Gas Company, the Canadian-Montana Pipe Line Company and the Consolidated Natural Gas Company to export additional quantities of natural gas to the United States. In all the fairly substantial, requests were amounting to a total throughout the vear of 160,000 million cubic feet, or equivalent to nearly half as much again as was already being exported from Canada. Nevertheless, according to the gas companies and also to the government of Alberta, the gas was theresurplus-so why not export it, thereby earning valuable dollars and stimulating much needed exploration and the development of the industry?

In making its decision to reject the applications the National Energy Board of Canada has first and foremost stuck to its policy that before any surplus can be exported, the quantity of gas remaining in established reserves must stand at 25 times the level of Canadian requirements estimated for the fourth year from the time of assessment. At the end of 1969 the total established reserves stood at 57.4 trillion cubic feet (each cubic foot is equivalent to 1,000 BTU). Subtracting from the total those reserves that were known beyond economic reach, the pipe line losses and shrinkages during processing, and adding any imports, the total supply at the end of 1969 stood at 48.3 trillion cubic feet. Canadian requirements, including 11.9 trillion cubic feet for export, left a surplus of 6.5 trillion cubic feet, and the National Energy Board therefore authorised the sale of this surplus to the United States.

By mid 1971 the situation had changed, and instead of finding itself with a current surplus the Board found itself staring at a potential 1.1 trillion cubic feet deficit. Not that resources of natural gas were running out, just that demand in Canada had increased during the intervening period by nearly 15 per cent.

#### Natural gas discoveries

What about natural gas discoveries? During the ten-year period previous to mid 1970 the Board was able to report that its reserves of natural gas were increasing at a rate of 3.5 trillion cubic feet per year. Since 1970 some large finds of natural gas have been made in the northern territories and the growth rate has risen to 3.8 trillion cubic feet over the past year.

But if the finds of natural gas or crude oil for that matter represent capital, they are being consumed at an increasingly rapid rate and between now and the year 2000, Canada will require for itself some 70 trillion cubic feet, and perhaps another 10 trillion cubic feet if it is to meet its export obligations to the United States-which by 1980 will need in excess of 30 trillion cubic feet, with domestic supplies to cover only 15 trillion. It is therefore inevitable that the Canadian North will be opened up and very soon, in spite of opposition from many environmental groups.

In 1972 a number of gas finds were made not only in the Mackenzie Delta area which lies at the northwest corner of the northern territories but also in Melville island, plumb in the middle of the Arctic Ocean. Called the Drake Gas Field, the Melville Island natural gas field is probably the largest in the Arctic area. Talking about a gas find at a depth of 3,600 feet, made in October 1972, Charles Hetherington, president of Panarctic Oils-a Federal Government and private industry syndicate-declared it as being "in the same sands, the same horizon and part of the same reservoir" as the original discovery on the island, some 12 miles to the northwest.

Under controlled conditions the flow of gas from the well was 5.5 million cubic feet a day. A step-out well some 5 miles away registered 265 million cubic feet a day when the valves were fully open—a considerable flow and more than enough to justify commercial exploitation.

Pipelines have yet to be laid from Melville Island, King Christian, and Ellef Ringes Islands, where other gas discoveries have been made. The idea is then to join up with the proposed pipeline running south-east from Prudhoe Bay in Alaska to the Mackenzie Delta area and then due south to Alberta. Before any pipeline is built from the Arctic Islands at least 30 trillion cubic feet of natural gas will have to be found. Panarctic estimates that it has now delineated about onethird that quantity, and by next summer hopes to have 18 wells in operation. One can only hope that Panarctic has better luck with its wells than it has in the past. In July 1969 its original Drake Island discovery "blew wild" and it took 14 months and two separate attempts with relief wells to subdue the flow of gas. Fortunately for Panarctic that wild well did not catch fire as did a subsequent one on King Christian Island.

The cost of laying the pipelines is going up at a fast inflationary rate. Each pipeline will now cost in the region of 5 billion dollars, at least twice that estimated in 1970.

#### Appeasing the environmentalists

The Canadian government is trying hard to appease environmentalists and has brought in pipeline guidelines to ensure that the exploitation of gas and oil from the North will cause minimal environmental and social disturbance. Originally the planners spoke of "a narrow corridor". They have since changed their minds. "If we crowd all the facilities together, including a road, one or two pipelines, a waterway system with barges and high voltage transmission cables, we may put a severe strain on the relatively fragile environment and so defeat our objective", says Jean Chrétien, Trudeau's minister of Indian and Northern Affairs. Broad corridors are now the thing-in places perhaps 10 to 15 miles wide-with every precaution being taken to prevent ecological imbalances, especially in the areas of continuous permafrost.

Can the pipelines be laid and operated without causing permanent or longterm damage? Undoubtedly the Mackenzie Delta is one of the most ecologically sensitive areas of the entire frozen North, and where there has already been damage the rate of recovery is almost imperceptible in terms of the human life span. During the early sixties damage was done, especially in the permafrost areas. It was then the practice to bulldoze vegetation down to the topsoil and thereby in one stroke remove the very layer which was protecting the ground against the effects of solar radiation. The true permafrost consists of soil with a very high water content, sometimes as high as 50 per cent, but which is basically frozen sometimes to a depth of 1,500 feet or more. Once melting occurs to any extent on the surface the liquid topsoil is likely to run off leaving grooves in the ground. The sun can then work on the exposed grooves deepening them until they become unnavigable gulleys. A vehicle track injudiciously placed can cause an entire hillside to slide away.

By revegetating as they go along, operators in permafrost areas hope to overcome any damage to the soil when laving pipelines. What about the pipelines themselves? A distinction has to be made between oil and gas. Oil has to be heated before it can flow in the Arctic temperature and therefore the pipeline carrying oil must be raised on supports. This raises questions about the possible disturbance to migrating animals such as the caribou which traditionally cross permafrost areas along which the pipeline is laid. Another problem could arise from the differential shading of the ground caused by the shadow cast by the pipeline. Such a differential might cause the supporting piles to shift resulting in pipe distortions and therefore leakages. Natural gas, on the other hand, does not have to be heated to flow and the pipelines can therefore be laid directly into the ground. The main problem stems from the laying of the pipe and the ensuing maintenance.

#### Jobs in the pipeline ?

"It is no longer a question of whether the pipelines will be built", says Jean Chrétien. "The question has become when?" As minister of Indian and Northern Affairs he has latched on to the old argument of the importance of development for the Eskimos and the northern Indians. He points out that the population of the North has grown by 50 per cent since 1961 and that there are now 16,000 students in schools who will soon be looking for jobs. "Wherever I have travelled northerners have made it abundantly clear to me", says Mr Chrétien, "that they want jobs for themselves and their children-not a stagnant economy, not welfare ...." And written into the pipeline guidelines is the statute that a large proportion of the permanent jobs derived from the oil and gas will go to Indians.

Just how permanent will the jobs be? It is apparent that there is enough natural gas in the northern territories -given sound management-to last Canadians to the end of the century and possibly beyond. As for oil, the experts now reckon that there is as much oil locked away in Canadian deposits as the world has consumed to date-some 500 billion barrels. But with the world oil consumption doubling every decade and even less, it can be seen that the enormous quantities of oil in Canada do not amount to much. And in Canada there is hardly the heady excitement at the knowledge of their oil reserves-so much larger than those of the full extent of the North Sea-that Britons have been getting from the big oil companies over the past year. Indeed, says Donald Mac-Donald, "just to meet Canadian requirements, we can expect to need aditional reserves approximately equal to all proven reserves to date".

#### Keeping pace with consumption

It has become common knowledge that within a decade at least two Alaskasize oilfields will have to be discovered every year to keep pace with world oil consumption. And once everyone gets hooked on natural gas for heating their houses for cooking, for industry, perhaps even for running their cars it is unlikely that the prospects of natural gas lasting the world much into the 21st century will be any better than those for oil.

Speaking at the Second North Sea conference at the end of 1972, Dr Frank G. Symon, a gas consultant with Phillips Petroleum Company, Europe-Africa, said that when the North Sea gas was discovered in 1965 the impression was that there existed an inexhaustible reservoir of cheap, easily exploitable energy.

"In fact, the natural gas reserve proved to date could not be classed higher than being a comparatively short-term but valuable asset", he told the conference. "To put all the North Sea gas reserves into perspective, they would last the US less than  $2\frac{1}{2}$  years".

Proponents of nuclear power as the primary energy source, should take into account that the nuclear industry has a long way to go before it proves itself capable of sustaining the industrialised world of the year 2000. To provide 90 per cent of Britain's electrical energy by the end of the century —by then approximately 50 per cent of the entire primary energy requirements of the country—135,000 Megawatts of nuclear plants will have to be installed, in just over 20 years.

To achieve this feat the electrical industry will have to improve on its present ability to build power stations of any kind by two and a half times. Remarkable in view of the increasing difficulties of locating acceptable sites.

It has taken the government a long time to realise the predicament Britain is facing-an impending energy shortage of horrendous magnitude by the turn of the century. It has taken the government an equally long time to pay much attention to its coalminers. But now it seems that the gloomy prognoses of dwindling energy resources put out by the mineworker's union is at last being heeded. The massive injection of financial aid to Britain's coalmines is almost certainly a sign that the energy crisis has been brought home to Whitehall. Perhaps it takes someone like a coalminer with his ear close to the ground to really know what is going on.



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## Miracle rice and miracle locusts

#### by Michael Allaby

In 1970, the United States lost one sixth of its maize crop in an epidemic of southern corn leaf blight. The effect was so traumatic that the National Academy of Sciences conducted an inquiry into the epidemic and into the genetic vulnerability of other crops of economic importance. The report describes a disturbing situation with immediate implications for other areas and especially for developing countries seeking to increase their agricultural production through the introduction of new "miracle" cereals.

At London University's Wye College and at the East Malling Research Station, both in Kent, research has reached an advanced stage on a new technique for the mass production of coconuts that may be of great commercial value in those non-industrial countries where coconuts are an important cash crop.

The technique is based on cloning. This is not new in itself: it is nearly twenty years since a complete carrot plant was grown from a single parent cell. What is new is the application of the technique to a slow-maturing tree crop.

Like any tree that is grown commercially, coconut palms need to be replaced from time to time. Unlike other trees, however, the coconut cannot be reproduced vegetatively, by layering or grafting. It must be grown from seed. This is a slow business. Germination takes from three to six months and it is eight to ten years before the trees begin to fruit and 15 to 20 before they are in full production. Moreover, there is a high degree of genetic uncertainty, which means it is impossible to guarantee that the new tree will be as productive as its parents.

It is the genetic unreliability that cloning may overcome. If it proves possible to grow an entire tree from the tissue of another, genetically the two trees will be identical. All the virtues of an individual plant are immortalised and can be multiplied as extensively as growers demand. The advantages are obvious of replacing all the trees in a plantation with a similar number exactly identical to that odd individual which produces twice the average yield. The disadvantages are more subtle.

#### Genetic uniformity

In selecting plants for a plantation, growers will choose those that promise the largest and quickest return on their capital. If they are offered genetically similar plants that can be guaranteed to yield a particularly heavy crop given the right soil and weather conditions, they will buy those plants, provided the price is competitive. Over a period of years it is possible that a substantial proportion of the plantations in a given area may be growing that tree.

All breeding of crop plants aims at genetic uniformity in order to produce particular desired, and replicable, characteristics. Uniformity is highly desirable. Trees grow slowly and it would take a very long time to reach a high degree of uniformity in any one area, but with annual crops the situation is different. Farmers buy their seed every year and each year they will choose the variety most likely to give them the results they desire. It is entirely possible for a large number of them to sow the same variety in the same year so that whole regions may be growing a very limited number of varieties. Plants that are reproduced vegetatively have achieved genetic uniformity already. Genetically, all potatoes of a particular variety, for example, are the same plant.

The height of the mature plant, rate of growth, responsiveness to fertiliser and water inputs and the weight of the fruit are all characteristics that are inherited, but plants are also bred for resistance to attacks from pests and diseases. If resistance to attack can be inherited, so can susceptibility. It is here that the danger lies.

#### The Great Famine

In the eighteenth century the potato was introduced into Ireland from the Andean regions of South America. The number of varieties planted was small and so there was a high degree of genetic uniformity. Isolated from their natural pests and parasites, they yielded well. The Irish population increased to eight million and the potato became its staple food. In the 1830s the spores of a fungus, Phytophthora infestans, reached Ireland for the first time. There was an epidemic of potato blight and by the mid 1840s, two million Irish had emigrated, two million had died and the remaining four million lived in dire poverty. All the potato plants were susceptible to blight. Genetic uniformity can confer a high degree of vulnerability.

In 1870, Ceylon was the world's leading producer of coffee. By 1885 it was able to export none. The plants had all succumbed to coffee rust (*Hemileia vastatrix*). A bank failed and the British became a nation of tea drinkers. The Americas escaped the ravages of coffee rust until 1969, when there was an epidemic in Brazil.

In 1917 Americans had two wheatless days every week. In the previous year the United States had lost two million bushels of wheat and Canada one million, to red rust. Red rust was known to the Romans. They had a god for it —Robigus. It is the Biblical rust which, together with the moth, "corrupts".

The story of agriculture can be told in terms of the fight against crop diseases and pests. Breeding for resis-



Selecting barley for different characteristics in Colombia (Rockefeller Foundation photo issued by FAO)

tance makes obvious sense. Unfortunately, the weapon is two-edged.

For many years wheat yields in Britain were reduced by attacks of rust. Then two varieties, Joss Cambier and Cama, were introduced. They were rust-resistant. Farmers bought them and they were grown very widely. In 1972 they were attacked—by rust. The expected yield fell by 25 to 30 per cent. The rust fungus had mutated and the plants were defenceless. Overnight extreme resistance had been replaced by extreme vulnerability.

#### Southern corn leaf blight

The most spectacular case of the failure of resistance in recent years occurred in the United States in 1970. In that year the country lost about 15 per cent of its total maize crop. Satellite photographs showed the extent of the spread of southern corn leaf blight. America was fortunate in that it does not depend on maize directly as food for humans, but the experience was sufficiently traumatic for an immediate investigation to be instituted into the genetic vulnerability of other crops of economic importance. The report of the investigation, Genetic Vulnerability of Major Crops, was published by the National Academy of Sciences in 1972.

The story of the 1970 epidemic began in 1917. In that year a graduate student, Donald F. Jones, discovered a way of producing hybrid maize that could be exploited commercially. His hybrid produced a yield 25 per cent greater than that of the standard varieties being grown at the time.

However, the production of the hybrids was expensive. The maize plant is self-fertile, the tassels at the top of the plant being the male flower. To cross two varieties it is necessary to plant them in alternate rows, but to ensure that row two was fertilised only from row one the tassels of the plants in row two had to be removed. Schoolboys were employed to do this, but an intensive search began for a cheaper alternative. In 1931, a variety was developed in which the male flower was sterile, but unfortunately all the progeny from this cross also proved sterile so that the seeds were useless. It was realised that sterility is inherited, not through the genes themselves, but through the cell cytoplasm of the female line. The new and useless hybrid suffered from cytoplasmic male sterility.

Jones reasoned, however, that there should be a gene that would restore fertility. He found it and incorporated it in the male flower of the pollinating plant so that when the female was fertilised, fertility would be restored to the progeny. It is this combination of cytoplasmic male sterility and a restorer gene that has made possible the development of all the modern hybrid maizes. The cytoplasmic male sterile mutation with which Jones worked was discovered by two Texans, Mangelsdorf



Wheat with rust (USDA photo issued by FAO)

and Rogers. It was called the T (for Texas) strain.

#### The T strain

T cytoplasm was tested and then it began to be used commercially. During the 1960s the number of varieties of maize with T cytoplasm increased steadily. By 1970 nearly every maize farmer in the country was growing maize with identical cytoplasm.

In 1962 a note appeared in a scientific journal in the Philippines, the *Maize Genetics Cooperative Newsletter*. Two maize breeders, Mercado and Lantican, pointed out that in their country there was a fungal disease caused by *Helminosporium maydis* that was particularly virulent on hybrids carrying T cytoplasm. In 1965 they published a second paper on the



The wheat ear on the right has been attacked by black mould (Cladosporium herbarum Fp.) (Photo: Shell International Petroleum Co. Ltd., issued by FAO)

same subject, but in neither did they point out the danger of an epidemic. They did not see it. Neither did anyone else.

Helminosporium maydis, corn leaf blight, had been present in the United States since before the arrival of the Pilgrim Fathers. It was not a serious disease. Each year it would rot a few plants and from time to time it would mutate to produce a more virulent strain, but these never established themselves and they died out. It continued to mutate and the farmers continued to introduce their T cytoplasm hybrids. Scientists had no reason to believe H. maydis presented any real risk to the new varieties, which in tests appeared neither less nor more vulnerable than other varieties. The observations in the Philippines were explained away as being associated with tropical conditions and not typical of the United States. Then *H. maydis* mutated again.

The epidemic began in early spring, 1970, in Florida and spread northwards. *H. maydis* had appeared in a strain that was highly virulent to T cytoplasm. The weather was favourable to the spread of the fungus and suddenly, too late, scientists realised that almost the entire national crop was exposed and vulnerable.

By 1971, conditions had not improved. T cytoplasm varieties were still being grown because commercially they had ousted their competitors. Fortunately in that year the weather did not favour the spread of the disease and it soon became clear that the 1970 epidemic was not to be repeated.

#### The risk to other crops

The subsequent inquiry examined in a general way the principal factors underlying epidemics of crop diseases and then it went on to consider the degree of genetic uniformity that existed among some of the major American farm crops: maize, wheat, sorghum, pearl millet, rice, potato, sugar beet and sweet potato, soybeans and other edible legumes, vegetables and cotton.

Wheat is now widely hybridised. The inquiry found:

"It is too early to say whether hybridisation will directly or indirectly increase the genetic vulnerability of wheat. An obvious analogy can be drawn between hybrid corn (maize) and hybrid wheat. Most wheat workers have concentrated on a single cytoplasmic sterile type, Triticum timopheevi, just as corn workers placed most of their emphasis on the Texas T cytoplasm type that ultimately led to the southern corn leaf blight epidemic. The wheat sterile cytoplasm base is equally as narrow and could be a dangerous weakness. It is already known that ergot will be as serious a problem in hybrid seed production in some areas, as it is in sorghum. Similarly, there could be dangerous increases in loose smut and Karnal smut in hybrid seed production fields. Fusarium head blight or scab may also pose a threat to hybrid wheat, since the open-flower nature of the female lines would encourage infection.

"Widespread use of certain important genetic traits could pose a threat to stable wheat production. Examples of genes now being utilised extensively and often in similar genetic backgrounds are the semi-dwarf genes of Norin 10, the high protein gene of Atlas 66, the light-sensitive genes of the CIMMYT (Centro Internacional de Mejoramiento de Maiz y Trigo, Mexico City) wheats, the compactum gene of Omar derivatives, and the restorer genes of *Triticum timopheevi*."

New, disease-resistant wheat varieties last usually for five to six years, about the same length of time as those introduced in Britain.

Of sorghum, the Report says: "... the genetic diversity in parents is not sufficient to give adequate protection against a catastrophic epidemic and a real threat exists". There is no danger with pearl millet, which is genetically diverse, but of rice: "Over 90 per cent of the southern rice acreage is planted to five varieties and virtually all of the California rice acreage is planted to three varieties. Thus, the genetic base for commercial rice varieties grown in the United States is narrow". Potatoes grown commercially have a narrow base and although the Report concludes that no immediate threat exists, there is a warning: "Are there undescribed diseases or pests now present in Central or South America that could be catastrophic if introduced into North America or Europe? As we increasingly use the species from these geographic areas as sources of resistance to the currently known pests and diseases of the temperate zone countries, we may be unknowingly breeding for susceptibility to an unknown Cercospora or Septoria.... At the present time we rely on chemical protectants more heavily than we should. Breeding to relieve this situation is under way. If new varieties should result in dramatic improvements in yields we may be, in the end, slightly worse off, with perhaps one variety making up 72 per cent of our crop instead of four not greatly different ones".

The US grows 1.4 million acres of sugar beet. Over 90 per cent of the seed is hybrid and produced with the aid of one source of cytoplasmic male sterility. Like potatoes, sweet potatoes are propagated vegetatively. It is not grown very extensively, but in 1970 68.8 per cent of the total crop was of one variety.

For the rest: "... for the soybean varieties currently grown, genetic uniformity is pronounced"; "There is very substantial evidence that the genetic base for peanuts has become increasingly narrower throughout the world wherever higher yielding varieties have replaced the numerous varietal strains once grown by farmers in local communities. This is cause for concern"; "Since one of two germ plasms is present in most pea varieties used for processing today, one can assume a considerable degree of genetic vulnerability to disease or insect attack. Indeed, the disease outbreaks in peas during the past 40 years bear out this assumption"; "The inbreeding of cabbage, broccoli and Brussels sprouts tends to isolate the existing germ plasm into highly uniform genetic subpopulations and tends to eliminate much of the genetic variability"; "Tomatoes are



Top: Primitive wheats from Afghanistan, 1968 Centre: Primitive wheats from Greece, 1969 Bottom: Primitive wheats from Cyprus, 1969 (Photos: FAO)



Collecting samples of primitive wheats from a crop growing in Greece. (Photo: FAO)

particularly important as a source of vitamin C in our diet, and all varieties are highly inbred populations with no significant genetic diversity within a variety. Self-pollination in nature eliminated variability in these crops (i.e. tomatoes, peppers and eggplants) long before man tried his skill." More than 50 per cent of the Upland cotton grown in the US is of three varieties, but the risk is less than it might appear since no single nuclear or cytoplasmic factor has been introduced and so. genetically speaking, the establishment of a single variety does not constitute a monoculture.

#### The Green Revolution

Clearly, several crops of major economic importance to the United States are at risk, but the danger does not end there. The "Green Revolution" plans of the FAO to increase agricultural productivity in underdeveloped countries is based largely on the introduction of new varieties of cereals. These are hybrids bred specifically for certain qualities, such as dwarfism, rapid growth and high yield. Their genetic base is narrow and the success of the programme depends on the traditional varieties, which are highly diverse, being replaced. Tropical climates favour the proliferation of parasites and so the risk is greater there than it would be in temperate countries. Several thousand acres of rice were destroyed in the Philippines in 1969 by blast, a fungal disease, and famines in Asia are frequently the result of crop failures due to epidemics. New varieties that are resistant to some diseases

are vulnerable to others. The risk is particularly great with rice:

"Many of the tall, traditional varieties are being rapidly replaced by a few genotypes. IR8 and other dwarf varieties with almost identical plant types are now being grown on an estimated 20 to 25 million acres in the tropics. This process of what might be called 'genetic suffocation' is likely to continue in coming years....

"The high-yielding varieties seem to be more prone to the attack of certain diseases and insects, such as sheath blight and brown planthoppers.... Several instances of hopper burn in the fields of dwarf varieties caused mainly by the brown planthopper have been recently reported from the Philippines, Indonesia, Vietnam, Korea, Thailand, East Pakistan and India....

"Farmers are increasingly using more fertiliser and are practising more thorough weed control. The resultant luxuriant growth of the crop also favours the rapid multiplication of disease organisms and insect pests....

"With the development of daylength-insensitive varieties and irrigation facilities, the area under continuous cropping with rice has been increasing. Continuous cropping with susceptible varieties of rice increases the likelihood of large-scale build-up of insect populations and disease organisms...."

Just as inbred resistance to diseases breaks down after a few years, so does pest resistance. There is a joke in Pakistan to the effect that the introduction of "miracle" rice has produced a "miracle" locust to eat it.

#### Increasing diversity

At the present time, farmers rely mainly on pesticides to protect their crops from insect attack. To a lesser extent fungicides are used to control diseases. As these lose their biological efficiency and as their effects on nontarget organisms become more apparent it is necessary to find alternatives. Breeding plants for resistance produces none of the side-effects associated with pesticides, but by narrowing the genetic base it tends to exacerbate the problem. The only longterm solution must be to increase the diversity of the crops themselves. Throughout the world today the trend is in exactly the opposite direction.

If plant breeders are to be able to increase crop diversity, indeed, if they are to be able to continue breeding for resistance ahead of the mutating enemy, they must be able to draw from a pool of genes. These can be stored in seed banks, of which there are many throughout the world. Seed banks are not wholly satisfactory, however. Seeds have been lost or lost their viability. They may be discarded as irrelevant to current programmes and as their number increases future scientists may have to work with seeds with which they are unfamiliar and have never grown. Seeds may be stored only for limited periods of time. Then they must be planted and grown to maturity to provide the new stock.

It is much more valuable to retain areas of land in which traditional varieties can be preserved on site. This means that as new varieties are introduced, certain areas must be set aside for the continued cultivation of existing varieties. This is not happening. The new ousts the old to the extent that farmers can afford to buy the new seed and the fertiliser and pesticide it requires; and the aim of development programmes is to enable all farmers to use the new hybrids.

It is important, too, to preserve in their natural state those areas of wilderness from which our major crop plants originated and other areas from which plants may be taken in the future for development into commercial crops.

At present our diet is very restricted. More than half the world's human population depends on rice for its calories and more than 60 per cent depends on rice, wheat, maize, sorghum or barley. The balance of our calories is provided by potatoes, sugar cane, cassava, bananas, peanuts, beans and soybeans. I. V. Vavilov, the Russian geneticist, identified eight major and three minor areas, called "Vavilov Centres", from which he believed our main crops originated. They are all in mountainous areas in the tropics, close to the sites where agriculture was first practised, but isolated by the terrain. Whether his theory is entirely valid or not, these areas are of obvious value. There are other places, though, where cultivated plants grow almost side by side with their wild relatives. In Mexico, teosinte, the wild maize, grows close to the maize fields and from time to time it hybridises naturally with the cultivated variety to give added vigour to the crop.

Yet it is the wild plants that are eliminated as the pressure on available land causes agriculture to expand into every last acre and it is the wild areas that are threatened by developers.

#### Animal banks

Many of the arguments against narrowing the genetic base of crop plants and against depleting further the world's pool of plant genes apply equally to livestock. Here, too, the trend is toward increasing specialisation of breeds and greater uniformity, with a consequent reduction in diversity. With animals, as with plants, susceptibility to disease may be inherited.

Animals have not been bred so intensively as have plants. While many of our crops are now completely dependent on the regulation of their



This hairy little grass is a wild wheat, growing in Afghanistan. (Photo: FAO)

environment by the farmer, so that they could not survive in the wild, most domestic animals revert to a wild state fairly readily. Yet this situation is changing and the demand now is for livestock that will thrive in the controlled environment of an indoor, intensive unit. We may be heading toward a system of livestock husbandry based on stock that cannot live out of doors and that is genetically uniform. As it is, can we be sure that no genetic factor rendered British poultry susceptible to fowl pest during the 1971 epidemic?

Britain controls certain livestock diseases, such as foot-and-mouth, by slaughtering any animal that may have come into contact with a source of infection. Since resistance to disease in animals is often acquired by exposure, the slaughter policy is likely to increase the susceptibility of the national herd. At the same time, by interfering with the process of natural selection which would eliminate from the gene pool those genes that render individuals abnormally prone to the disease, we may be breeding for increased vulnerability. While the policy can be maintained all is well, but should it fail, the result could be catastrophic.

The world has even fewer species of domesticated animal than it has domesticated plants and as with plants, much of the specialist breeding has been performed in temperate regions. Animals adapted to a temperate climate do less well in the tropics and in the years to come it is probable that the world's meat supply will depend more and more on the domestication of animals that are indigenous in tropical areas. At present, these species are wild and their survival depends on the continued existence of their habitat. Again, this means the wildernesses must be preserved.

According to Mr A. H. Boerma, Director General of the FAO, if the world's human population is to be fed. for the remainder of this century total food production must double every 18 years. It is unlikely that this can be achieved, but in our efforts to achieve it we are increasing the area of agricultural land at the expense of the gene pool we need to safeguard the viability of present and future crops, while at the same time the widespread introduction of highly productive varieties narrows the genetic base and so renders crops more vulnerable. Paradoxically, the more successful our efforts prove, the greater the danger of a major collapse.

There is an urgent need to find other ways of increasing the amount of food available without increasing production. We need to reduce waste and to use existing resources more efficiently. We need to widen our range of foods.

Above all, we must halt any further development of the world's remaining areas of wilderness. They are of more than aesthetic value; our ability to feed ourselves in the future depends on them.

## **Propaganda for what?**

#### by John Adams

"The following few paragraphs present the 'official' party line about the role of the economist as the detached adviser on optimal strategies for somebody else's value judgements. Personally, I don't subscribe to this doctrine, and I regard the economist as a special kind of propagandist. But if this were made widely known our propaganda would be less effective, which is why I make this point in a footnote where nobody is likely to read it".

This quotation is a footnote taken from an essay by Prof Beckerman entitled "Why We Need Economic Growth".<sup>1</sup> The passage to which it refers is a discussion of "the contribution the economist can make to the question of whether society is making the best choice between economic growth and the 'quality of life' and what sort of information he needs in order to make a greater contribution".

That economists are nothing more than specialist propagandists is something that people like Joan Robinson<sup>2</sup> have known for a long time. What is revealing about Prof Beckerman's quotation is not his disclosure of this ill-kept secret, but his confession that he does not believe his own propaganda. In her discussion of the way in which values permeate purportedly "objectstudies in economics, ive" Joan Robinson makes the point that neither an economist, nor any one else for that matter, is capable of a value free view of the world. Her objection to socalled positive economists is not that they are deliberately deceiving their readers but that they are deceiving themselves. Prof Beckerman's case is different: he knows that he is not capable of looking at the world "objectively" but chooses to pretend that he is. The arguments, to which he says he does not personally subscribe, play a central role in his propaganda and reappear in other papers he has written without any footnoted retraction, as though he believed them. This is the sort of behaviour that could give propaganda a bad name. The vigorous espousal of ideas in which one believes can be a perfectly honourable activity of which one need not be ashamed. But it is precisely the practice to which Prof Beckerman confesses of misrepresenting one's case for ulterior, unspecified motives, that has caused the word to acquire the unsavoury connotations it already possesses.

In recent years there has been a remarkable increase in the volume of economic propaganda espousing a concern for the environment. That there are indeed serious problems confronting the world few would dispute; the economists have by no means cornered the market in concern. However more than concern is needed. A device very commonly employed by the propagandist is to dwell on what is obviously wrong, win his audience over by sharing its concerns, and then sweep it along into an uncritical acceptance of his solutions. A great tide of concern threatens to engulf us. It has already thrown up a whole host of non-solutions that many people seem prepared to believe in. Let us consider a recent example, an anthology of current economic thought on environmental matters entitled The Economics of Environment.3 It is a matter for speculation whether the authors of these essays are self deceived in the manner described by Joan Robinson or consciously deceiving in the way explained by Prof Beckerman. But in all cases the essays represent propaganda for a cause that is not made explicit by the authors.

#### "History in the making"?

The editors begin on a concerned but optimistic note by telling us that this collection of essays by "prominent, internationally known scholars" is "a piece of intellectual history in the making". In the past, they concede, economists have been remiss in ignoring environmental issues, but now the problems are acknowledged; the profession is "rethinking, extending and revising its concepts, and finding new applications for them". The result, they say, is "reminiscent of the constructive ferment in the profession when Keynesian revolution was in progress". The book is described as "an example of the response of economists to the challenge of environmental degradation". Part one describes the challenge, parts two, three and four, dealing respectively with theory, method and application, contain the response. If it is typical of the response from economists then I fear environmental degradation will be a clear winner. The response is simply not relevant to the challenge.

The first essay "Background for the Economic Analysis of Environmental Pollution", is by Kneese. In it he outlines succinctly the reasons for the irrelevance of the remainder of the book. Emerging very clearly from his discussion of global environmental problems are the two features of the present environmental predicament that distinguish it from similar problems in the past: the growing scale of man-induced environmental change and the growing uncertainty about the consequences of such change. There are many examples. While apparent progress has been made in cleaning up the Thames and other rivers, the oceans are becoming dirtier; while the air in many parts of Britain has been made cleaner, almost the whole of Scandinavia is threatened by the fall out of British atmospheric pollution;

and while persistent toxins such as DDT have "cleaned up" local pest problems, they have also entered global food chains. And as man's abilities to upset natural ecological balances have increased, uncertainties have also increased. Although it is widely agreed that man's activities are producing measurable changes in the composition of the atmosphere, there is little agreement about the consequences of these changes. Some believe that they will cause drastic increases in global temperatures, while others predict that they will induce a new ice age. But still more confess they do not know what will happen; they can only agree that as the scale of man's interference increases, so do the uncertainties. The uncertainties are growing too great to bear thinking about, so for the rest of the book they are ignored.

The theoretical section contains essays by Mishan, "Pangloss on Pollution", Baumel and Oates, "The Uses of Standards and Prices for the Protection of the Environment", Dahmen, "Environmental Control and Economic Systems", and d'Arge, "Economic Growth and Environmental Quality". Mishan's essay is a telling and entertaining satire on the view that free market forces will, if not impeded, produce the best of all possible environments. The remaining three essays, however, are most notable for their tendency to assume away all the important problems and their remarkable confessions of inadequacy. For example, Baumel and Oates, speaking of their own contribution to the literature, say, "It would seem to us that such a blunt instrument as acceptability standards should be used only sparingly because the very ignorance that serves as the rationale for the adoption of such standards implies that we can hardly be sure of their consequences". Since Kneese has already pointed out that the distinguishing feature of contemporary pollution problems is their subtlety, it is difficult to think of any non-trivial uses for the instrument at all.

#### Parable of the astronaut

D'Arge is also extremely modest about his contribution; it is he says "no more than suggestive of extremely feeble beginnings". But in the light of what follows even this claim seems unduly confident. The first part of the essay is devoted to a parable of a lost astronaut. The most remarkable conclusion he derives from what he calls this "extremely naive model" is that if the astronaut's objective is to prolong his life as long as possible he will consume his limited supplies at the minimum subsistence rate. As a bleak truism it is rivalled in its usefulness only by the Keynesian dictum that in the long run we are all dead. All other propositions derived from his spaceship model have, he informs us, "at best very tenuous connections with reality".

Having decided that his spaceman does not have much of a future, he rather abruptly abandons him in favour of another more cheerful parable-a modified Harrod growth model. The principal reason why this second parable offers us a much more hopeful future is that it assumes a world in which resources are in infinite supply. In a final section dealing with the problem of controlling international pollution he again assumes away the core of the problem that he is confronting. He suggests that countries dependent on trade, such as Britain, cannot afford to attack problems of pollution unilaterally because in so doing they would jeopardise their price competitiveness. But he ignores

the question of externalities which features so prominently in the rest of the book, thereby begging the question of just who in Britain cannot afford to control pollution. It is surely not the recipients of the pollution, who are subsidising the exporters with their uncompensated suffering, who cannot afford it.

Dahmen is perhaps most notable for his refusal to follow his argument in the direction in which it leads him. He sees the "disintegration" of economic decision making as the principal cause of environmental deterioration. As economies grow in scale and complexity, decisions are increasingly made with reference to only a small part of the total system. Externalities arise because there is no adequate central authority to deal with the compound consequences of large numbers of small decisions. But although he argues that the magnitude of the externalities is directly related to the scale and complexity of the economy, he refuses to see scale and complexity themselves as problems. Instead he considers various methods for devising some sort of central authority which would be able to restrict the harmful externalities without impinging upon the efficiency of the disintegrated decision-making process. Not sur-



prising y his conclusions are rather inconclusive.

In the sections dealing with methodology and application there is no longer any pretence at a discussion of the larger problems of environmental deterioration. The essays in these sections are all concerned with the problems of measuring and regulating public goods and "bads" on a micro scale; these are problems, the editors tell us, that are "central to rational economic policy".

### "Rational" policy based on ignorance

Bohm, in "The Problem of Estimating Demand for Public Goods", deals with the tricky problem of finding out how much public goods are worth to peop e. The difficulty seems to be that there are no market prices for such goods and people do not answer honestly questions about the value of such goods. Their answers, not surprisingly, depend on whether or not they will have to pay for them. They will claim to value highly things that they want but will not have to pay for, and place a low value on things that they think they will be obliged to pay for. Bohm's solution to the problem is to confuse people by making it impossible for them to know whether they will have to pay for the goods in question or not. The idea that "rational policy" could be based on a questionnaire that is based on ignorance is simply silly.

The essays by Malinvaud and Maler, respectively, "A Planning Approach to the Public Good Problem" and "A Method of Estimating Social Benefits from Pollution Control", are also divorced from reality. They are both sophisticated mathematical exercises. Malinvaud's model convinces the reader that the "problem" is extremely complicated when a society contains only two people and two goods. Although he suggests that his model can, in theory, be expanded to deal with m individuals and n goods, such an expansion, in terms of both its data computational requirements, and would be quite impracticable for dealing with any real problem. Maler builds his complex econometric structure on the assumption that the quality of a sport fishery can be measured by the number of fish caught per unit of time fished. The sport fishery case was, of course, chosen by Maler only as an illustration of the method. But what it illustrates is that the method can deal only with totally unreal problems. Environmental problems are characterised by myriads of subtle interrelationships. Methods which must assume them all away cannot be much use in dealing with such problems.

The ambition of Lave and Seaskin in "Health and Air Pollution" is to convert deaths caused by air pollution into dollar sums that they can enter into a cost-benefit table. They succeed. They find that the cost of morbity and mortality attributable to air pollution in the United States is \$2,080,000,000 per year. The only possible response to such a number is blank incomprehension. Yet such numbers, it is argued in this book, are the foundation of "rational policy".

The major fault of the book was hinted at in the introductory essay by Kneese and Bohm. All the essays represent attempts to find new applications for old concepts. Among the principal features of "the environmental problem" are scale complexity, uncertainty and growth. They are ignored in The Economics of Environment and by all economists, qua economists, because economics has no way of dealing with them, except by putting all its conceptual machinery into reverse. If a fat man consults a physician whose dietary theories are based on the principle that the optimum diet is the maximum diet, he is unlikely to get any helpful advice. The doctor will treat all the man's symptoms of obesity, and perhaps even sug-"residual gest solutions for his excrement removal problem". But so long as he ignores the cause of the problem his advice can only aggravate the man's condition. The economist has a medicine chest full of growth models, and a simple faith in the insatiability of man's appetites; his most common prescription for the environmental problems associated with mass gluttony, is forced feeding.

#### Cleft stick for anti-growthmen

A so-called anti-growth economist such as Mishan is caught in a cleft stick. As an economist he finds that his conceptual heritage consists of mathematical models which optimise monetary indices. Having concluded, rightly, that these indices, as they have been calculated traditionally, are useless as measures of welfare, his solution is to calculate them differently. For the anti-growth economist, man remains an income maximiser; he simply must be induced to revalue the terms in his income function. The index to be optimised must include not only material goods but spiritual and aesthetic goods as well. Not only clean air and fresh water but things like "beauty", "romance". "security". "contentment", and "a sense of community" are externalities which must be included in the function. Formulating the problem in this way permits the economist to apply all his old concepts to the pollution problems. He can reorder consumption patterns by applying appropriate taxes and subsidies; thus by raising the price of material (polluting) goods and lowering the price of non-material (non-polluting) goods he can divert consumption into envinronmentally desirable channels. It also gets round the awkward problem of having to advocate retrenchment. "Growth" and "progress" are still perfectly possible; they are simply redefined.

But there is a basic contradiction in this approach. Spiritual and aesthetic "goods" do not have cash equivalents. Indeed they are antithetical to the very idea of cash equivalents. The economist is most ingenious in the way in which he manages to attach cash values to non-material goods. Consider a rather extreme example in which a prosperous business man decides to give up his job and house and car and television and all his extravagant and polluting habits to become a hippy; the economist attaches a cash value to the nonmaterial (non-polluting) satisfactions of his new way of life by comparing his material standards of living before and after he has become a hippy. The difference is the opportunity cost of being a hippy. Thus the only way desirable non-material goods can be given a cash value is by relating them in a quite arbitrary way to the undesirable material goods. The undesirable becomes the vardstick by which the desirable is measured. Further, the only incentives that the economists can employ in order to induce people to become less materialistic are materialistic incentives. For these to work, they depend on the very attitudes that they seek to alter.

#### Logic of choice

"Economics proper is about the logic of choice", Prof Beckerman tells us in his inaugural lecture. This is true so far as it goes but elsewhere in the same lecture he enunciates a very important qualification: "It is a basic proposition of welfare economics that commodities cannot enter directly into any social welfare function but only through their contribution to somebody's utility function". Thus economics proper is about the logic of choice among commodities which can be valued in terms of cash.

"Utility", says Joan Robinson, "is a metaphysical concept of impregnable circularity; utility is the quality in commodities that makes individuals want to buy them, and the fact that individuals want to buy commodities shows that they have utility". The price that an individual is prepared to pay for something is a measure of its marginal utility and a rational economic chooser will spend his money on a collection of commodities that will maximise his total utility. This simple principle is a useful rule for both guiding and explaining the behaviour of people faced with simple uncomplicated sets of choices among material commodities. But where different people have different amounts of money to spend, and where significant numbers of people derive little or no additional utility from the consumption of ever more material commodities, then the whole apparatus of decision making based on utility becomes useless for making decisions affecting the collective welfare. The "collective welfare" becomes abstraction incapable of meaningful quantification because it means different parts of collectivity. The larger and more disparate the collectivity the more remote the possibility of a consensus regarding the meaning of any aggregate index of welfare.

Economists, and especially Prof Beckerman, become indignant whenever this limitation is pointed out. Prof Beckerman declares "Professional economists have always been aware that economic welfare is not the whole of welfare". But neither the pro-growth nor the anti-growth economists seems prepared to accept this limitation as final. Prof Beckerman notes optimistically that some "stimulating pioneering work" has already been done toward overcoming it. The "valuation" of things such as "beautiful views", "quiet countryside areas" and even risk to the life of "the average individual" are just some of the utilitarian advances which he anticipates.<sup>4</sup> Although Mishan on occasion betrays doubts he too advocates the relentless pursuit of values which have "escaped the pricing system":

"If the problem is to be tackled by society, the economist must persist in revealing the nature of the beast, and must suggest the circumstances under which meaningful magnitudes may be attributed to external effects. Nor should he shirk detailed description of cases wherever the social consequences that escape the pricing system appear to be so involved that a comprehensive criterion for evaluating them cannot, *as yet* (my italics), be satisfactorily evolved".<sup>5</sup>

#### Propaganda

At the beginning I asked "Propaganda for What"? Although economists argue fiercely among themselves over issues that their "science" will always be too crude to resolve, they are agreed on one vital, unifying point. What the world needs is more economics. They are above all specialist propagandists for their own speciality.

This is not to say that none of the economists discussed here has any insights of value. The following passage from the essay by d'Arge for example is worthy of contemplation. He suggests that pollution might be reduced by investments that "are directed towards inducing the populace toward consuming less time devoted to material consumption and more time toward services, solitude, or recreational-aesthetic pursuits involving little or no waste generating goods".

It is a simple and sensible idea, but when dressed by the language that economists too often use when talking to each other, it is only barely recognisable.

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#### Man's Environmental Predicament

An Introduction to Human Ecology in Tropical Africa

#### D. F. Owen

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### Down to earth

#### **Frying tomorrow**

The fish of the future will be one of the Tilapias, *T. melanopleura*, *T. mossambica* or *T. zillii*, now widely farmed in the tropics. They are deep bodied like bream, with large, easily found bones, firm and flaky flesh and a delicious flavour. Moreover they are vegetarians starting at the bottom of the food chain with a production rate of up to 5,500 lb of fish per acre every year, in Rhodesia, Uganda and other countries where the  $55^{\circ}$ - $75^{\circ}$ F they need is easily provided.

Whatever may be said in America on growing Tilapia fed on lawn mowings in small geodesic domes over children's paddling pools, when the temperature drops to 50°F they die. In our climate they could grow only in something like a small swimming bath with a greenhouse over it, warmed by waste heat from a power station. This would serve for the experiments that must replace speculation before we can end the pollution of rivers by heat from the 1,500 million gallons a day of cooling water from power stations and industry. For heat can be as poisonous to British fish and wild life as toxic metals.

In Britain and Europe fish grow only between April and October, so the average yield is 300 lb an acre, with the sewage fed ponds at Munich holding the record with 500 lb of carp from this space in a year. It takes Europe three years to grow a saleable carp, Israel takes 1–2 years, but Africa can grow a  $\frac{1}{2}$  lb Tilapia in nine months. So the only fish that it pays to grow in our climate are those which are expensive in relation to their weight, like the trout we import from Denmark, fed on fishmeal and chopped raw sea fish, for trout are carnivorous.

The vegetarian Tilapias will fatten on cut foliage as well as waterweed and algae, so sweet potato haulm, yam leaves and fodder grasses are thrown in to supplement what can be grown in the ponds by animal or artificial manuring. The droppings of the vegetarians grow tiny mobile plants or "phytoplankton", eaten by minute crustaceans known as "zooplankton" that feed plankton-eating Tilapia such as T. macrochier, T. nilotica and T. nigra. The final link in the chain is fertile mud to spread on the crops round the fishponds when these are drained every 3–4 years.

The kind of sewage effluent rich in nitrates and phosphorus that grows algae "blooms" in rivers, could grow even more phytoplankton and zooplankton to graze it with cooling water enough to hold the 70°-75°F at which Tilapia feed fastest even in the depths of winter, with less in summer. Lorry loads of grass mowings from parks and sports grounds could replace yam leaves and Guinea grass in spring and summer, with the vegetarian Tilapia harvest in the autumn when the supply ended. Skilled derris application to stupefy the fish for easy netting of one species makes it possible to leave the others to recover and grow larger.

Rearing "day-old Tilapia" like chicks would need tropical fish tanks and the skills of those who rear guppies, but the major problem would be capital investment. The ponds themselves, machine excavated to about five feet deep and polythene lined, would be relatively cheap, but even  $2\frac{1}{2}$  tons of fish a year would have a struggle to pay the interest, upkeep and depreciation on an acre of greenhouse, or a geodesic dome to cover that area.

In Britain we have a Municipal "fish farm" at Broxbourne, where the Middle Lea Main Drainage Scheme turns effluent with a Biochemical Oxygen Demand of 10 mg per litre, the same suspended solids and a generous supply of dissolved plant foods through eight 20 acre ponds each a metre deep. It leaves the last pond with 4.5 BOD and of drinkable quality —the difference has gone to feed the plankton that feed vast shoals of roach up to  $\frac{1}{2}$  lb weight.

There is no record on increase in pounds an acre a year, for all are used for stocking the Metropolitan Water Board's reservoirs or LCC lakes. Roach are easily raised on this system, but they taste of mud and are full of small bones, as every angler's wife knows if she cooks her husband's catch.

The native fish that would repay research is the minnow, *Phoxinus phoxinus* which can grow six inches long, but 3–4 is more usual. These grow faster than roach and are zooplankton feeders by choice, though they are ideal to keep in ponds or water butts to destroy mosquito larvae. They are river fish and the steady current of effluent through ponds like Broxbourne's is just what they prefer.

Their advantage lies in flavour, for they were served as "Thames Whitebait" a luxury dish at riverside inns in the days of "Three Men in a Boat". Sold in bulk like sprats or converted to "Freshwater Fish Fingers", they could provide good food from the effluent that causes eutrophication in our rivers. Their problem is that if land near a town sewage works is going to be worth £50,000 an acre for building, not even Munich carp, Arkansas Catfish or Rhodesian Tilapia vields can pay interests at 83 per cent on local government loans to buy it, apart from other costs.

Minnows can be bought at aquarium shops and timing how long inch-long specimens take to reach four-inch size on a diet of daphnia and cyclops and eating them like sardines on toast, will teach far more about backyard fish culture in Britain than any American magazine article.

Still more could be learned by a biology class with samples of effluent from their local sewage works, by observing the diatom and zooplankton growth round the year at the 55°-75° water temperatures for Tilapia. It might be necessary to import African plankton to increase at the heat for optimum fish yields. Again there is need for research to find if it is possible to hold that 50° for survival on a freezing night in January with the ponds full of steaming cooling water and the Tilapia munching thawed out savoys with a drifting snow warning on the radio.

If we could cut out the greenhouse or domes, then the next twenty years could see the Central Electricity Board launching "High-Speed Rock Salmon" and all over Britain Tilapia would be Frying Tonight.



#### In which the Author discovers some Effects of an universal Addiction to Touring.

The Automobilians are not totally blind to the Shortcomings of their familiar Haunts. This I deduce not from their faint Efforts to ameliorate them, so much as from their Eagerness to exchange them. Every Man when he is at Leisure from his Business strives to put as many Miles as may be betwixt his Home and himself. Nay, the very word Holiday signifies among them a Sojourn away from Home: so that one who works but five Days in every Week, or less, will complain that he hath "had no Holiday this Twelvemonth", meaning thereby that he hath in that Time slept under no Roof but his own. I was curious to know what they seek upon these Grand Tours of theirs, and whether they find it: and to this End made inquiry of many, and accompanied with some upon their Journeyings.

The foremost Desideratum appears to be climatick, namely, an unstinted Abundance of Sunshine, Automobilians of the lowest Sort, indeed, ask no more of their Tour than this, to lie Cheek by Jowl upon a sandy Shore, in such few Cloaths as satisfy but the barest Demands of Modesty, and so roast their Bodies to a Brownness which will, upon their Return home, proclaim their Travels to their envious Neighbours. Few of the more temperate Coasts of Automobilia have escaped being turn'd into the Ovens wherein these human Loaves may be bak'd: and where a few Years past the simple Fishers beached their Boats and spread their Nets, those same Fishers now earn their Livelihood by making Catches of a far different Sort, and ply the unworthy Trades of Waiter and Guide, Pimp and Pedlar, to minister to the swinish Luxury of their Invaders.

The inland Parts are not spared their Share in these seasonal Immigrations, which fall, however, chiefly upon those Regions as yet least tainted with the characteristick Vices of the Nation. For as an old Lecher must needs satisfy his jaded Lust with the Deflowering of Virgins, so these Tourists (as they are call'd), wearied with the Noise and Stink and Ugliness and Hurly-Burly of their native Place, seek out the remaining Refuges of rural Felicity and Repose: and, when they find one, demand Lodgings and Coffee-Rooms, mechanical Carriages and smooth Roads, Shops and Pleasure-Houses and publick Privies. These Demands being satisfy'd, they grumble that the Place is spoil'd, and pass on like Locusts in search of new Fields to devastate: but leave behind them a Peasantry corrupted by the specious Allurements of the Town, abandoning their Freeholds for a more lucrative Slavery, and prostituting their ancient Crafts to the Production of showy Gewgaws and catchpenny Trinkets for the credulous Traveller.

The Beauties of the natural World are under Assault throughout this Land: for scarce a Mountain stands but some greedy Merchant would fain level it for its Stone and Minerals, and scarce a River flows but some Manufacturer longs to suck it dry for the Augmenting of his Production. And since Rarity was ever a great Part of Value, the Automobilians will go many Miles to view some natural Phaenomenon which in a more fortunate Nation would attract very little Attention by Reason of its very Commonness. Thus, wherever they find a great Waterfall, or a Cragg affording an extensive Prospect, or a still Lake embosom'd amid Trees or Hills, there they gather by Dozens or by Hundreds (provided only there be a good Road near at Hand), and so sit eating and drinking, and reading the Newspaper, and listening to mechanical Musick or Reports of Horse-Races and Games at Foot-Ball. Others will travel yet further afield to view wild Beasts in their Haunts, until by the Multitude of their Carriages the Antelope is driven from the Waterhole and the Lion from his Prev. The Grass dies beneath their Wheels, and their Passage is mark'd with a Trail of discarded Bottles, Packets, and all Manner of Nastiness.

Some again, find their Pleasure in viewing the Arts of Man. Great Lords abandon their ancestral Seats to Crowds of Visitors, the Shrines of ancient Piety are besieged by Armies of curious Atheists, and every Town or Village which retains some few relicks of a more gracious Age must submit all Summer long to such a Concourse as would make Bartholomew Fair seem a Desert. In the Museums and Galleries, many a Painting or Statue is view'd by more Folk in a Twelvemonth than would formerly have seen it in a Century: but I am doubtful how far this Multiplication of Impressions may be suppos'd to propagate true Appreciation. Indeed, most of these Spectators would gowk at a Hayfork or an Inkhorn if they were assur'd it was the only one of its Kind. Beauty is to them a mere Commodity; and every Man has a Right to as much of it as he can buy: but I know not how long any will remain to be sold. Nicholas Gould

#### How to play the Environment Game Theo Crosby

The effects of bad planning are all around us. Theo Crosby explains in words and pictures the rules, tactics and theories of the 'game' of redevelopment and suggests ways in which we can affect the result. This book is published in association with the Arts Council; the exhibition on which it is based is now showing at the Hayward Gallery, London.

Publication: 26 April 1973 80p

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### **Conservation Society**

#### **Population Day**

By now all regular readers of the *Ecologist* must be pretty ill-informed on environmental issues if they do not know that Saturday May 12th is to be Population Day. Hopefully, indeed, a large majority will have ensured that at least one of the Call for Action Forms such as were enclosed in their last issue has been sent in, complete with 25 signatures. If not, there should still be time before the day itself.

The Government has to be shown the strength of public support, and all the activities leading up to and on Population Day, trivial and serious, are designed with this in mind. Politicians listen mainly to one argument, on pain of death to their aspirations if they do not: the argument of the vote. Hitherto there has been a fear that they will lose votes if they advocate a population policy (caricaturised in Maudling's phrase "a policeman in every bedroom"). We have to show them, nationally and at local level, that they will lose a great many more votes from this year of 1973 onwards if they do not, in the well-known words "declare publicly that the size of the United Kingdom Population is a rightful concern of Government", "voluntary, and introduce wellplanned and effective action now to halt population growth and to stabilise at a level that can be sustained".

It is unfortunate that the Government did not accept in full the Lords' Amendment to Clause 4 of the National Health Service Reorganisation Bill, to provide all advice and the supply of contraceptive substances and appliances free of charge, as a prescription charge will normally be paid (from April 1974). However, as the wording on the back of the petition forms makes clear, a Population Policy involves far more than family planning. Traditionally, birth control has been "sold" solely on the grounds of benefit to the individual family; now it must be sold, in schools and in the population market-place, on and environmental grounds as well.

Population stabilisation is no panacea as we all know, and the telling words in the call for action above are

"at a level that can be sustained". Sustainability, as the "Limits to Growth" study showed, depends on much more, on controlling growth in many other areas of human activity which harm the environment. If Population Day succeeds in its aims, it will be but the end of the beginning of the battle for survival, but it will be that: non-industrial countries may for instance take note that one densely populated industrial country has set its own house in order before preaching to them at the United Nations World Population Conference in 1974.

### Activities in relation to Population Day

The sponsors are the Conservation Society, whose members Lyn and Colin Groves had the original idea, Countdown Campaign with the FPA, Doctors and Overpopulation, Environmental Communicators Organisation, Population Stabilisation, the Birth Control Campaign, and Friends of the Earth; but many other bodies have now given their support.

Events are planned to be multicentric, having an impact over the whole country and not just confined to a conventional rally in one place such as Trafalgar Square. The "Call for Action" is to be presented between 11 a.m. and noon on May 12th to Mayors, Council Chairmen, Health Committees and Members of Parliament, and to the Prime Minister, Lord President of the Council, Secretaries of State for the Social Services, Environment and Education. An all-party Early Day Motion will be tabled in the House of Commons, a Symposium has been arranged by the BMA on May 11th, and there will be other central meetings in London. Activities are planned in all parts of the country -it is not too late to contact the local organiser in your town (through the National Secretary, Lyn Groves, 26 Halifax Road, Cambridge) and discover what you can do locally.

These may include meetings, symposia, marches, "pram parades", "population bombs", digital clocks to indicate world and national population growth and exhibitions—arranged according to local conditions. Regular Briefing Notes, Fact Sheets, and other papers have been sent to each regional organiser and they can supply you with Population Day leaflets, posters, car stickers, button badges, petition forms and headed notepaper.

We hope to get as much free mileage from the media as possible, and this depends on being different. Although Population Day has a serious aim, and well-researched supporting documents will be available for those in authority, it is a fact of 20th century life that the latter often need a nudge from the general public via the mass media before they will act. So wellplanned stunts and slogans are unavoidable-regrettably perhaps, bethe great danger cause of of to misunderstandings due oversimplification and the involvement of individuals or groups with different axes to grind. Some of the antiimmigration backlash may be prevented by making a special effort to recruit representatives of all races now living in this country, to join in.

Statements should be positive. referring for instance to improving the quality of life and preserving the countryside, and not negative; children, pregnancy and family life must not be put in any context that implies disapproval; and all statements must be accurate and supported by quoting your sources. It is essential not to fall for "Aunt Sallies" about coercion, baby licences, and contraceptives in drinking water or bread. (Only if voluntary measures are brought in too late will more stringent ones be unavoidable.) Avoid also antagonising those potential supporters who had more than two children in the past, when the problems were less widely understood. A useful question and answer leaflet, and fact sheets, are available from the National Secretary.

In short, we live on a finite planet, "spaceship earth", and cannot go on adding 200,000 passengers daily for ever—not all possible technology, husbanding of resources nor recycling can alter that. Our small islands likewise have a fixed land area and already have to import resources of all kinds including food, from a world gone mad with growth mania. These stark facts are the ground and substance for Population Day.

John Guillebaud

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### Friends of the Earth

#### **Digging** around

It makes sound sense to find out what resources there are available to us in the rocks and soil over which we build, live, travel and play. But is this the best way to go about it?

In February, 1972 the Government passed an Act in which it set aside £50 million of public money from the Treasury as a "contribution towards expenditure incurred on searching for, or on discovering and testing, ... any natural deposits capable of being lifted or extracted from the earth ...".

The DTI's Mineral Development Division believes (along with the mining industry of course) that Britain has considerable potential for mineral development and they want to know where these deposits are "so that they can be used to best advantage" (brave words from the DTI Press release of 8.7.71).

Consequently the DTI is now handing out 35 per cent subsidies of exploration and evaluation costs incurred by companies who need only form a UK branch to pass the first basic test for eligibility for grants.

How does the scheme work? At present confined only to non-ferrous metal ores, barium minerals, fluorspar and potash (potash? There is a long term world glut of the stuff, but no matter...) the wording of the Act allows the Government to extend it to any other mineral—even to hydrocarbons.

The DTI is the operator, assisted by the IGS who must receive and have access to all technical information obtained by a company working with financial assistance. A company can file claims for payment of grant for an approved work programme at minimum periods of six months, entering then, together with the proof necessary to satisfy the DTI that the work has been carried out, the relevant information obtained. Thus the grant gets paid as the work is completed; more assistance may be available if the original cost estimates are forced up by unforeseen circumstances.

Should an exploration programme

so funded lead to commercial production of minerals within 12 years of the last payment of contributions, then the assistance given by the Government is repayable with interest by the company. In this twisted way the government hopes to see a large bank of information accrue to the organisation directly responsible for geological survey in Britain, i.e. the IGS. The information, however, derived from private companies financed out of the public pocket comes too late for any long range planning to take place on what we, the nation, should do with the discovered resources.

But that is only the beginning of the odd situation that arises from what is, (despite other good intentions), primarily a Government effort to satisfy the ever-active mining industry lobby that saw new mining legislation proposals go under in the last government, and then protested as investment grants were butchered from June 1970. The mining industry, do not forget, just like most of us in this time of prices and incomes freezing, believes it has a "special case" not satisfied by enormous capital allowances, double taxation relief, priority by reason of uniqueness of location and so on, but which should, in its opinion, at least extend to better rights of access in exploration, complete tax holidays in early mine development and the like. For look at the following points.

There is nothing Machiavellian in the fact that most of the mineral exploration concentrates on National Parks and other designated areas. There is, though, in the fact that the Treasury could fork out £50 million for mineral exploration, but find less than 7 per cent of this for National Park expenditure in 1971-72.

There is something horrific, also, in the DTI's faith that present planning controls will keep developments under the thumb. This scheme is administered without reference to land use in the relevant area other than notification to the Nature Conservancy of the areas involved. And the DoE, with ultimate responsibility for planning (although faith here is perhaps even more inappropriate) might not come in at all even with development of a mine. No application *has* to be called in for ministerial decision. Perhaps the Stevens Committee on minerals planning control (with whom, by the time you see this, FOE representatives will have followed up orally our extensive submission of written evidence) will be bold in their recommendations and make things a little more equitable.

But the information from this exploration "is given in strict confidence". So far as can be gathered this Commons assertion from the former Minister for Industry is the only justification (sic) for this secrecy. You and I are not allowed to know what company is working where, what companies are receiving grants, what information has gone to the DTI or the IGS, or how much the companies are getting.

And it will be quite a while before any of this information is published. The DTI's "guide to industry" on this scheme allows for the release of the details only if a company defaults on any part of its grant contract, or, after two years have passed since the DTI notifies the company that repayments of grant are not required, or, after 12 years have elapsed since the last contribution was paid and no mineral development has occurred.

Under these arrangements, commercial interests (the reason for this wall of secrecy on national resources) are coddled in velvet rather than "protected". Also the scope of the Act is enormous. The word "testing" has been construed by the DTI to include mineral processing and metal extraction assessments, pilot plant operations, and costs of feasibility studies to decide whether or not to mine, and if so, precisely how it should be done. This means that the public is paying 35 per cent of the costs right up to the final moment-the risk in the high risk capital normally outlayed by industry in mineral exploration has been completely removed at our expense.

The returns to the nation in this situation are poor. The cake (which will keep well and improve in value if conserved) is plundered by the few to the detriment of many, and we shall end up with a bunch of geological information that is interesting for its historical value alone. Simon Millar

### Books

#### **Finnish Stockholm**

THE ENVIRONMENTAL FUTURE edited by Nicholas Polunin, Macmillan £9.25

This book contains the proceedings of the first International Conference on the Environmental Future held in Finland from 27 June to 3 July 1971. The object of the meeting was "to bring together for free discussion in a stimulating atmosphere, as complete a range of leading experts as possible, covering between them all the main aspects of environmental study and implications. Their chief tasks were, (a) to give specialist accounts of the global situation in their fields, (b) to prognosticate what in their considered opinion was most likely to happen in the foreseeable future and (c) to suggest what can and should be done to alleviate environmental degradation and to avoid concomitant catastrophes to Man and Nature." This was a particularly useful undertaking since the United Nations conference on the Human Environment, due to take place in Stockholm a year later, was very much a governmental affair and provided no opportunity for the free expression of views by scientists specialised in environmental problems.

The meeting appears to have been remarkably well organised; the Prime Minister of Finland himself, H. E. Dr. Ahti Karjalainen, took on the Chairmanship of the Finnish organising committee. The participants were drawn from among the leading figures from all those fields associated with the environmental problem.

The proceedings were edited by Nicholas Polunin, editor of the journal, *Biological Conservation*. The resultant book is possibly one of the best source books I have come across both for detailed and up to date information on practically all aspects of the present environmental crisis as well as for high calibre debate on how this information should be interpreted. It is divided into 17 sections on different subjects plus a final section on education and legislation. Each subject is dealt with in a Keynote paper, in each case presented by a leading authority on the subject, followed by a discussion.

The Background Paper was very appropriately written by Sir Frank Fraser Darling. Professor Bryson presented a particularly interesting article on Climatic Modification, in which he emphasised the frightening reality that man is "so numerous, and so profligate in the use of energy, that he can now change the climate of the world." This was followed by a heated discussion on the effect of contrails from jet aircraft, during which Bryson pointed out the already important effect of jet planes on particulate pollution. He remarked that in Iowa City, for instance, the condensation trails "are the equivalent of twenty overcast days per year. This is significant when you consider that the total number of overcast days per year in the vicinity is only 120 or something like that-to which should now be added another 20 due to condensation trails."

During the debate on the possible effect of SST's on the ozone layer, Professor Polunin read the following extract from a letter from Professor Johnson: "Oxides of nitrogen are a very important variable in this problem and they have been either overlooked or incorrectly discounted by SST planners. Ozone is very strongly reduced by NO and NO2; but there are many technical questions, as, for example, how fast are NO and NO<sub>2</sub> converted to nitric acid in the stratosphere? I think it is clear that if stratospheric ozone were reduced almost to zero (a most unlikely prospect), then the radiation between 240 and 300 nm would destroy most living things on the surface of the earth. However, what would be the biological effects of reducing the world-average ozone from 100 per cent to 98 per cent, to 95 per cent, to 90 per cent, to 75 per cent, to 50 per cent, to 33 per cent? The absorption spectrum of ozone is such that these reductions of ozone would greatly increase the radiation between 280 and 300 nm at the earth's surface."

The conclusions reached by Dr. Vallentyne in his paper on Fresh Water Supplies and Pollution were particularly pessimistic. "As a result of power struggles during rapidly changing times, one can expect increasingly serious breakdowns in countries with a relatively rapid technological build-up. There will be ever-present dangers of land misuse that could be catastrophic during times that are calling for increased production of food. Famine, however, is more likely to result from disruption of transportation per se." ... It is probable that at least one major global outbreak of disease will occur before the year 2000. The consequences are difficult to predict; however, the focus of origin will almost certainly be somewhere in Asia. probably in south-central Asia. Nonviral infections can probably be contained or largely limited to the continent of origin. Viral infections, on the other hand, can spread with disastrous consequences around the world. The reasons for this are the comparative ease with which viruses can be distributed in water-supply and sewage systems." He finishes by suggesting "that we may be living in some kind of Faustian world, in which we do not solve our problems, but merely replace them with other problems."

Professor L. Kassas from the University of Cairo was clearly the ideal person to deal with the ecological consequences of water projects since he has watched very closely the much-publicised effects of the Aswan Dam.

Perhaps the most outspoken of all the participants was Dr. Wurster, on the subject of the effect of insecticides on human health. He pointed out that "Several studies of the physiological effects of DDT, Aldrin, Dieldrin, and Endrin have involved human subjects (Jager, 1970; Hayes et al., 1971). These studies were deficient in experimental design, failed to consider the most relevant parameters, and were more concerned with levels of CH storage than with physiological or biochemical effects. They establish only that under current environmental conditions. excluding accidents and suicides, members of the general population are not dying of acute CH insecticide poisoning nor are they suffering overt, toxic symptoms. Long-term, chronic effects were inadequately studied.

"To be more specific, the investigations by Hayes *et al.* (1971) and those conducted in the Shell Laboratories (Jager, 1970) had only men in their samples; women, children, infants and foetuses were not studied. The small numbers of men involved were completely inadequate to evaluate biological events (such as carcinogenesis or mutagenesis) that may occur once in many thousands of individuals. Periods of exposure were too short to detect biological effects involving induction periods that may be many years or decades. Emphasis was given to reviewing the men's attendance records at work, and many of the other simple blood and other routine tests performed were largely irrelevant. When two of 22 men who were being fed high dosages of DDT became severely ill after months on this diet, they were dropped from the experiment and excluded from the data with the conclusion that 'at no time was there any objective finding to indicate a relationship between illness and DDT storage' (Hayes et al., 1971).

"It is unlikely that these tests on men could have detected behavioural changes, hepatic enzyme induction, carcinogenesis, mutagenesis, or other effects that might be anticipated in man because they occurred in experiments with laboratory animals. The authors concluded, nevertheless, that exposure to these CH insecticides involved no ill-effects on human health -a conclusion that has been widely quoted by the pesticide industry. It seems remarkable that, although hundreds of millions of people have been exposed to these substances for more than two decades, their effects have been so inadequately tested by such primitive studies on such a small number of men!"

He also pointed out the tremendous inertia within our society that prevents the withdrawal of pesticides, even ones that have been proved harmful.

"As for steps that should be taken by governments, it seems that so far the main steps taken by the United States Government have been to generate propaganda. Thus the US Department of Agriculture has the habit of cancelling certain uses or registrations of various pesticides. They usually cancel those that are no longer used, which makes good publicity and doesn't change usage patterns at all. They have hundreds and hundreds of such registrations and, when enough public pressure builds up, they cancel 50 or 100 and then the newspaper headlines say, 'Department of Agriculture bans 47 uses on 32 different vegetables', which sounds great. But it doesn't do anything, it's a completely useless step. The intricacies of Federal Law are such that the effect of cancellation in any event is to do essentially nothing, because all it does is initiate an administrative procedure that goes on virtually forever without any conclusion. There has never been a cancellation proceeding that has gone to termination, except where the manufacturer agreed to it. In other words, there have been many so-called steps taken by the US Government to restrict the use of DDT: but as of this moment there is no restriction whatsoever in the United States at the Federal level on the use of DDT. There are some state restrictions, particularly in Wisconsin, to a lesser extent in New York, in Arizona, in Illinois, and a few other states; but at the Federal level it's been all talk an no action."

Professor Kovda's paper on World Soils and Human Activity was highly informative as was Dr. Worthington's paper on Sustained Biological Activity.

David Brower was the ideal person to deal with what organisations and industry should do and his paper was followed up by a number of actionorientated talks which neatly rounded up the conference.

Edward Goldsmith

#### **Towns or Cars ?**

TOWNS AGAINST TRAFFIC. Stephen Plowden. Andre Deutsch £2.75.

For many people it remains inconceivable that so many highly paid, trained and obviously skilled transportation experts can be so consistently and totally wrong. Billions of pounds have been spent all over the world by traffic engineers attempting to ease congestion, improve the environment, relieve residential roads of the burden of heavy traffic, prevent the decay of urban commercial centres and generally provide an adaptation of traditional city forms to the demands of the motor-car. Almost without exception the intended results have failed to occur. More often than not the results of the exercise have been the direct opposite of those intended.

Perhaps there is deep in the psyche of modern man a wish that the world should collapse and allow him to retreat into a primeval state where life is less complicated and the rules for living are more readily understood. Or perhaps modern man is just plain dim, his mind eroded away by the repetition of television jingles and the absorption of mono-sodium glutamate. Whatever it is nothing seems to shake the faith of those in power in the ability of traffic engineers to manage the miracle if they are given just one more try. It is as though a patent hair-restorer not only failed to grow hair but made what was there fall out, and everyone stood around convincing themselves that because it cost so much they had to go on using it.

Stephen Plowden is a transportation expert himself and in this lucid and quietly revolutionary book he traces the evolution of transport planning and identifies the crucial fallacies which vitiate it and make useless the impressive edifice of its theory. The fundamental objective of transportation planning has always been to provide adequate road space for the number of vehicles wishing to use the roads. Give or take a compromise or two it still underlies the most modern transportation study: public transport is there to cope with the journeys which cannot be made by private transport. and walking or cycling are not even counted as transport modes at all.

Elaborate statistical techniques are used to calculate anticipated "demands" for road space basing themselves entirely on the proposition that everyone wants to travel by car and this demand must be met even where it conflicts with people's equally clear "demand" for quiet streets, safe and reliable travel, comfortable shopping facilities and the rest. No comparative evaluation of the conflicting "demands" is made: the primacy of traffic demand is assumed. Then meticulous calculations are done to match the level of "predicted demand" with the road-space it will "need".

One might argue that the process is at least self consistent and logical within itself. It is a dubious enough proposition. But it is completely overridden by two basic points. Firstly it is not possible within an existing city to accommodate the "demand" predicted in this way: secondly, by conceiving the problem in these terms the basic mobility requirements of that majority of the population which does not have continual access to a car are not met. In other words the traditional traffic engineering approach to traffic problems if followed to its logical conclusion leaves the majority of the population without mobility in a city rendered virtually uninhabitable by the provision of mobility for the minority of its inhabitants. The final stage is that its mobile inhabitants leave it altogether.

The struggle is towns against traffic. Once the decision has been made that the town and its people are to be masters the remainder is simple. Providing answers to the problems of making motorways work in cities is impossible—which is why so many people are employed trying to do it. Moving *people* round a city, enhancing the environment, providing facilities for pedestrians and cyclists in contrast are problems to which there are readily accessible answers.

Plowden's book is a notable addition to the developing literature of "people's lib" planning in which the unhealthy dominance of the motorcar is firmly rejected. It should be compulsory reading for city planners everywhere. To ensure they do read it and understand it everyone concerned with amenity affairs and urban conservation should read it themselves. Then at the public inquiries which should henceforward be held into every proposed new inch of urban road the questions asked here can be raised and those in favour of road building can be forced to answer them satisfactorily before proceeding.

Gerald Foley

#### Socialist environment

CONSERVATION IN THE SOVIET UNION, by Philip R. Pryde, Cambridge University Press, £5.

Western conservationists are usually ill-informed about the environmental situation in the Soviet Union. They tend, perhaps, to feel vaguely that things must be better there, since so many of our own problems can be blamed on free-enterprise capitalism. Professor Pryde's book shows that generalisations are impossible: the Russians are better than us in some ways, worse in others. The centralised organisation of the economy, and the absence of the time-consuming formalities of parliamentary democracy mean that theoretically the passing and enforcing of conservation laws should be easier in the USSR. On the other hand, Pryde points out, "there is only one effective lobby in the Soviet Union, and that is the ... immutable emphasis on industrial expansion." Public opinion, as a force independent of, and capable of changing, government policy, scarcely exists. Moreover, the "ruthless Soviet efficiency" which Western propaganda makes so much of is presumably all used up in some field other than conservationthis book is full of instances of wellmeaning but vague legislation inadequately implemented. Who would have guessed, for example, that poaching of wildlife could be described in a Soviet journal as having "assumed the proportions of a national calamity"?

Marxism is a 19th century philosophy and so it is not surprising that the Soviet attitude to the natural world often displays some of the worst features of Victorian industrialism. Soviet planners still tend to think of themselves as in conflict with nature, which must be bludgeoned into submission to its master, Man. Hence the popularity of grandiose schemes for diverting the large Siberian rivers, damming ocean straits, eliminating deserts and melting glaciers: the naive optimism of it all reminds one of the more absurd fancies of H. G. Wells. Pryde cites some specific Marxist doctrines with alarming environmental implications-for instance, the assumption that only labour produces value: this leads to the conclusion that natural resources are a "free" input into production, and can in consequence be squandered or abused with a clear conscience.

Fortunately, the Soviet attitude to wildlife is not governed purely by economic motives. A number of threatened species are strictly protected: in one case at least, that of the polar bear, the Soviet Union has apparently done more than her Arctic neighbours. But the vital role of predators in a balanced ecosystem seems to go unrecognised: only recently has it been tentatively suggested in Russia that total extermination of the wolf might not be desirable. An interesting experiment is in progress in one Soviet nature reserve, to domesticate the European elk as a work animal and a milk producer. (It is an oddity of human history that no important addition has been made to the list of domesticated animals since the Bronze Age: in the future, perhaps, domestication or controlled exploitation may

offer the only hope of survival to many of the larger mammals.

It is a tenet of Soviet faith that natural resources cannot be used unwisely under socialism. This leads to the tendency in Soviet writings "to discuss conservation problems primarily in the context of other countries, and to pass over or understate obvious domestic examples." This doubtless helps to foster in the West the vague impression of Soviet virtue which I mentioned above: Professor Pryde's full and extremely well-documented study should set the record straight.

Nicholas Gould

### Coming events

**3 May**—Water Research Association Open Day. For invitation and brochure please apply to The Water Research Association, Medmenham, Marlow, Buckinghamshire SL7 2HD. Telephone 049 166 282.

**7 June**—The determinants of growth, a review lecture by R. A. McCance, FRS, at 4.30 p.m. at the Royal Society, 6 Carlton House Terrace, London SW1Y 5AG. Details from the Executive Secretary, Tel. 01-839 5561, extn. 278.

**21 June**—Human adaptability in a tropical ecosystem (an IBP human biological investigation of two New Guinea communities). Meeting organised by G. A. Harrison and R. J. Walsh for the Royal Society and the Australian Academy of Science. At 10 a.m. Details as above.

**17-20** July—Conference on Pollution Criteria for Estuaries. Further details from Mr. M. A. McSweeney, Department of Civil Engineering, The University of Southampton, Southampton SO9 5NH.

### Classified advertisements

**ORGANIC LIVING**/gardening/farming writers, researchers, interested in contributing knowledge and experience as part of new publishing team, write Box PD5 for details. Positions also for illustrator/photographer, and correspondents willing to travel and interview. State areas of interest and experience. Genuine enquiries only. Enclose S.A.E.

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### Letters

#### Concorde

Sir,

I was quite dismayed by John Adams' tirade against me on the subject of Concorde (*Ecologist*, November 1972), and I must state that I have no involvement in the project, have never been consulted where decisions have been made, and do not regard it as a major issue except that it is an example of two things—a decision arrived at (like many others that have a complicated technological basis such as nuclear energy policy) without proper democratic control, and a rare example of a long term project that has survived party bickering.

One of the ills of our present civilisation is that it is dominated by very short term investment policies, so high is the discount rate.

My concern is twofold, first that I do not believe there is any danger to the atmosphere from SSTs. I have argued this point elsewhere and my arguments have not been countered. Mr Adams quotes me as saying that 1000 Concordes might cause a danger, but what I actually said, quite off the cuff at a meeting, was that you would have to have at least 1000 to produce any perceptible effect. I don't believe that 10,000 would cause any danger, and I am sure that the rapid changes in world agricultural practices are already increasing the proportion of nitrogen oxides in the air much more than Concordes would ever do, and still nothing has happened to the ozone.

The second point is that the world fuel crisis is too big for it to be affected by whatever happens to Concorde. If the devices at present planned for Los Angeles cars to reduce the unpleasantness of their exhaust were to be fitted to all of them, their fuel consumption from this cause would increase by more than the fuel used by Concordes carrying 5000 passengers across the Atlantic every week. If they used smaller cars in L A they could easily save ten times this amount in this one alone. If economic conurbation measures were introduced to produce savings of this kind (and in London too) they would act also upon the economics of all aircraft operation and airport planning and real, as opposed to symbolic, effects would result.

The discussion of items which have become symbols is so loaded with emotion that perhaps the protagonists can appreciate that projects can be undertaken for emotional reasons. I think this is the case to some extent Concorde. The British and with French people were in a mood to embark on this kind of proud enterprise and that is one important reason why the project went ahead. The fury of the John Adams' against a person who seeks to get the scientific truth understood generates an emotional reaction on the other side which is equally unhealthy. If he does not share other people's pride in Concorde let him, please, recognise that it exists and will not be shaken by falsehoods about the stratosphere.

I take the view that the environmental crisis is a very serious matter and if the likes of John Adams would read what I have written about it\* instead of picking on some state he has imagined for my mind, and discuss atmospheric ozone as a scientific issue (if we must discuss it at all) instead of trying to bend it in the service of a cause, we would be on the way to getting our priorities right.

Yours faithfully,

R. S. Scorer.

Imperial College of Science and Technology, London, S.W.7.

\* (e.g. The Times, 28 November 1972, Concorde Supplement. Atmospheric Environment, 1971, Vol. 5, p. 903-943 (Pergamon Press). Engineering, August 1971. A radical approach to pollution, population, and resources, 1973 (Liberal Publications Department Strategy 2000, No. 1).

#### Technology versus nature Sir,

Dr Skolimowski raises some interesting points, but his "third solution" is something of an anti-climax. He rightly suggests that it may contain elements in Rousseauian and Marxian thinking, but is surely optimistic in the elements he chooses.

Rousseau sensibly stressed the necessity for individual reform, and Marx correctly saw the need for collective effort. But if a collective effort is made by unreformed individuals it has no more hope of lastingly improving society's lot than have the isolated energies of reformed individuals who have failed to accept the necessity for at least a minimal social structure through which to effect reform. The whole can be no better than the parts. The great illusion of our day is that group action can somehow make society better than the individuals who comprise that group. That we can believe such nonsense is proof only of how successfully we have been brain-washed into believing that psychology, sociology and political chicanery have made the most elementary philosophy redundant.

There is, indeed, a third solutiontruly civilised alternative. But it depends, it must depend, upon the bedrock of personal reform. This reform can come about only through a wider and deeper concept of our educational responsibilities. Through the schools, the home and constant individual concern we must take greater account of the need for a more compassionate, more eclectic and therefore more balanced and total regard for our environment. The pollution of men's minds and values must be treated with no less concern than we have begun to feel for our physical surroundings. How else can we develop a more integrated and purposeful sense of individual responsibility with which to combat the ills of a society dominated by violence, excessive organisationalism, a misdirected technology and mind-narrowing specialisation?

Yours sincerely,

Jon Wynne-Tyson, Paddocks, Fontwell, Arundel, Sussex.

#### Asbestos and cancer Sir.

In your January issue you state that "low levels of asbestos dust in the air increase the risk of cancer to the general public". The world's experts in this field have come to a precisely opposite conclusion. The Advisory Committee on Asbestos Cancers, reporting to the Director of the International Agency for Research on Cancer following the Agency's meeting on the Biological Effects of Asbestos at Lyon in October 1972, produced the following statement: "The evidence of an exposureresponse relationship suggests that an excess lung carcinoma risk is not detectable when the occupational exposure has been low. These low occupational exposures have almost certainly been much greater than that to the public from general air pollution". On mesothelial cancers it states, "There is no evidence of a risk to the general public at present." On lung fibrosis it states, "There is at present no evidence of lung damage by asbestos to the general public."

In fact measurements of the urban air taken in the United Kingdom by the Asbestos Research Council have determined that the asbestos dust level is at least 1,000 times lower than would be acceptable for occupational exposure over a working lifetime of 50 years.

On occupational risks and, in particular, the risk of gastro-intestinal cancers to which you refer, the IARC report states: "The excess of these tumours is relatively small compared with that for bronchial cancer," which, as already mentioned, is undetectable where exposure to asbestos has been low.

Your readers should know that the purpose of the 1969 Asbestos Regulations here is to ensure that no workers in the UK are exposed "to such an extent as is liable to cause danger to the health of employed persons".

It would be unfortunate if misleading comment caused unnecessary anxiety concerning the use of asbestos products which are largely employed for safety reasons, e.g. brake linings, which save lives on the road, fire protection boards, which provide occupants of buildings and ships with time to escape with their lives in the event of fire, fire protective clothing for rescue services and many others.

Yours faithfully,

W. P. Howard,

Secretary, Asbestos Information Committee, 10 Wardour Street, London W1V 3HG.

#### Materialist reductionism?

Sir,

Edward Goldsmith's article "Towards a Unified Science" in last month's *Ecologist* makes depressing reading. He rejects the dualist idea that man has part of his being which is beyond mere scientific examination and believes that cultural behaviour is much the same as that of the physical processes of the body.

In fact the whole article is an exercise in materialist reductionism. In

his haste to condemn man's folly in wrecking his world Mr Goldsmith reduces man to a mere collection of molecules all interacting to produce both physical and cultural phenomena. This narrow view of humanity is precisely the cause of the state of the world today. The elimination of consciousness in modern philosophy has done untold damage to man's moral outlook, it has encouraged him to chase after spurious material rewards and to indulge in systematic and uncaring exploitation of the environment to the detriment of all other living things on our planet.

All this we know and yet Mr Goldsmith, far from moving away from this crippling philosophy, only reinforces it. The environmental movement has done mankind a great service by showing that the component parts of the universe are not separate entities acting independently of each other. However, if this view is now to include the belief that man (and indeed all creation) does not have a deeper level of consciousness which is beyond the immediate level of the physical world and beyond straightforward scientific analysis, then I doubt if the environmental movement will contribute anything very positive to the sum total of man's knowledge and experience.

Yours faithfully,

I. Short, 1, The Glen, Worthing, Sussex.

#### Leicester: Transport and the Environment

Sir,

I write as editor of the Leicester Ecologist Action Group publication Leicester: Transport and the Environment. Our booklet was reviewed in last December's issue of the Ecologist (Vol. 2 No. 12, p31) but unfortunately did not give our address and readers will not have been able to obtain a copy. I would be most grateful if you would include a note in a future edition of the Ecologist to the effect that the booklet, Leicester: Transport and the Environment, reviewed in December's Ecologist, is available from the Leicester Ecology Action Group, 6 Newarke Street, Leicester at 25p +6p postage and packaging.

Yours faithfully,

S. H. Cousins



#### ECOLOGICAL PRINCIPLES FOR ECONOMIC DEVELOPMENT

#### by R. F. DASMANN

nternational Union for Conservation of Nature and Natural Resources, Morges, Switzerland

J. P. Milton and P. H. Freeman

both of the Conservation Foundation, Washington, U.S.A.

This book in particular provides guidance to development planners and decision makers in the hope that they will avoid environmental damage and its consequences in future development projects. The authors explore pertinent inter-relationships between development and conservation and demonstrate that both must be based on an understanding of ecology. Particular emphasis is placed on ecosystems which are currently subject to heavy developmental pressure; tropical humid forests, savannas and grasslands in tropical, sub-tropical and mediterranean regions, high mountains, coastal areas and islands. As an introduction to further studies planned for the future, a wide variety of problems likely to arise from irrigation and major river basin development, from forestry, livestock and agricultural projects and, in a rather different way, from the promotion of tourism are all reviewed.

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