

Ecologist

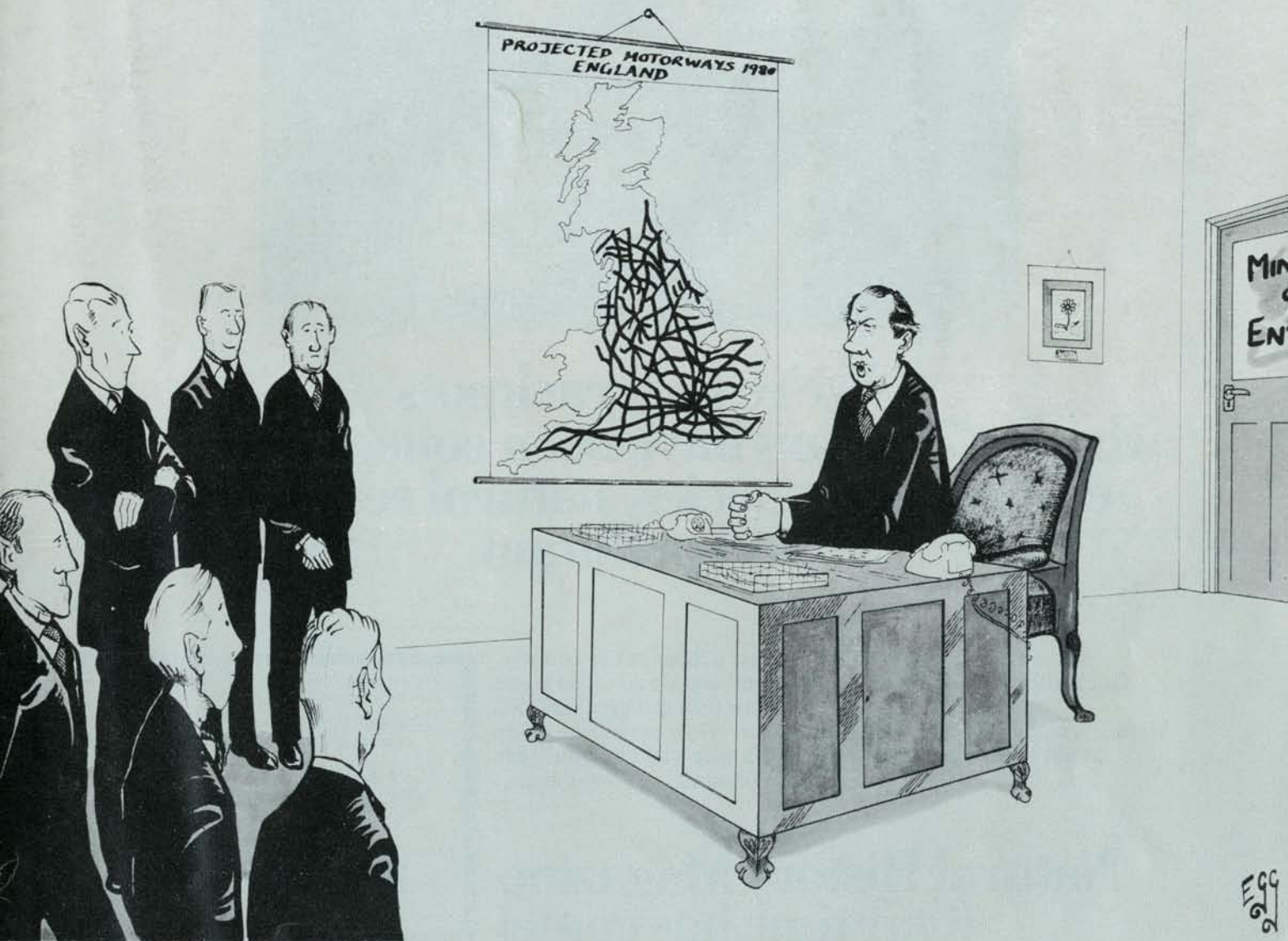
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Vol. 1. No. 17

November 1971

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The Ecologist

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Fantastic—at last, with replacement brain, eyes, lungs, heart, kidneys, bowels, limbs, etc, we'll be able to prolong human life for 150 years (at a mere £50,000 per head).

Editorial

The Sanctity of life

We have been taught since childhood to fear anything connected with death and decay.

A corpse fills us with horror, while the scavengers that eat it and the bugs and bacteria that decompose it are among the most despised of creatures.

Yet death and decay are as essential as life and growth—they are but parts of the same process: one would not be possible without the other.

Men and other animals die so that the carbon compounds in their bodies may break down into carbon dioxide which green plants build up into carbohydrates and other organic compounds.

They die so that there should be nitrates in the soil which the plants take up and combine with carbohydrates and build up into essential proteins.

They die to make way for subsequent generations, which would not otherwise come into being without causing a serious ecological imbalance.

They die, if weak and unadapted, to prevent their species from becoming weak and unadapted too, and it is the grossest possible illusion to suppose that we have obtained divine dispensation from this inexorable law.

They die so as to accommodate rapid environmental changes. Insects, that die on average 1,750 times more often than we do—with a new generation every two weeks—are correspondingly more adaptive.

If then death is so essential how can one explain our attitude towards it?

Before we can answer this, we must realise that it is not characteristic of all societies. On the contrary it appears to be peculiar to societies such as ours that have become unstable as a result of losing that essential social structure that previously permitted them to constitute autonomous self-regulating units of behaviour.

Thus on the whole primitive man does not fear death. He regards his life as but a stage in a process in which the life of his ancestors were previous stages and those of his children and their children will be future ones.

Thus when he dies, he will live on in his children and the process will proceed uninterrupted.

When a society disintegrates, it does so in time as well as in space. In the social chaos of our industrial conurbations a man is not only isolated from his fellow men but also from his ancestors and his descendants.

We, as temporal isolates, regard our ancestors with a mixture of scorn and pity. Old-fashioned and barbaric, they lived in an age before the coming of the jet plane and the electric toothbrush made life worth living. As for our descendants; let them fend for themselves. If we leave them a moon-like desert for a planet, it is up to them to make it bloom. After all, "what has posterity done for me?"

In such conditions our life is not a sub-process but a complete process in itself. When it is over, all is over. Hence its sanctity.

It is worth dwelling on the terrible consequences to man and to our biosphere of belief in this evil and pernicious myth.

Among them is the population explosion which must inevitably lead to the death by famine or pestilence of hundreds if not thousands of millions of people.

It would probably not have occurred if, in our self-righteous presumption, we had not proscribed those cultural controls such as abortion to prevent unwanted births and infanticide to get rid of children who were unlikely to develop into satisfactory members of society.

It would probably not have happened if we had not worked so feverishly to develop every possible gimmick to prolong human life, regardless of its possible effects on other lives, on our environment and, in the long-term, on human life itself.

Thus the World Health Organization spends a third of its budget on spraying large areas of the third world with DDT. Among other things this must have the effect of seriously compromising human health (see "Who Cares About DDT? Page 8.)

Such side-effects might be more

acceptable if WHO actually succeeded in eradicating malaria. But this it is not doing.

It is simply destroying those natural controls that previously rendered this disease endemic, killing but the aged and the weak. This means that when it strikes again, it will be an epidemic, that could kill off entire populations.

In the same way the antibiotics and vaccines we are introducing on an ever more massive scale are destroying natural controls by rendering them redundant.

As this takes place so the very survival of our species, instead of being assured by a complex set of self-regulating mechanisms, is now assured by human manipulation.

When there are no longer sufficient mineral and fuel resources to allow us to spray the world with poisons, and tear around injecting people with antibiotics and vaccines, or when our environment can no longer absorb the pollutants generated by such feverish activity on so vast a scale—then nature will show what little regard it has for the sanctity of human life.

Those who might object to my thesis would do well to consider just how superficial is their own belief in the sanctity of life.

By ensuring the abolition of public holidays, they could save the lives of hundreds of people killed on the roads on these festive occasions.

By persuading our government to abolish the cigarette or the motor-car they could save the lives of tens of thousands of people who die of lung-cancer caused by pollutants generated by these devices.

By forcing it to abolish television they could reduce our radiation burden and further cut down the rate of cancer and the number of mutations that will cause deaths in succeeding generations.

In spite of their pious sentiments, I cannot see them thereby compromising their immediate pleasures to achieve these ends.

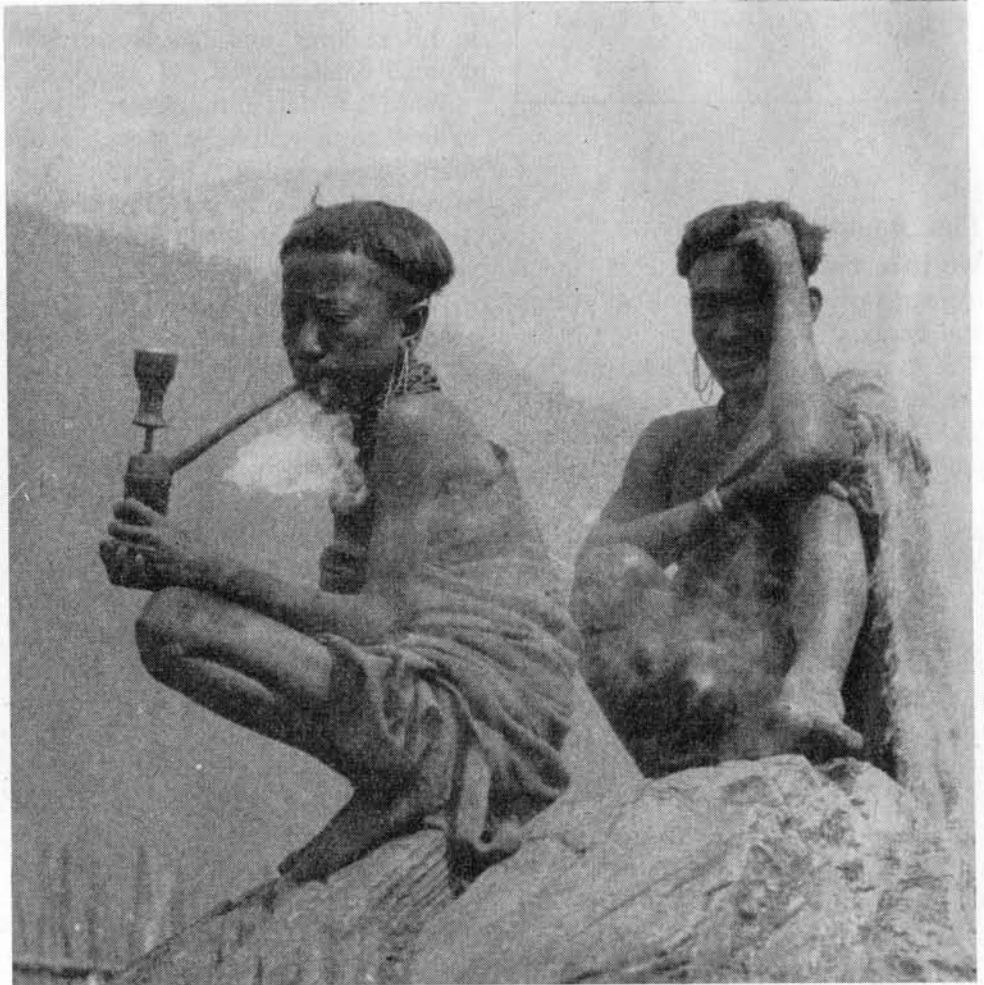
The sanctity of human life, let us admit it, is a myth only indulged in when it is convenient for us to do so, and yet it is in its name that we are methodically taking those very measures that can but lead to human death on a scale yet unimagined.

Let us abandon this myth while there is yet time. Let us accept death for what it is and learn again how to die with dignity.

The Hill Tribes of Assam

by S. Barkataki

The Barial range of hills is more or less a continuation of the Himalayas, which take a south-westerly turn at the north-eastern corner of the Indian boundary with China and Burma. This ring of hills cutting through the heart of Assam separates the valley of the mighty Brahmaputra river, called the Assam valley, from the valley of the Surma or Barak, to the south of which stretch in almost parallel lines from north to south the mountains of the Mizo hills district. The whole of this hilly region is fascinating country, but what is more fascinating than the natural scenery, vegetation and wild life abounding there are the colourful people, the tribes who inhabit this El Dorado.



Naga warriors from the village of Pangsha, one smoking the pipe of peace.

And who are these people? The origin of many of them is not clearly known. What can be stated with certainty is that about 2000 B.C. there was a movement of Mongoloid population from the valley of the Hwangho in China to India through its easternmost State, Assam. The more vigorous of these people settled down in the valley of the Brahmaputra and the weaker sections were driven to the fastnesses of the unpeopled, inaccessible surrounding hills.

Apparently, there was wave after wave of these migrations and the invaders belonged to the Indo-Chinese linguistic family of which the most important sub-families are the Mon-Khmer and the Tibeto-Burman. The third, Siamese-Chinese, included Shan, which was spoken by the Ahoms, the last of these invaders. The Mon-Khmer speakers appear to have come

earlier than the others. They were apparently driven by subsequent Tibeto-Burman hordes into the Khasi hills which is the only part in which the sub-family now exists. Of the Tibeto-Burman sub-family there were three groups, viz., Naga, Kuki-Chin and Bodo. In ancient Sanskrit texts these peoples are referred to as *Mlecchas*, *Kiratas* and *Cinas* (Chinese), in other words as non-Aryan barbarians. The most important amongst these tribes are the Garos, Khasis, Jaintias Mikirs, Dimasas, Kukis, Nagas and the Mizos.

Our surroundings influence our habits and character. The distinctive characteristics of these tribes are to a very considerable extent shaped by the climate, the nature of the soil, the terrain and the scenery of the land which they inhabit. As in countries like Scotland, life in these hills is hard.

An outsider can hardly imagine the hardship with which a Mizo or a Naga has to eke a livelihood out of his little patch of land. From before day-break the womenfolk of a village march in processions carrying on their heads long bamboo tubes in cane or bamboo baskets hundred of feet down to a spring or a stream to fetch water for the day's use. The return journey uphill with the load on their heads is strenuous. Immediately after their return they get busy preparing food for the family before they accompany their husbands to help them in their work in the *jhum* (cultivation). About half an hour is spent at midday in eating the pack-lunch (consisting of boiled rice, salt and chillies), which they carry with them to the *jhum*. Then work goes on again till sun-down—hoeing, sowing, weeding and so on. In the evening the menfolk snatch a

few moments of relaxation by drinking *zu* (rice-beer or occasionally strong spirits) while the women carry on with their household chores—cooking and attending to the pigs, the fowls and their little ones. On special occasions there is dancing by both men and women to the tune of music in addition to *zu* drinking. This, till very recently, was the normal pattern of the average tribal's life in the hills which could not perhaps be better described than in the following lines of Thomas Gray composed in a different context:

Far from the madding crowd's
ignoble strife,

Their sober wishes never learn'd to
stray;

Along the cool, sequester'd vale of life
They kept the noiseless tenor of
their way.

In recent years this pattern of life has changed with a bewildering speed and is still changing rapidly from day to day. Change is perhaps inevitable but one sometimes feels sad at the way the change is taking place. Soon after taking charge of the Naga hills in 1953 I expressed my own feelings in the matter in a letter written to the renowned anthropologist and a great friend of the tribals of India, the late Dr Verrier Elwin, in these words:

"Dear Dr Elwin,

I took over... on the 4th. The Angami Nagas are now having their big *Sacreni Puja* and I have been thoroughly enjoying myself taking part in their feasting and drinking bouts. It pains me deeply to think that all this colour and vitality are fast disappearing with the conversion of the Nagas to Christianity. I am writing to you about this, because I understood from Harper that you hold similar views. I had the opportunity of studying the effects of conversion on the Lushias (Mizos) at close quarters. Apart from the denationalising influence of conversion, I feel that it is striking at the very roots of a way of life which is in no way inferior to any other. I feel that the foreign missionaries in the hill districts are committing a crime against humanity.

My voice will not reach far but you have influence even with the Prime Minister. Cannot something be done about this? Please treat this, however, as personal and confidential.

Yours sincerely,

S. Barkataki."

Dr Elwin's reply contained views which are identical with my own.

"My dear Barkataki,

I was delighted to get your letter, and I at once sent you a rather vitriolic pamphlet and also a book of which I am rather ashamed, but I sent it because it will give you my background, particularly with regard to the missionary problem.

I had, of course, as Phukan, at present Vice-Chancellor of Dibrugarh University, Assam, may have told you, my little experiences with the Christian Nagas, and I wrote a 5,000 word report for the Governor on the business, which he had sent, I think to the higher authorities.

The American Baptists are a Christian RSS, and as a result of their teaching that all non-Christians are heathen and damned, naturally the Nagas develop an antagonism towards Hindu India. I do not suggest that the missionaries are consciously fostering a separatist movement, but I do insist that their teaching leads to it, as I saw vividly in Manipur.

What annoys me so much personally is that these people are given freedom to go anywhere among the Nagas (in Ukhrul I saw notices of a new missionary drive to be started among the Konyaks) while someone like myself who wishes to work for the preservation of their culture, whose loyalty to his adopted country, India, is beyond question, who cannot possibly do anything but good by his presence, is not even allowed to enter the Kohima Bazaar. I would not mind if everybody was banned. But I do strongly object to seeing these people whose lives are devoted to destroying an important bit of Indian culture, whose work is resulting in the very thing Government is most anxious to avoid, who are separating the Nagas from the rest of India, being apparently given every encouragement."

Effects of conversion

What is the effect which conversion produces on the tribal as a human being? The first thing a hill-man does after conversion is to discard his colourful native costumes of beautiful and highly artistic designs and put on a pair of drab khaki shorts and a bush shirt of cheap mill-made cloth. Drinking *zu* (which is part of the hill-man's diet), dancing and singing are taboo to Christian tribals because it is feared

that these little pleasures may, in due course, revert them to other pre-Christian barbarous practices such as head-hunting. The result is that the colourful, attractive hillman soon becomes comparatively dull and commonplace. His vitality is gone to a great extent. The striking contrast between a Christian and a non-Christian Naga village existing side by side cannot escape the least discerning eye. The Christian villages are depressing; the people have lost their distinctive character; the *morungs* (bachelors' sleeping houses) are in a state of decay; the colourful vitality of Naga life has disappeared. Dance and music have yielded place to hymns in borrowed tunes. On the other hand the pagan villages have still some throbbing left of primitive *joie de vivre*.

A brief digression about the bachelors' clubs mentioned above will not be out of place here. These *deka-changs* (young men's club houses—an Assamese word) are called *nok-pantes* in the Garo hills, *jawlbuks* in the Lushai hills, *morungs* in the Naga villages and *maros* by the Mikirs. These *deka-changs* are an excellent institution and a distinctive feature of every tribal village. These clubs, where young boys have to serve and obey older boys, besides being associated with agricultural, social and almost all other activities of the village community, instilled into the youth discipline, respect for and obedience to elders, a spirit of service to the community and a number of other admirable qualities. The village youths belonging to the club work in the field together, a patron being allotted to each house. Work is enforced by penalties. In the Mikir hills, in the olden days, it is said, shirkers were roasted alive. Nowadays, of course, such drastic punishment cannot be meted out. Nevertheless, severe beatings are often given. The boys of the *maro*, or *jawlbuk* or *morung* are in great demand for social services also, especially tasks and ceremonies connected with the dead. Dancing and singing are also practised in these clubs which keep the old ways and customs alive.

It is a pity that these clubs are gradually becoming a thing of the past, because they are banned by Christian missionaries as dens of vice, such as *zu* drinking and ribaldry.

Since independence the Indian Government has adopted various measures to win over the hill-tribes of this region, but the effect of these measures so far has been the reverse of what was intended and desired. In a fit of generosity Prime Minister Nehru tried to mollify the rebellious Nagas by granting them a separate State. This was only the thin end of the wedge. The Khasis and the Garos had to be given a separate State and the Mizos are demanding an independent State of their own.

The first instalment of reforms granted to the hill-districts after Independence was the Sixth Schedule to the Constitution of India, under which elected (largely) District Councils with limited powers were set up in each hill district. This measure was like the Montague-Chelmsford reforms which satisfied nobody. On the other hand it, coupled with other administrative changes introduced, did irreparable damage by destroying overnight an efficient administrative set-up and disrupting the life of the people. To explain the point I shall have to give briefly the background of the indigenous administrative and social set-up and the character of these people:—

The most outstanding features about tribal life in these hills had been two:

1) The fundamentally democratic and socialistic basis of their social and administrative organisations:

With minor exceptions, the land belongs to the community and not to any individual. Although in the Garo hills the *Nokhma* (the head of a clan or a village), in the Khasi and Jaintia hills the *Siem* or the *Doloi* or the *Raja* and in the Lushai hills, till recently, the Chief was nominal proprietor of all lands within his jurisdiction, every villager could cultivate his plot of land anywhere as a matter of right. In society, there is no distinction between high and low. Wealth and income do not confer social privileges. The once powerful Lushai chief and the Khasi *Siem* who were regarded by neighbouring people as *raja* or king, were as much commoners as the humblest of the humble. The rich are always ready to help those of their co-villagers who are in need and the strong are similarly inclined to the weak. In fact, the Lushai Chief, who wielded enormous authority over his subjects, was the *de jure* father of the villagers over whom he ruled. In times

of scarcity, if the villagers committed robbery from Chief's granary, they committed no offence.

This democratic spirit was strongly reflected in the indigenous administrative organisations. The Khasi *Siem* was a constitutional monarch. He could hardly ever give any decision independently. It is the *myntries* (ministers) who generally decided all matters for him. Although the Lushai Chiefs were more powerful and sometimes autocratic, they could disregard the advice of their *upas* (the village elders) only at their own risk. Thus in spite of the Chiefs and the *Siems* being chosen on the hereditary principle, their administration was thoroughly democratic. In other areas, such as North-Cachar hills both the hereditary and the elective principles were followed side by side by different tribes in choosing the chief or the leader. Disputes were heard in open court where all the male persons of the village took part. In some areas women were also allowed to be present at the trial of cases. The judgement passed on the offenders was regarded as a judgement of the whole village and not merely that of the chief and his advisers. This system of administration suited the genius of the people and they were happy under it. The British, with their experience of administration over half the world, were wise enough not to interfere with the indigenous administrative machineries. Administration was left almost entirely to the village headman and the elders, the Deputy Commissioner and the sub-divisional officer merely sitting over them as superintendents and intervening only in serious matters, such as disputes over the boundary between one village and another, or cases of a seriously criminal or political nature.

2) A proud and sturdy spirit of self-help and self-reliance:

As a magnificent example of this spirit I could not do better than to point out the challenge which the Mizo people threw in the face of the Government by taking upon themselves the task of building a 130 mile road.

Built their own road

The following extracts from an editorial from the *Oriental Watchman and Herald of Health* (Poona, March 1951) deserves quoting:

"The Lushai hills of Assam form an isolated and obscure little corner of North-East India, but a fascinating

bit of country occupied by a fascinating people called Mizos. Aijal, the capital town, with a population of about 4,000, and situated 113 miles from the railway terminal at Silchar, is approached by a rugged bridle path-way now widened sufficiently for jeep cars which are severely tested to negotiate unbelievably steep inclines and dangerous hair-pin bends. The fact that two days of strenuous driving are needed to cover the distance by jeep is an indication of the difficult nature of the road. From Aijal onward through the hills all travel is by foot-paths winding through the jungle which approach about 500 villages and hamlets perched on hill-tops and ridges. No wheeled vehicles can traverse these precipitous paths, and only here and there can they be negotiated even by mules.

To the south of Aijal about 110 miles by footpath is the southern capital, Lungleh, with a population of about 2,000. All traffic between these two chief towns is on foot, and constantly bands of men, women and children are carrying heavy burdens of merchandise on their backs. Great as is the temptation, we must at present forbear describing the simple austere domestic life of these honest people among whom theft is almost unknown.

For years there had been a demand for the extension of the jeep trail to Lungleh, but government's inability to supply the necessary funds had been allowed to be an insuperable obstacle, and more recently the prospect had become more remote than even before.

The work was begun on 26 January, 1950, with appropriate ceremony and great eclat by an enthusiastic gathering of 3,000 men, women and children, excavating the precipitous hill-sides not far from Aijal. Working for the improvement of their country, rather than for rupees, put zest into their labour and health into their spirits. The vision of a road 130 miles long between the only two real towns in the hills, and its benefits for the present generation and for posterity, is to these people a greater incentive than a few paltry rupees doled out to each one, even if it could be done. By March, five miles of the road had been made and in April it had been stretched to eight. Eighteen miles completed before the monsoon of 1950 was their commendable goal.

There is great need in the world for that spirit of self-help which is rapidly bringing to a successful completion that tortuous road, winding around and up and down the hills of Lushai, bringing with it economic advantages so long awaited."

A history of self-help

These hill people had always been helping themselves in this and various other ways. They made and maintained village paths, constructed school, church and hospital buildings, wells, water tanks, playgrounds and did other works of public utility voluntarily without remuneration. These were community projects in the true sense of the term. It is sad to observe, however, that in recent years this admirable spirit of self-reliance has all but evaporated. Why? Mainly because of the misconceived and misdirected efforts made since Independence to improve the lot of these "Backward Scheduled Tribes" overnight. The very term "Scheduled Tribes" has a stigma attached to it, because the term "Scheduled Castes" was a euphemism for India's untouchables. Besides, these people are not only not more backward than people in the rest of the country but were actually, in literacy and other respects, more advanced. The establishment of development blocks on a stereotyped all-India pattern without taking local conditions

and the temperament of the people into account, and the liberal doling out of grants, loans and subsidies in the name of community development, have now completely changed the habits and attitudes of these people. The people now not only refuse to perform any of the tasks mentioned above without payment, but these doles have affected their attitudes to such an extent that they have stopped giving proper attention even to their rice-fields, knowing that if crops fail, free, or at least subsidised rice, would be made available by "Government". Extracting something for nothing out of "Government" has in fact become a pastime with them and it is looked upon as a creditable performance. These once sturdy, self-respecting and self-reliant people have thus been so demoralised and corrupted that they do not hesitate to resort to chicanery for obtaining gifts which they look upon as graft for keeping them peaceable.

Sudden overhauling of age-old administrative and social institutions did far more harm than good to the people. The fact that these people, even granting that they were backward, were at least comparatively happy in pre-Independence days, while at present they are seething with disaffection and unrest, perhaps proves my point. The establishment of District Councils, under the Sixth Schedule to the Constitution suddenly brought party politics into these hills

where it was unknown before. In addition, the creation of numerous government departments and the consequential induction of hordes of officers from the plains, with hardly any service to render to the people and with hardly any co-ordinating agency to regulate their activities, practically destroyed overnight the strong, efficient administrative set-up and disrupted the life of people. From this point of view the abolition of the institution of "Chiefs", who for generations have been the pillars of tribal society was perhaps a premature and unfortunate step the consequences of which are seen in the disturbances now shaking the once happy land of the Mizos.

Wholesale and indiscriminate imposition of alien institutions on primitive races is a practice which cannot be too strongly condemned. It can but tear them away from their roots, breeding in them a contempt for their own race and racial traditions, causing a loss of pride and self-respect and turning them into unnatural specimens of humanity, ill-at-ease everywhere, at home nowhere. By disrupting tribal foundations and destroying an age-old way of life, not inferior to any other, it engenders in them a sense of frustration or ennui and an indefinable fear about the future—a kind of mental unrest, which finds expression periodically in violent eruptions as in the Naga and Mizo hills.

"Wangala" (Harvest dance) performed by the Garo village children.



Who cares about DDT?

by Göran Lofroth

Breast-fed babies in Western Europe and North America are exposed to 25 times more DDT than adults and 3 to 4 times more than the maximum recommended by the FAO and WHO. We are told that DDT is vital to food production and disease control and that it is harmless. Is this true?

According to various national and international authorities pesticide manufacturers, and allied interests, DDT and other persistent insecticides must be used in the developing countries for an undefinable period in the eradication and/or control of insects. Up till lately no independent evaluation of the effects of large-scale eradication projects with persistent insecticides in developing countries had been performed. A recent study in Central America has, however, now revealed that more than ten years of spraying operations have failed to achieve the purported goal of malaria eradication and that the human environment is heavily contaminated with DDT-compounds.

The use of DDT and some other of the so-called persistent organochlorine insecticides has been restricted in several countries in the northern temperate region of the world. Although headlines in public mass media might indicate the contrary, no total prohibition of DDT has yet been achieved in any country, while exemptions for loopholes in the new regulations are abundant.

It is sometimes said that certain well favoured, industrially developed countries in the temperate region probably can do without DDT and other persistent organochlorine insecticides completely, but that developing countries should not be urged to follow such a policy. Reference is then made to the poor food situation in many developing countries, but without any mention of the scientific documentation which shows that continuous use of persistent insecticides causes new and more severe pest problems.

One also refers—with pathos—to the eradication campaigns against malaria and other diseases transmitted by in-

sects. Representatives of the World Health Organisation (WHO) declare with distressed mien that DDT, dieldrin etc., must be used in order to achieve eradication and that these compounds are harmless. All information which has been available up till now about the situation has passed through official national and international authorities. It is there maintained that the battle against the insects goes well, provided that there are no interferences from environmentalists.

The first crack in this official wall has now become visible by an investigation in Central America which has been performed by independent researchers associated with the 'Center for the Biology of Natural Systems' at Washington University in St Louis, United States. The investigation is described in two recent issues of the Center's Magazine (CBNS Notes, Vol. 4, No. 1 and 2).

Oddly enough, this investigation has not made the headlines in mass media.

I will here summarise the published results which concern the malaria eradication campaign in the investigated area (Guatemala, Nicaragua, Honduras, Costa Rica and El Salvador) as well as concentrations of DDT-compounds found in foods and human milk in Guatemala. From these DDT analyses I will also give some estimates of the exposure to DDT-compounds comparing them with other data.

Controlling Malaria?

Large-scale malaria eradication campaigns were launched in the area in the late 1950's. Dieldrin was initially used, but resistance to this insecticide soon developed. Major use of DDT followed throughout the 1960s. Some resistance to DDT has also developed but this has been ignored until recently when a

partial switch to the carbamate "pro-poxur" has taken place.

A decrease of the malaria frequency was noted in the early years of the campaign, but following this initial success the situation has worsened. In the beginning of 1971 the average malaria frequency in the investigated area was as high as it was at the start of the eradication programme.

In addition to the fact that more than ten years of spraying operations have not achieved the purported goal of malaria eradication, the human environment seems to have become heavily contaminated with DDT-compounds. (DDT-compounds = DDT + DDE + DDD). The reported residue levels are of such a magnitude that probably even the most stubborn DDT-enthusiast might begin to feel some uneasiness.

Six different foods of animal origin in Guatemala had concentrations in the range from 0.52 to 10.3 mg DDT-compounds/kg with an average of 4.8 mg/kg. Five different foods of plant origin had residues between 0.070 and 0.68 mg/kg with an average of 0.28 mg/kg. These residue levels are between 10 and 100 times higher than the average amounts found in Western Europe, United States and Canada. The highest residue level in the plant group, 0.68 mg/kg, was found in white corn, the staple food of many Guatemalans.

Nineteen individual samples of human milk from two different regions in Guatemala contained between 0.41 and 12.2 mg DDT-compounds/kg milk with an average of 3.1 mg/kg. This average is 25–30 times the average levels found in United States, England and Sweden.

It is convenient to express exposures to food additives, pesticides and other contaminants as the daily amount of the chemical per kg body-weight in order to have a standardised comparison, *e.g.* between laboratory animals and man or adults and infants. The total dose per individual can then be calculated *e.g.* by multiplication with 70 for an adult person and with 4–6 for a baby. Unless otherwise stated I shall express exposures to DDT-compounds as daily dose in mg per kg body-weight, abbreviated mg/kg, in the following discussion.

It may first be appropriate to mention that WHO and FAO committees in 1969 recommended 0.005 mg/kg as

the maximum acceptable daily intake (ADI) of DDT-compounds. This was a decrease by a factor of two from the previous recommendation.

From total diet analyses in United States, England and Canada it can be concluded that the adult population in these countries on average ingests 0.0005–0.001 mg/kg. Analyses of human milk in United States, England and Sweden has shown that breast-fed infants on average are exposed to 0.015–0.02 mg/kg daily. Thus while the adult population in a number of industrially developed countries is exposed to doses of DDT-compounds which are five to 10 times lower than the maximum recommended ADI, breast-fed infants are exposed to doses three to four times higher than this ADI. *It is noteworthy to observe that on an average and continuous basis, breast-fed infants are exposed to a dose of DDT compounds which is about 25 times higher than the exposure of the adult population.* All these data are well known to many of those who are seriously concerned about the deteriorating quality of the environment.

Based on the reported analyses of DDT-compounds the situation in Guatemala can be summarised into these figures: The daily exposure of the adult population is on average about 0.02 mg/kg, and the breast-fed infants ingest daily on average 0.5 mg/kg. These averages are four and 100 times, respectively, higher than the recommended maximum ADI. As these doses are averages, there are individuals whose exposure is less as well as those whose exposure is higher.

DDT and DDE belong to a heterogeneous group of compounds which causes a phenomenon called hepatic enzyme induction, i.e., following administration of such a compound there is an increased level of various liver enzymes (hepatic microsomal mixed function oxidases) resulting in a quantitative shift in the metabolism of compounds which are handled by these particular enzymes. Such a change in the metabolism is not always harmless. An increased metabolism of steroid hormones might result in an imbalance of these hormones in the body. An increased metabolism of a compound can result in the formation of a toxic compound or in a toxic intermediary product which leaks out from the otherwise well organised multi-enzyme detoxification system.

The classical example here is the fact that DDT strongly enhances the toxicity of carbon tetrachloride.

Since a few years it is known that DDT causes enzyme induction in man. The hitherto only available quantitative information is on a jaundiced patient given 1.5 mg DDT/kg daily for six months in whom a strong enzyme induction was noted soon after the medication started and persisted at least seven months after the last dose.—The notorious DDT-advocate in the United States, W. J. Hayes, Jr., has exposed male adults to as much as 0.5 mg DDT/kg daily for almost 22 months but unfortunately relevant and sensitive tests on enzyme induction were not performed.

In experiments with rats it has been shown that 1 ppm DDT in the feed was the lowest dose which gave a measurable liver enzyme induction. One ppm in the feed corresponds in rats to daily doses of 0.05–0.1 mg/kg body-weight.

All this takes us to the conclusion that there is very little doubt that the levels of DDT-compounds found in Guatemala cause liver enzyme induction in those breast-fed infants.

A daily exposure of 0.5–1 mg/kg, i.e. about 2–10 mg DDT/compounds for an infant, over a long period results in a high storage of DDT-compounds in the adipose tissue. It is conceivable that some neurological effects might appear if the infant is subjected to sudden starvation after weaning, as high amounts of DDT will be released into the body fluids when the depot fat is used up.

These alarming data from Central America call for further investigations by impartial and independent research groups on the situation in developing countries wherever DDT, dieldrin and other persistent organochlorine pesticides are or have been used in extensive pest eradication and/or pest control projects. The credibility of official national and international authorities as well as pesticide manufacturers has become questionable.

A final word of caution is necessary. Although the situation might be alarming it is wise to remember that also an abrupt cessation of a failing treatment could cause serious problems. The remedy is to replace the failing treatment as gradually as possible with ecologically sound pest control methods.

THIS DIRTY WORLD

Ronald C. Denney
with a foreword by
Sir Gerald Nabarro, M.P.

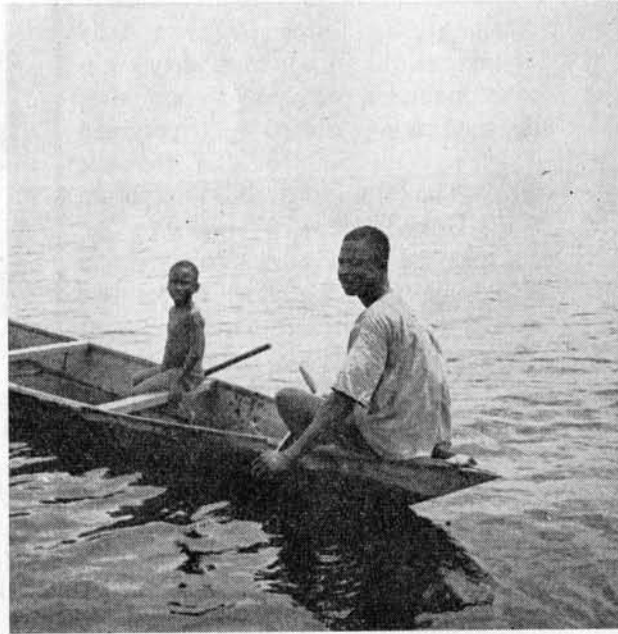
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NELSON

A Second Look at Volta Lake

by Stanley Johnson



Large dams may create far more problems than they solve and in some cases, such as the Aswan High Dam, they may lose more water than they conserve. One of the first objectives of the newly independent Ghana was to construct a major dam on the River Volta. The Volta Dam has solved some problems, but it has caused others. In the long run its construction may mean radical changes in the way of life of many Ghanaians. Is it worth it?

The symbol of modern Ghana is the Volta Dam. The Volta is the second largest river in West Africa, after the Niger. It has four major tributaries: the White, Black and Red Volta and the Oti, whose catchment areas cover roughly two-thirds of Ghana. The idea of damming the Volta River was an old one. A dam site at Akosombo gorge about 60 miles northeast of Accra and about 100 miles from the river's estuary in the Gulf of Guinea, was first noted in a geological survey conducted in 1915. Numerous studies and reports were made over the years and in 1953 the Volta River Project Preparatory Commission was established. Sir Robert Jackson—who in 1970 published his crucial report on the capacity of the United Nations Development Programme and its relationship to the whole UN system of economic and social agencies—took charge of the Commission which com-

pleted its work at the end of 1955.

The realisation of the Volta Project was one of the first and foremost objectives of the new independent Ghana. The Volta Dam would provide power for the electrification of Southern Ghana and for a big aluminium smelting plant on the coast. Since most of the construction and service industries are concentrated in the south and most of the modern sector of the economy (in all over 70 per cent of total value added), the scheme seemed vital.

The World Bank provided a major loan for the project. Other loans were made by the US and UK governments. Construction started in January 1962; resettlement of the affected population in July 1963. The dam was formally completed in February 1965, and the Volta Project officially inaugurated in January 1966.

The dam rises 244 feet above river level with a crest length of 2,100 feet.

In the power station, four generating turbines were initially installed and commissioned, producing a maximum of 588 Megawatts per annum. Two more units are to be installed by 1972, bringing the total capacity to 882 Megawatts. The Valco aluminium smelter at Tema has already reached full capacity and a second stage is being built. The construction of a high voltage transmission grid, extending to Accra-Tema, Kumasi and Takoradi is finished; a branch line to Togo has been agreed upon and a further extension to Dahomey is being considered.

The lake which has backed up behind the dam covers at flood level 3,275 square miles or about 4 per cent of Ghana's total land area. It is about 250 miles long and about 50 miles wide at its widest point. Its northern half reaches deep into the savannah zone, whereas the southern part crosses the forest belt.

This colossal enterprise is the new nation's show-place. Visitors take their drinks out onto the verandah of the Volta Lake Hotel and watch the water thunder down the spillway, arcing its way over to eat away the very hillside on which they stand. They gaze down at the great orange pen-stocks or walk through the ultra-modern, incredibly silent, totally automated power-house. Inevitably, they are impressed. They are meant to be. But there is another story behind the Volta

Dam, one which is not very often told.

Lake Volta is a kind of sea, an artificial sea. The overall impoundment is 120 million acre feet (a million acre feet—MAF—is one million acres flooded to the depth of one foot.) The annual flow into the lake varies; on average 120 MAF equals about four years flow. Judged by its surface area, Volta may be the largest inland lake in the world. Its shoreline may be as long as that of the Caspian and is probably longer than that of Lake Victoria. It's hard to establish this kind of data with precision, because it depends on the type of map you use. If you use a map with a very large scale and (assuming the lake has been flooded to the 280 foot level) trace the 280 contour, you can—in the case of Volta at least—pick up a great many nooks and crannies and squiggles to be added in to the mileage count. The contour is more squiggly on Volta than on Lake Victoria. This means that at a very detailed scale Volta appears to win the shoreline contest.

Increase in fishing

The fishing industry on Volta Lake is correlated more with the shoreline than with the total area of the lake. There are masses of slime and weeds in the drawdown zone, and also in the slope just beyond the drawdown. There is more plankton; more benthic organisms which flourish and multiply in the mud and rotten wood. What happened on Volta, as the Lake filled up, was a sudden explosion in the fish population, a flash in the catch rate. Not a single species of fish was introduced, yet 120 species have been recorded in the lake and in the river system, 60 of which are found in commercial quantities and can be eaten. (The fishermen, and others who have the right "ju-ju" will even eat electric fish.)

It is a strange business. Bill Taylor, an Australian, who, at the time of my visit, was the Director for the United Nations Development Programme and the FAO of the Volta Lake Research Project, described it to me. "One of the critical things is the number of canoes. You go on this lake; you don't see any fishermen. You see the odd village, the odd canoe. But not much more. One of our people decided to map the shore-line. He covered it, found it was dense as hell. Hundreds of villages. He went to a part of the

shoreline where there weren't meant to be any villages and found out that there were even more. The land at the water's edge hasn't been cleared of course. None of the land was cleared before they flooded it. It's still forest. That means, because of the trees you can't go in a big boat and you can't go in a cabin cruiser. You've got to go in a work boat and even then you may be 50 yards from the shore. The villages are in the trees, set back from the water. They don't know how far the water may be coming. They don't know what the 280 foot contour is or where it runs.

"People from the traditional fishing tribes have come back into fishing," said Taylor. "There may be 70,000 people altogether along the lake shore. The villages are very evenly spread. The best fishing is close to the shore; fish move towards the food in the drawdown level. The people move their villages to where the nets are. They don't want to have to paddle three or four miles. Naturally, you'll find some concentration in areas of good road access, especially on the southern arm of the lake and part of the eastern arm. There we estimate an average of 10 canoes per mile; the average over the whole shoreline is about four canoes per mile. You can reckon that a canoe equals the fishermen, an assistant, a wife and the children.

"The traders walk in to where the villages are, buy the fish in a fresh state, walk away with the fish on their heads, process it—probably salting or sun-drying, then sell it to the market. At the farthest point of the coast, you will still find that five to 10 per cent of the fish eaten comes from Volta. In nearby areas the proportion may be 30 or 40 per cent. It's cheap and it's good. Probably just as good as marine fish. Kwashiorkor in the area has almost gone."

If the decline in Kwashiorkor in the Volta area is one of the pluses on the health side, there are minuses as well.

River blindness

Over half the people over 40 years old living on the Volta are blind. What happens is this. If an infected fly bites you, a worm develops, then another worm, then a nodule, micro-filaria under the skin. When these tiny little worms die, the body encases them in fibre. If they die in your eye, a fibrous substance can develop and

cover your eye completely. Europeans rarely contract river blindness as it is called, because their nutrition levels are better and the period of exposure generally too short.

With the creation of the lake, and the flooding of the gorge, the experts thought they had wiped out the breeding grounds for the simulium fly. In fact this is not the case. The people on the breeding grounds of the Volta River are now being infected by flies developed on the breeding grounds of its tributaries. What is more, the installation of the turbines and tunnels in the dam itself has meant that there are, downstream of the dam, beautiful man-made rapids, a nice steady flow of 20,000 cubic feet per second providing ideal conditions for the simulium fly. Plagues are recurring.

The situation may not be improved until demand for Volta electricity reaches such a level that they have to install a second dam, to take advantage of the final 40 foot drop remaining in the river. In that case the river itself between the two dams would flood out the rapids and the simulium problem it is hoped, should be at an end. In the meantime, they are trying to use chemicals such as DDT to control the fly. The ecological consequences remain unevaluated.

Bilharzia

If the position for river-blindness is ambiguous, the bilharzia story is not. The increase in bilharzia was one of the most serious side-effects of the Volta Project.

"Schistosomiasis — bilharzia — is of two forms. The rectal form and the urinary form. Let us forget about the rectal form because it is very patchy and not important from the medical point of view. Let us concentrate on the urinary form.

"I am not a medical man but, as I understand, the urinary form of bilharzia has more or less the following pattern. You step or swim in the water and a schistosome will or may swim towards you. When you get out, it may be on you. If you can, you rub yourself down with a towel, or with alcohol or take a shower. If you don't (and not everyone can), the schistosome may go into the bloodstream. Then it goes into the bladder and the urinary system and you bleed. In another stage of the schistosome's life cycle, you urinate its eggs, the egg gets

washed down into the water, it finds a snail, creates an eruption on the host and from that eruption continually escapes the disease. When you urinate blood, you know you've got bilharzia. That is why the villagers call it "piss blood".

"Blood in the urine is not necessarily more significant than menstruation in women. It's just a dramatic way of stating the problem. But in the third or fourth decade of infection, schistosomiasis buggers up the water-works. X-rays on the kidneys show they are distorted and damaged. You get all this gubbins in the bladder; the bladder becomes fibrosed and smaller; this leads to back pressure so that the ureters are dilated and the kidneys injured.

"Opinions are still divided as to the true importance of bilharzia. In countries like this, where 50 per cent of the people die before they are five years old, that is to say where a cohort of 1,000 is likely to be reduced to 550 or 500 before the end of the fifth year, you have to have the thing in perspective. Priorities aside, it is clear that before the lake came there were low rates for bilharzia on the river. Then, quite unexpectedly, al-

though they rehoused the population from the flooded area, some 60 to 90 thousand Ewe fishermen came up from the Lower Volta region where bilharzia endemicity was very high and settled on the lake. So an infected population moved into the lake.

"The attraction, of course, was—as you know—the biological explosion of fish who liked the slow moving water and the rich weeds. But this was also the favoured environment of the vector snail. So when the infected population moved in, an intense cycle of transmission was generated. Infection rates started to rise enormously. At the end of 1966, there were 10 per cent of children between the ages of 10 to 15 infected. By the end of 1968, the rate was probably 100 per cent. By 1970, the rates were falling. We have not found any snails since January, or damn few. Either there is an intense seasonal fluctuation, or the snails have gone. Perhaps it's too rough for them. Usually, the schistosome thing likes relatively placid conditions. They can't stand waves. They've only got 48 hours to find a host. One could summarize it by saying the ecology appears to be changing in a direction unfavourable to the vector snail."

The interesting question is: why? Bill Taylor could offer no clear explanation. "We have a weed control programme set up. By removing the weed, you can reduce the feed supply for the snail and thus the snail population itself. WHO were impressed because the infection rate had dropped from 90 per cent to 10 per cent. They concluded that the weed control programme had worked; but in the villages without weed control programmes the infection rate had dropped even further.

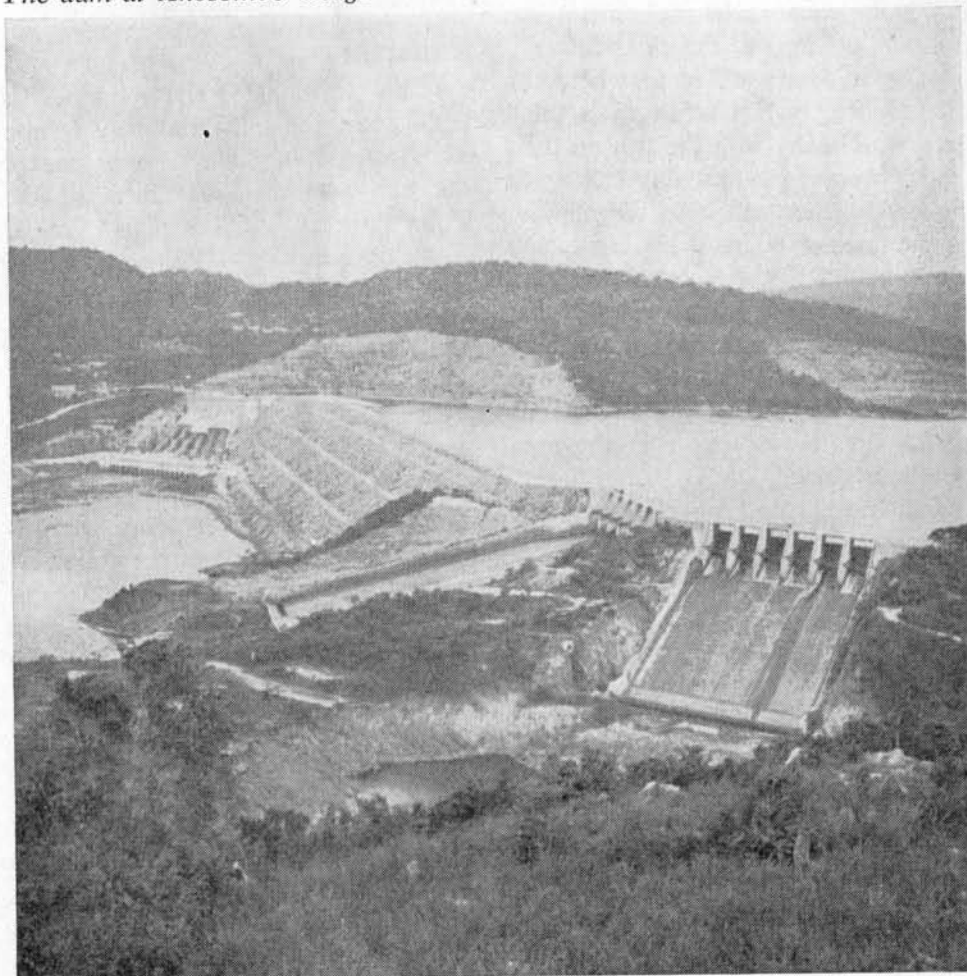
"It may be that the fish population has reached stability with its food supply. There isn't much submerged weed any more. The fish may have eaten the snail and the food of the snail at the end of the low season. But, we'll have to wait till the flood season when, with the drawdown covered with water again, there'll be lots of food for fish and snails. All we can say at the moment is that maybe God is on the side of the Ghanaians."

Re-settlement problems

The Volta Project, in its earliest conception, placed a strong emphasis on self-resettlement. Compensation was to be paid according to the value of the properties destroyed. This was the thrust of the Jackson report. But, by 1962, Ghana was independent and no government could afford to implement fully the self-resettlement idea. To get a fall of 300 feet at Akosombo, they had to go 200 miles up country. Three per cent of Ghana's territory or the equivalent of half of pre-1967 Israel had had to be flooded. One per cent of the electorate was directly affected by the dam and that one per cent was probably related to about five per cent of the electorate. Self-resettlement was just not politically expedient. In any case, there was a danger, perhaps a certainty, that people would merely take the compensation money and go and drink it away all at once.

There were roughly 80,000 people in the area before impoundment began—in May 1964. They were spread out between some 750 villages. 67,000 people were resettled by the government into 52 villages. The remainder chose cash compensation. A few—perhaps around 1,200 men or 5,000 people altogether, if you allow for women and children—came back as fishermen, to be joined there by the great inrush of Ewes from the Lower Volta.

The dam at Akosombo Gorge



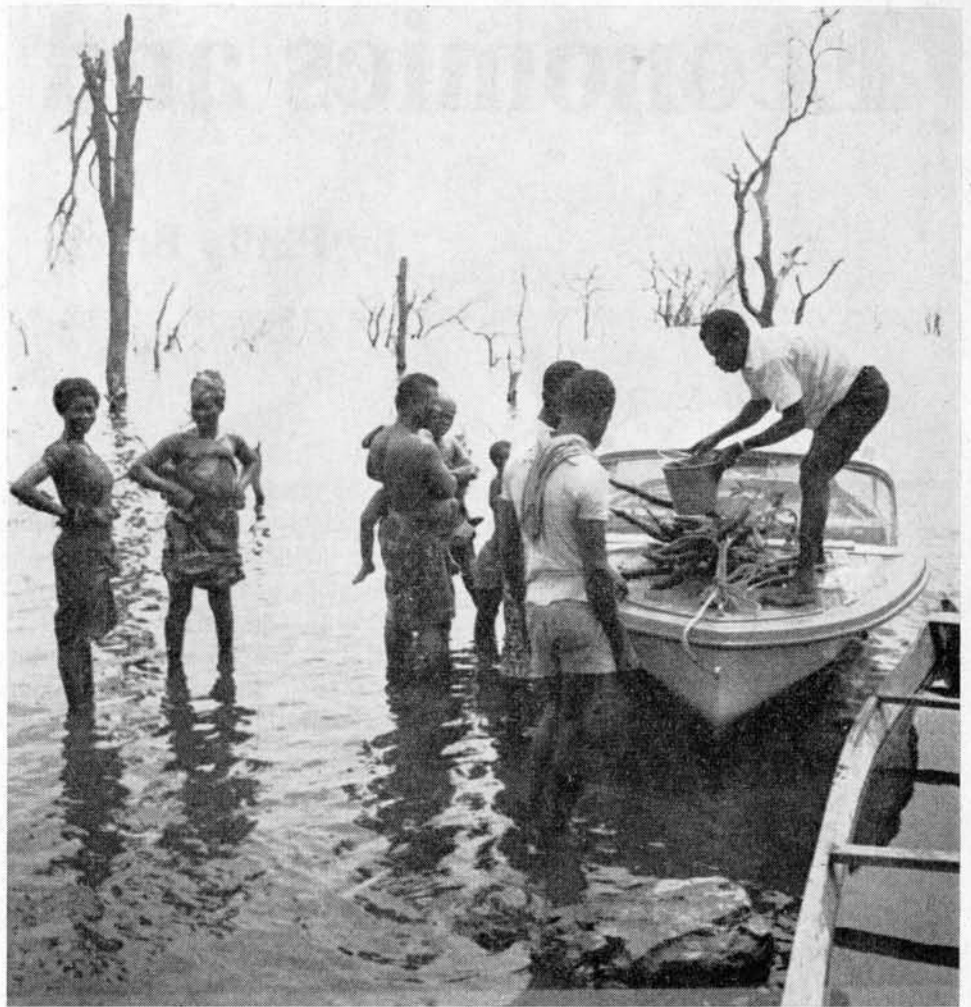
The resettlement process was a difficult and complex operation. The Volta River Authority, which had charge of the resettlement scheme, had originally hoped to have fewer than 52 villages. But this proved impossible. Some villages, conscious of traditional feuds, refused to amalgamate with others. Others were debarred, whether through custom or taboo, from crossing certain rivers. Still others could only be resettled on ancestral land.

No room for wives

But the problems of persuading people to move to the right place at the right time were small compared to the problems which arose when they arrived at their destination. Polygamous for the most part, the settlers objected to the concrete houses which had been constructed for them by the Volta River Authority. It was not the concrete they minded. On the contrary, a concrete house back in his "home town" is the average Ghanaian's idea of paradise. (The Tongu Ewes will never settle on the lake. They will simply stay there until they have made enough money to return home and start building.) No, what bothered them was the size. In the traditional village houses, the wives had separate rooms. The man moved round from one room to the other, changing monthly or weekly depending on taste or circumstances, e.g. pregnancy or lactation. The new houses offered only one room for the man and all the wives.

Apart from the question of housing, there was the question of land. The settlement villages were often designated in what were already heavily settled areas. Competition between residents and newcomers was sometimes intense. The switch-over from traditional patterns of shifting cultivation to stabilised agriculture, which was what the government intended, meant teaching the peasant a totally new system; required a complete change of attitude. The sheer labour involved in clearing and cultivating, surveying and demarcating vast tracts of territory implied a different sort of farmer, one imbued with a "modern" set of values and a "modern" approach to life.

Anyone who has endured the horrors of down-town Accra, and witnessed the ultimate consequences of a "modern" set of values and a "modern" approach to life, may justifiably wonder whether the game is really worth the candle.



The Lake covers about 4 per cent of Ghana's total land area and the sites of some 750 villages.

Not a single species of fish was introduced to the Lake, yet 120 species have been recorded.



Economics and Ecology

by Philip Brachi

Economists define their job as the allocation of scarce resources among competing objectives, so their link with ecology is clear: the surface of this island (and planet) is the most manifestly finite of our resources. Yet how often have we heard that some crass project for mineral extraction or motorway boxes is "economically justified"? While one may wish for a little less figuring and a lot more feeling, we harm our own cause if we cannot, at least initially, tackle partial and dishonest economics on its own terms.

The aim here is to illuminate some of the murkier areas of economic decision-making, and to suggest how it might become more truly a social science.

In the report of the Roskill Commission on the Third London Airport¹ we have a fine example, as contentious as it is contemporary, of Cost-Benefit Analysis (CBA). This economist's technique is merely an effort to add up all the pros and cons of alternative projects so as to select the best. To simplify the final totalling, money is used as the common yardstick for each comparison—be it of the cost of concrete or cacophony—and the project with the least cost wins.

There is nothing inherently sinister in this use of the £ sign in such matters; what is critical however is the relative importance given to each item. Thus, while the Foulness site on the Thames

estuary inflicts less noise on homes than does Cublington, it also needs a longer rail link. Which factor should weigh more heavily in the final decision? In other words, what price amenity?

Roskill's economists attempt objectivity, though there were of course some awkward calculations to make. Stewkley's 800-year-old church would be destroyed if Cublington were chosen; described by Nikolaus Pevsner² as "the most splendid piece of Norman parochial architecture in Buckinghamshire", it entered the CBA as worth £51,000, its fire insurance value!

Beyond such absurdities, one glance at the CBA Table will show that there is a much more significant cause for alarm; quite swamping the remainder of the analysis is the passenger's supposed valuation of his travelling time. The empirical economist simply observes the free choice people make between spending time and spending money; will a man go by bus or by rail across Britain? From such "revealed preferences" the economist calculates the traveller's implied time values.³

Many such travellers each saving a few moments—Cublington would be 39 minutes, Foulness 44 from central London by rail—add up says Roskill to a £187 million extra cost if Foulness were chosen. The plain exhaustion of long-distance flying is well known, as is the notion that a journey by train to or from the airport might actually be relaxing and enjoyable. Yet the economist's treatment of the businessman's time "lost" in airport access is such that the ideal would be for the Chairman to step off the Concorde straight into the boardroom, his decisions dizzied by having crossed the Atlantic's time-zones in 3½ hours! Time saved may mean capabilities lost. Sometimes it seems that if you cannot quantify commonsense you do not use it.

The Roskill Commission chose Cub-

lington; only Professor Buchanan dissented: "a decision which conceded the importance of the environment... would be an event of great significance for the future of Britain... and would redound to our credit in more senses than one." The fact that the Government has now selected Foulness may reflect realisation of this, or perhaps only a recognition of what is possible in the realm of the Peers.

But while the Essex Brent Goose vies with Stewkley Church for survival more fundamental questions remain unasked.

In Roskill's CBA, Cublington costs £176 million less than Foulness, the difference stemming mostly from the controversial passenger access costs. However, since there is nowhere in Roskill any figure for *total* costs, including operation, the significance of Foulness' extra cost is impossible to gauge. Is it large or small in relation to the costs and benefits of the whole enterprise?

Of course, as Professor Buchanan stresses, any new London airport would be "an environmental disaster". How then does Roskill's CBA show our need of one? Incredible though it may seem, no such attempt is made. It took the Commission two and a half years to fulfil their all too limited brief, but making out an economic case for a third airport was no part of it. There are not even any figures in the report for the rates of return on costs; this is like advertising a building society without mentioning the rate of interest. So quite possibly there are far better returns to be had from society's investing in housing, hospitals or hog-farming.

It is the economist's avowed creed to encourage all human activity, including air travel, subject only to two conditions: (1) The broad social costs must be less than the benefits. (2) No activity should be pursued beyond the

point where better value can be had elsewhere.

Incidentally Roskill appears to have overlooked the elementary economic principle that, for a fixed or growing demand, a reduced supply of an item (say open country between London and Birmingham) leads to an increase in its price. Thus the value of an absence of concreted countryside may be expected to rise rapidly as our populace spawns.

The idea of an economic optimum for population is beyond the scope of this article. More importantly it is apparently beyond the ken of some who should know better: "At the present rate of growth of population going on here, by sensible planning, proper land-use and anti-pollution policies, there is no problem." (The Rt Hon Peter Walker).⁴

Roskill's own air traffic forecasts show a rise from 18 million passengers per year through London in 1969 to 294 million in the year 2006 (at which date the CBA ends—a symptom of a basic malaise, of which more anon). Over the same period the world's population seems set fair to double. At some point one might suppose that disamenity and crowding at the home airport and foreign resort will be reflected in a falling demand for air travel. This would be so even if we assume as Roskill does implicitly, that air fares continue to be charged without regard to the unevenly distributed social costs of flying borne by society.

The airlines wanting Cublington ought to be able to afford to bribe the people of Buckinghamshire to accept the airport, thus paying the social costs they impose. If they could not afford to do so, and instead went out of business, then this would be a net social gain. However, the economist's CBA tries only to enumerate social costs; it does not demand that they be paid, and in reality such payments are rare. The compensation recommended by Roskill is far in excess of any present legal requirement, and if ever paid would be from the State and not from the airlines.

Interestingly, three airlines have recently been made to pay local inhabitants full damage for smoke and noise nuisance at Orly Airport, Paris.⁵ If taken as a precedent this case could help bring nearer a fuller social costing of all economic activity, and so redress the imbalance of the law that gives good protection to property rights,

while amenity remains a matter of chance or privilege.

With Roskill making such a brave attempt to measure and recommend compensation for the most immediate of these social costs, namely the noise burden, it is grimly ironic that the whole basis for the "need" for another airport rests upon ignoring these same social costs, and continuing to allow air transport to develop way beyond the society-optimal amount.

Perhaps the problem is one of acceptability. While politics, sex and religion are all approved topics, social costs remain inexcusably taboo in public discussion. The damage is incalculable.

The Economist, The Ecologist and Time

Time is important in economic decision-making, not only because "time is money" for those against whom the ecologist argues, but, more locally, planning blight may set in if decisions are protracted. The whole treatment of time by the economist is of crucial concern to all those who look to the future.

The value of time spent in airport access was decisive in Roskill's conclusions; yet instinctively one agrees with Buchanan that the prologue or aftermath of a flight are not time "lost" in the same manner as a daily commuter trip in a crowded train.

The advantage of a broad CBA is that it forces one to consider all the issues involved, and to make explicit one's value-judgments—always a good exercise for a social scientist. The real worth of Roskill is that it was published, greatly raising the level of public debate. It cost £1.1 million, but this is a mere 2p per head of the present population, and infinitely less when we consider all those to whom we later bequeath this island.

The danger of CBA is that it may allow "revealed preference" to write in market-place values for items which society might rather weight differently, so that poorer people today and in the future do not have their legitimate interests prejudiced by narrow economic Darwinism. Thus our present CBA-backed infatuation with urban motorways at the expense of advanced public transport makes little sense to those whose economic voice is weak—the aged, the invalid, the unborn.

Going beyond these instances where CBA refers to time-present, what of

time-future? Attitudes to the future are central to the ecologist's role. Economists use their "social time preference rate" (STPR) to indicate society's overall regard for the future. It expresses our willingness or otherwise to postpone gratification in favour of benefits later, benefits which perhaps only our grandchildren will enjoy.

The STPR is thus a percentage discount rate; if it is, say 5 per cent per year, this means that people as a whole feel that the promise of 100 apples in a year's time is equal to having 95 apples today. The more prevalent the "eat, drink and be merry" school of thought, the higher the STPR. Short inter-election horizons of politicians, individual pessimism, social entropy or "egotely"—any or all of these may combine to raise this critical indicator, by which we discount the costs we impose on those-to-come through our present decisions.

Roskill's choice of a 10 per cent rate for all its CBA work is staggering. It means, for example, that a side-effect involving £100 worth of disamenity to our children (or ourselves) in just 50 year's time, will be given a value in the CBA of 85 pence. The same disamenity 100 years from now is valued at just one new ha'penny—and note well that these figures have nothing to do with inflation; they are the actual significance that Roskill gives to the legacy we hand on. As the report says, "in many cases it is impossible to judge whether future generations will attach more or less value to those things we now cherish". Precisely. So how dare we presume to use so high a discount rate with its grotesque effects on the yet unborn.

"What has posterity ever done for me?" might be the retort to the suggestion that the State should be custodian of the future and that investment for posterity is a "public good" (something paid for and enjoyed collectively or not at all). That question should be easy for anyone who ever visited a museum, drank at an olde pub, or watched a Shakespeare play. Also there are good reasons why the lag between "us" now and "them" in posterity may be shortening. With mad scientists working to arrest the ageing process, and exponential growth rates of many things other than the surface of the planet, the pressures are such that the subjective gulf between "it happening" to my son/grandson and "it happening"

to me ought to be closing. Slowly we realise that the ecosphere is not infinitely compliant, but has thresholds beyond which harm is irremediable.

In numerous ways action and reaction, cause and effect, are coming closer together in time.

The Roskill Report is a rare publically discussed instance of the sort of decision criteria used many times behind closed doors. What, then, of the fact that all Roskill's calculations stop at the year 2006? Are the four 2½-mile runways supposed to vanish thereafter? Already it is rumoured that God laughs each time a plane rolls along the ground to take to the air; surely there should have been a huge figure written into the CBA for concreting the Vale of Aylesbury for all who are to follow. The benefits may stop by 2006, but never the costs.

Economists have long acknowledged the existence of unpaid social costs; Keynes:⁶ "There is no clear evidence that the investment policy which is socially advantageous coincides with that which is the most profitable". Joan Robinson⁷ wrote of the "fundamental bias in our economy in favour of products and services for which it is easy to collect payment. Investment in, say, the layout of cities, cannot be enjoyed except collectively and are not easy to make any money out of; while negative goods, such as dirt and noise, can be dispensed without any compensation being required."

Who though will go beyond acknowledgement and suggest what ought to be done? E. J. Mishan⁸ has thought further than most, leading to his plea for full recognition of amenity rights at law; immeasurables of noise, aesthetics and other trespassing on private amenity become claims for damages, which would enter into costs of production on a par with payments for the use of other people's property.

If we now dig just one layer deeper are there not signs here of the basic malaise of western man today?

The Planet as a Closed Economy

The concept of "Spaceship Earth" belongs to Buckminster Fuller, and is an elaboration of the first sentence of this article; it is only reasonable to consider the planet as a closed system. Despite mankind's initial legacy to the conquered Moon being ¾ ton of assorted garbage, we ought not to consider this a solution to our domestic

problems of waste disposal. It is a great pity that Fuller is not a trained economist, for "the dismal science" has entirely failed to see the implications of considering the Earth as a closed economy. There is just one exception.

Kenneth Boulding⁹ has made the distinction between the "cowboy economy" of the past, "symbolic of the illimitable plains, associated with reckless, exploitive, romantic and violent behaviour", and the "spaceman economy" of the future "without unlimited reservoirs of anything, either for extraction or pollution". The crucial difference between the two lies in their attitudes towards consumption. In the cowboy economy there are supposed infinite pools from which resources are obtained and into which effluent can be dumped; thus Gross National Product (the throughput per year), is a rough measure of the economy's success. We are dealing here with flow economics, in which concern is for activity per unit of time. Thus such phenomena as built-in obsolescence, preposterous packaging, and arms/space races are all seen as beneficial.

In the spaceman economy throughput becomes something to be minimised rather than maximised; the criterion of a healthy economy is not production and consumption at all, but the nature, distribution, quality and variety of the whole capital stock, including the physical and mental wellbeing of all the people in the system. Here we are using stock economics; the maintenance of a given stock with a decreased throughput is seen as clear gain.

Relevant to Britain's problems of conservation versus suburban sprawl, we can cite housing policy, in which there has recently been an encouraging shift of emphasis from flow thinking—"Your government only built X thousand houses per year"—to stock thinking, with Julian Amery's publicity for improvement grants. In the late 1960's while 400,000 houses a year were being built, more than 75,000 for which permanent renovations would have been economic slipped into irreversible slum status.

But, more generally and importantly, the much talked-of antithesis (an inverse relationship?) between the standard of living and the quality of life may be seen in the same terms. The former is measured by economists

as Gross National Product per person, a pure flow concept. The quality of life is seen to depend on rather more than this, including such essentially stock quantities as the length of clean coastline, the area of natural landscape, the volume of breathable air.

Should not true human welfare, then be regarded properly as a stock? Yet every politico-economic promise of "progress", "better standards of living", "faster growth", "a greater Britain"—each is dominated by flow thinking.

Is it eating that is good for you, or being well fed? Does economic wellbeing involve having good clothes, fine houses and good equipment, or is it to be measured by the depreciation and wearing out of these things? Boulding's "spaceman economist" sees nothing whatever desirable about consumption.

With posterity closing upon us, and the ecologist as society's unheeded lookout, how can the economist, endorsing so much that threatens, be anything but a hindrance? His analytical techniques are invaluable, but naïvely misdirected. Fixations must be dismantled; the new creed will have optimum population at its centre.

Transition from income-flow to capital-stock concepts through all our economic activity will not be painless, but the alternative is total anguish. There is no reason why economics and ecology adjacent in the dictionaries, should remain opposed.

SIMPLIFIED ROSKILL COST-BENEFIT ANALYSIS

(discounted to 1982)

	Cublington Site (mid-Bucks)	Foulness Site (Thames estuary, S.E. Essex)
Airport construction	cheapest	£14m more
Passenger access cost	cheapest	£187m more
New rail link	cheapest	£23m more
Residential noise	£13m more	cheapest
Loss of buildings	£11m more	cheapest
Loss of agriculture	cheapest	£4m more
Loss of recreation	£13m more	cheapest
TOTAL INTER-SITE DIFFERENCES	cheapest	£176m more

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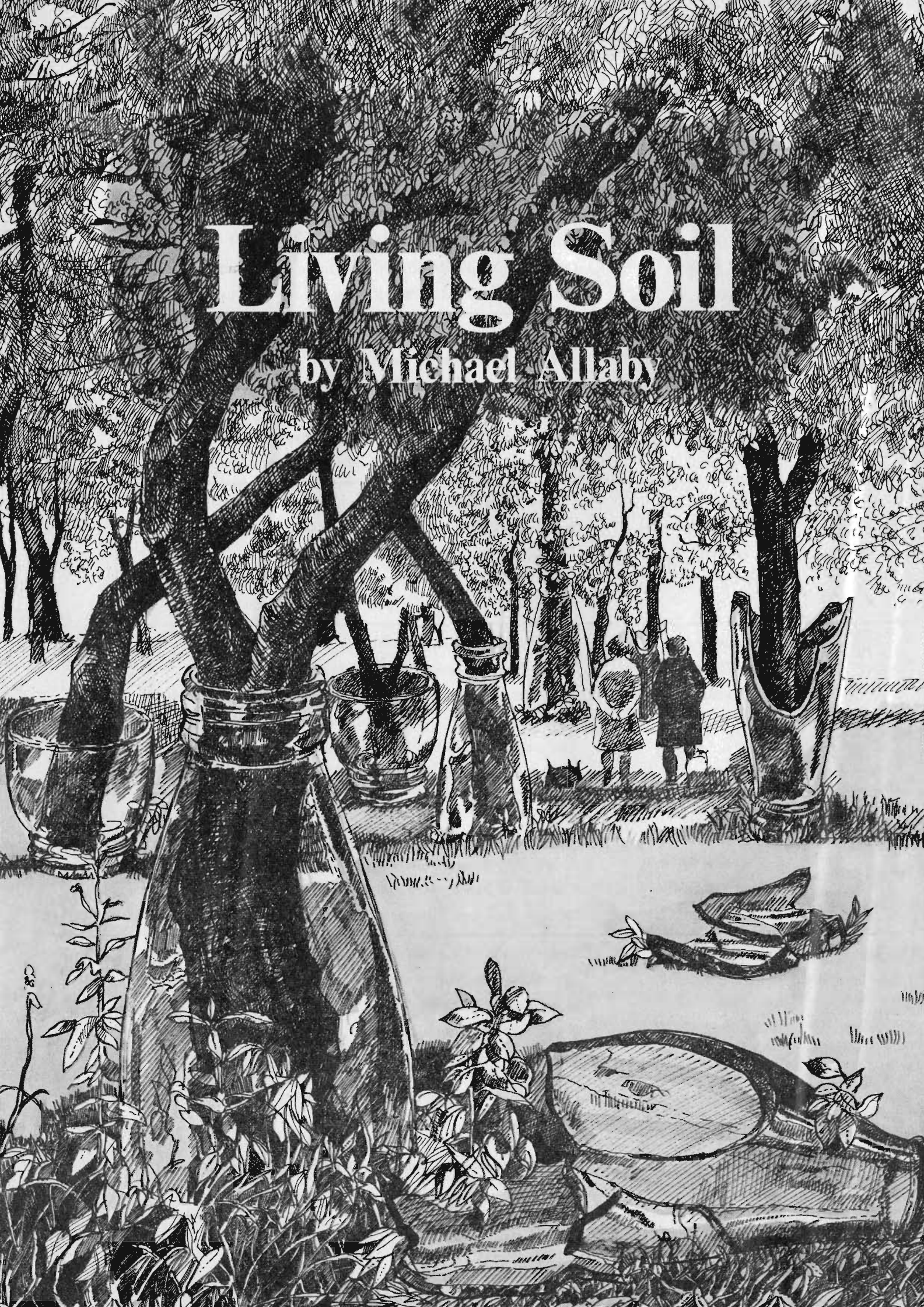
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Living Soil

by Michael Allaby



Soil is alive. The weight of living organisms in the top soil of a field may be greater than that of the cattle grazing above them. These micro-organisms and small animals form the base of a biotic pyramid on which all other land-based life depends. Destroy them and we create desert; nurture them and we build up rich fertile, soil.



They say that if you fly into Copenhagen on a sunny day you will notice the fields around the airport twinkling and glistening in the sunlight. The glitter is caused by countless small pieces of glass which have survived pulverisation and screening in Copenhagen's municipal compost plant.

Copenhagen composts its organic wastes on an industrial scale. Though not new, this method of waste disposal is growing more popular and many towns and cities employ it. Leicester is believed to have the largest plant for this purpose in Europe. It accepts the whole of the town's dustbin refuse and all of its sewage. Its end product is a fine, friable humus, sold to local gardeners and market gardeners as "Les-cos". It is a valuable soil conditioner. But it contains small pieces of glass.

The strange thing about this glass is that although there is so much of it and although it is handled quite extensively, there are very few reports of it cutting anyone. Some years ago this intrigued a group of German scientists working at Blaubeuren, near Heidelberg, and they set out to find the reason. They examined the compost, and the glass in it, and found that the fragments had no sharp or jagged edges. This accounted for the absence of cuts, but what could account for the absence of the sharp edges? It could not be normal erosion. A piece of glass in the sea will be ground and rolled and washed back and forth

by the tides until it is worn into a smooth pebble, but this is erosion on a greatly accelerated scale. In time the same thing would happen to any glass left out of doors, but the glass they were considering had been exposed for, at most, a few years, and it had not been subjected to such a battering as sea glass. If the edges had been eroded physically in the time available, none of our windows would be able to survive. There must be another reason. They wondered whether it is possible for glass to be eroded by bacterial action: whether it rots, in fact.

They searched the scientific literature on the subject and found that other workers had encountered the problem, but in a different context. Lenses, it seems, will deteriorate if they are stored for long periods. They will become "cloudy" and opaque.

An experiment was established. Polished glass plates were placed in fresh compost. Three months later they were removed, cleaned with water and alcohol, and examined. They appeared to have been etched and discoloured and no amount of rubbing would clean them any further. Under the microscope what had looked like etching showed up as complex patterns of oval cavities, highly uniform, between 0.5 and 1 micron in width and 0.25 micron deep. Further investigation identified some of the micro-organisms responsible. When placed in compost, glass is attacked by bacteria.

Glass is made from sand (silicate) with soda or potash or both, with the addition of alumina or lead oxide. It does not sound appetising, but clearly there are organisms which can extract from it nutrients which they need. Another scientist, Dr N. P. Burman, says he has isolated thermophilic silicate dissolving bacteria from samples of compost and by means of a simplified technique has isolated phosphate and silicate dissolving bacteria from sewage effluents. So the organisms which attack glass are common in compost. Since compost is similar to humus which occurs naturally, it seems that these organisms will also be found in the soil. If the soil will erode glass, what else will it erode?

For one thing, it will attack stone. If it were not for these stone-assimilating organisms there would be no soil at all and the earth would be as barren as the moon. These are the creatures at the base of all life on land, for it is they which convert the planet's mineral substance into nutrients available for more

complex life forms.

Soil is alive. Sixty to 70 per cent of a good, fertile, agricultural soil is purely mineral, but the balance includes about 8 per cent of living organisms. This may not sound much, but an acre of good soil may contain $2\frac{1}{2}$ billion live creatures, including 26,000 earthworms. The weight of the organisms in the top few inches of a field may well be greater than the weight of the animals grazing that field.

Obviously, these unicellular organisms are the oldest form of life on earth. Samples of rock taken from the Funflint chert in Canada have an estimated age of over two thousand million years. They contain the earliest evidence of life, in the form of microscopical formations resembling blue-green algae and possibly thermophilic flexibacteria. Almost certainly they were anaerobic, or at any rate anoxygenic, for the earth's atmosphere contained no free oxygen at that time. Probably they lived in water.

Life began in the sea and spread to the land as soon as the action of the weather had broken rocks close to the water's edge into small fragments offering a suitable habitat for organisms able to subsist on stone. These would have found themselves washed ashore, dried out, and then picked up and dispersed by the wind. From time to time, here and there, they would lodge among small stones, or in cracks, long enough to begin to colonise.

They may have included microfungi, similar to one of our most common moulds, *Aspergillus niger*, which extracts potassium from rocks, and several of the actinomycetes, which extract other elements.

We cannot know for certain what happened, for no one was there to see, but the organisms which attack stone are still with us, and we may deduce that the process which resulted in the formation of soil was similar to the processes which we can still observe.

After a time the surface of the colonised stone looks rough to the naked eye. Under the microscope it shows a structure of great complexity as the advancing culture seeks out the cracks and crevices which offer the best shelter and the largest surface area. Further organisms continue to arrive from the sea and, life being what it is, the stone-assimilating organisms are followed by predators, which live on them, and saprophytic organisms, which live on dead organic matter. The whole com-

munity creates around itself a strong colloidal structure which protects it from extremes of heat and cold, from drying out and from being washed away. Within the colloidal cover the microclimate is largely independent of the macroclimate outside.

Blue-green algae arrive to stain the surface of the rock with their characteristic "ink streaks". They are closely related to the photosynthetic bacteria which utilise chlorophyll. We are now very close to the first visible plants.

After the algae come the lichens, mostly *Laminaria* and related species. They decompose the rock even further by breaking into it, thus increasing again the total surface area and so improving the habitat for the original stone-assimilators.



Each time the surface area is increased the habitat is improved and this is an extremely important factor. The extent to which the breaking up of small into even smaller particles increases surface area has been calculated by a French worker, Nef. He asks us to consider a pine needle measuring 60 mm \times 1 mm \times 0.5 mm. The surface area of this needle is 180 sq mm. If it is cut into 60 pieces of 1 mm thickness, the total area will be 240 sq mm. The *Oribatidae* are able to break these particles into small cubes with 10 micron sides. This produces 30 million fragments with a total surface area of 18,000 sq mm. A nematode may then cut these pieces into still smaller ones, with 0.1 micron sides. There will then be 3×10^9 pieces and the total surface area will be 1,800,000 sq mm, or 1.8 sq metres: all from a pine needle only 60 mm in length.

Mosses follow the lichens. Each new life form is sustained by those which have gone before. As growth increases above, lower layers die down and yield new organic decay products. So the process continues until the first blade of grass, or the first small fern, takes root. Its roots hold together the flakes of detritus, now rich in organisms, and between and around the roots new

organisms settle. Slowly a thin layer of soil collects. It is still highly mineral, but it is earth, not stone. The difference between the two lies in the living organisms and the organic matter which accumulates as a result of their activity.

All stone surfaces are subject to bacterial attack, provided conditions are moist enough. The wall of an old house, and old garden wall may have green or blue-green streaks or patches; algae. On close examination the wall may seem rough and spongy, although it is quite hard to touch. The blade of grass, the tiny patch of moss, clinging to a tiny crack in a wall, may seem to be growing on the wall itself. In fact they are between the fifth and seventh distinct state in the formation of soil. This process takes place all over the world, all the time. It is only in the driest of deserts that it may be arrested and even there, there may be autochthonous microflora and green coccae which can condense from the atmosphere sufficient water for their needs.

The story of soil and its creation from rock has been described very graphically by Annie Francé-Harrar, a German biologist who worked in Mexico for many years, with her husband. They studied the process in relation to badly eroded soils and succeeded in putting bacteria to work, for if soil can be created in this way from rock, then direct application of the appropriate cultures to barren, highly mineral, soils, will increase their fertility. She has succeeded in colonising soils which consist of little more than volcanic glass and splinters, and making it fertile.

From the beginning, soil and vegetation develop together. A more complex soil permits the growth of more complex plants, and vice versa. More complex plants feed more highly evolved animals. Eventually a stable climax is reached in which every possible ecological niche is filled and in which no one species predominates. Over much of the world the natural climax vegetation is forest. Most of Britain was once forested. Left to itself, a deciduous forest is highly stable. Trees root deep into the subsoil to extract nutrients which are carried through the trees' metabolic pathways to the leaves. When the leaves fall they return to the surface what the roots took from a much deeper level. Thus a forest soil is often regarded as the most highly developed and the richest soil there is.

The study of the life in soil is attract-

ing increasing interest. A project is about to begin at the Soil Association's experimental farms in Suffolk to determine the size and variety of the soil micropopulation in order to discover the effect on it of different systems of land use. In France a similar "micro-census" is being carried out by a team of pedologists, botanists, zoologists, microbiologists and climatologists as part of France's contribution to the International Programme for Biological Research. Three members of the team, Claude Delamare Deboutville, Jorge Paulo Cancela da Fonseca and Guy Vannier, described the work in the July/August 1969 issue of the French journal *Atomes*. They are working in a large oak forest at Senart, 25 kms south-west of Paris. The forest, which is state-owned, has been protected for almost a century. The soil is rich. They are counting the population of protozoa, nematodes, arachnidae and insects, taking one species of each. This is a gargantuan task and involves working with almost astronomical numbers. The protozoa which they are considering are found at a density of several hundred millions to the square metre. Nematodes, which are small worms, may be found at more than 30 million to the square metre, the *Acaridae*, which is the species of arachnidae they have chosen, have been counted at 45,000 per square metre 10 cms deep. The insect they have chosen, the *Collembola*, has between eight and nine thousand known forms. They do not give its population density, but according to Sir E. John Russell, in *The World of the Soil*, there may be 248 million per acre in the top 12 inches of soil.



The total mass of all the living organisms on the earth is called the biomass. The dependence of each life form on those which support it gives the biomass a pyramid structure—sometimes called "the biotic pyramid"—with the soil micro-organisms at the base and the most highly evolved animals at the apex. Thus, if we consider the number of individuals at each level which are

required to sustain each member of the level above during any given period of time, we can obtain a very clear, if rough idea, of the implications of overloading at any level but the bottom. It is just one more way of highlighting the serious situation which arises if, for example, man's numbers increase beyond a certain point. The pyramid becomes top-heavy, each level in turn consuming too much of the level below until the whole structure collapses. Man depends on the micro-organisms in the soil. It is here that ecology and economics meet, for a soundly based economy must take account of the total living resources of the world and the complex interrelationships which sustain them.



There is a natural progression from the simplest unicellular organisms to the mighty oak forest and the large animals which live in and near it. When it reaches its climax the ecosystem will sustain the widest possible variety of species of flora and fauna and the most complex patterns of relationships between them. It is this diversity and complexity which gives the system its high degree of stability, but any progress can be reversed. Any changing environmental circumstance which reduces the complexity of the system may initiate a reaction within it which will cause it to break down. This breakdown may, under extreme conditions, cause the breakdown of the soil itself. Just as the decline in the ecosystem as a whole will be evidenced by a loss of the diversity of its species, so the soil may suffer from a reduction in the diversity of its micro-population. If this should happen the fertility of the soil, its ability to sustain plant life, may decline and the soil itself may revert towards rock.

The most likely author of such an environmental change is man. Any action which tends to simplify the environment, to reduce the diversity of its species, may start a process which is difficult to reverse. History is full of examples.

Professor G. W. Dimbleby, of the Institute of Archaeology, University of London, has studied pollen in the region of identifiable, and datable, archaeological sites. For some reason pollen does not deteriorate in the soil and from it he has reconstructed vegetation patterns at various points in history. He has been able to trace the history of plant life in particular areas.

Like any other organism, man evolved into, and as a part of, an ecosystem. His arrival added to the diversity of species. Within the system he had considerable freedom of action and for a long time produced little effect on the ecology of the regions in which he lived. He learned to make and use tools to fashion artefacts, but this did not necessitate the destruction of other organisms. He hunted and was hunted, ate what meat he could, fruit and vegetables and roots and probably insects, all without changing anything. Then he discovered fire and domesticated the sheep. The sheep required land for grazing and the fire cleared away the forest to provide the land.

The first time a forest is burned the removal of trees favours grasses and shorter stemmed plants, so providing a good sward for grazing animals. But nature is resilient and the trees come back. However, this time there are fewer species. Each time the forest is burned the simpler will be the pattern of plants which emerges to replace it. The degree of complexity of the forest varies inversely as the frequency of burning. If the forest is burned every 250 years, let us say, it will be much more complex than if it were burned every 50 years. If it is burned every five years it will not recolonise at all. At the same time over-grazing may reduce the complexity of the shorter plants still further and may so deplete them that the swards break up. For a long time this did not happen because before great harm had been done, man moved on, with his flocks. He was a nomad.

The removal of forest cover will affect the climate. This is noticeable today in East Anglia where the clearance of the original forest has taken away the windbreak which sheltered the area from the winds from the North Sea. The mean temperature is lowered a little and the soil microclimate changes, too. The nutrient content of the soil also changes. Those nutrients in the subsoil which depend

on deep-rooting trees for their availability will no longer be available.

The long term effect of these changes will depend greatly on the climate and on the frequency and intensity of the clearances. Professor Dimbleby has studied heathland and moorland in Britain, tracing the history of heaths in North Yorkshire from before the beginning of the Bronze Age. At that time the area was under forest. Repeated burnings and the grazing of stock simplified the vegetation pattern and shifting cultivation increased the acidity of the soil, banishing the earthworms and washing out nutrients from the upper layers. As the countryside became more open, the fire risk increased until in the end heather began to colonise and a self-perpetuating fire hazard was established. The whole area is now semi-desert, a continuous sea of heather Dimbleby concludes:

"Such, then, is the contrast between the ecological potential of this land, as shown by its original state, and the condition to which it has been reduced by 4,000 years of exploitation. Yet even now natural succession if allowed to take place, will start the long trail back towards stability."

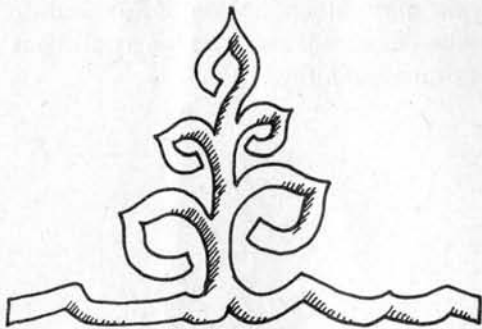


Annie Francé-Harrar has traced a similar pattern in Central America and in Spain. The land from Sinaloa to Baja California is now in a condition between desert and steppe. The part of it that is pure desert is the habitat of a single flora from the primitive mesquite and cactus forests. In the soil the microbial population has sunk to a minimum, lighter particles and the organisms associated with them have been blown away, and with them has gone the soil's capillary structure. Long droughts bake the surface hard. Plant roots cannot penetrate and the land cannot be worked by conventional implements. Irrigation serves only to transform it to a sea of grey mud, which then bakes hard again. Such corn as there is dries on the stalk before it can ripen. In 1952 Mexico had more than 40 per cent of "destroyed" land,

of which only $7\frac{1}{2}$ per cent can be irrigated and supplied with sufficient organic matter. This is man-made desert. It occupies the area that was once the high rain forest of the Tierra Caliente.

The comparative fertility of the soil may be gauged by the time it takes maize to ripen. At the time of the Conquistadores maize ripened in three months. Now it takes six to seven months and on the completely eroded tableland the small grains which thrive there at all do not ripen in less than 11 months.

This is only one example of a desert which has been created directly by man. There are many others. They have been caused by the over-simplification of ecosystems. Yet if agriculture is to be carried on, if man is to feed himself at more than the most primitive level, the land must be managed. If the land is to be managed the natural vegetation must be cleared to give way to a preponderance of single plant varieties. This is possible, of course. It is possible to farm well and wisely.



In a stable environment there are two processes at work, which could be described as entropic and negatively entropic. As simple substances are organised into ever more complex substances and organisms, so this is balanced by the breakdown of these into their original forms so the cycle may begin again. Each of the many parts of these processes is essential to the well-being of the whole and the removal of a component may interrupt the cycle, which will eventually result in a victory for the entropic part of it. The System will run down. Therefore, if components must be removed, then there must be compensation in order to fulfil their function. If trees are removed, for example, there will be loss of nutrient availability which must be allowed for, and there will be a loss of organic matter in the leaves, which is important to the soil structure.

This, too, must be allowed for. There will be a climatological change. Basic-

ally, everything that is taken from the land must be returned to it in one form or another. In small communities feeding only themselves, this is not difficult. All the wastes go back to the land and although the new ecosystem will not be the same as the original forest, it will be stable. It is when large cities must be fed that problems arise. It was Victor Hugo who pointed out that the fertility of Sicily went down the sewers of Rome. It was the over-simplification of ecosystems with too little knowledge of, or regard for, the compensations required to establish a new stability, that led to the downfall of empires. The Bronze Age nomads and the medieval monks, who burned the Yorkshire forests and over-grazed their sheep, the Mexican farmers and even the American farmers who created the dustbowl, acted out of ignorance. We are not ignorant.

The soil, being alive, must be fed or it will die. Do we need it? Nowadays plants can be grown without soil at all. A great deal of work has gone into the development of hydroponics, the growing of plants in nutrient solutions. Soluble plant nutrients can be, and are, applied to the soil in order to feed the plant directly, by-passing the soil micro-organisms. It has been suggested that in time it will be possible to produce enough food with fertilisers, using the soil only as an anchor for plants. Even used on their present, relatively small scale, fertilisers pose unanswerable questions regarding their long-term availability. Permission has recently been given to mine the rich potash deposits on the edge of the North Yorkshire moors and it is estimated that by the mid-1970s it will be possible to produce $2\frac{1}{2}$ million tons a year. This sounds a great deal. At present consumption rates it is roughly five times Britain's total requirement. However, if we are to consider the soil as obsolescent we will have to allow for greatly increased consumption. One day it will run out. Nitrogen fertilisers are allied to the petrochemical industry. Petroleum will run out within the next century. If the growing of food is to continue it must be based, as it has always been based, on renewable sources of nutrients. The reliance on artificial fertilisers is short-sighted. If it results in our allowing the soil to deteriorate it is suicidal. The biotic pyramid is there, whether we like it or not, whether we see it or not. It can be

maintained by wise and skilful management, but not by cleverness alone.

It is possible now to return to the land much that is taken from it. Provided the population being fed from the area which produces its food is not greater than the land can sustain, the break in the cycle of growth and decay which was created when cities developed to accommodate large numbers of people at a distance from the source of their food may be closed. It is technically possible to separate out the organic fraction of urban wastes as part of a general recycling. To this may be added sewage sludge from which much of the water has been removed for purification. The two parts are then fermented together in a huge, speeded up version of what happens in a garden compost heap. The result is much the same. Municipal composting is becoming increasingly attractive economically, as tipping sites are used up. At present its chief competitor is the incineration plant and when the eyes of the anti air polluters settle on its chimneys the compost plant, which causes no pollution, may have won. Its real importance, however, is not as an economic method of waste disposal, but as a means of closing the biological cycle which our urban civilisation has broken.



One of the few things which cannot be removed from the raw material is glass. It often arrives broken, passes through the coarse screening, is smashed to tiny fragments by the pulveriser, survives the composting process and passes through the fine screening. Some people worry about it and are afraid of handling the compost. There is little need to worry. The glass does not really matter.

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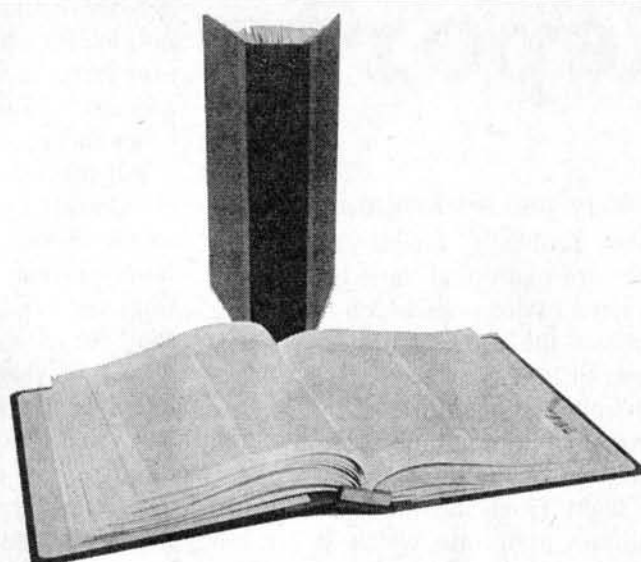
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Reports

Ecology and agriculture in Spain

The problems facing farmers in Spain are many and varied, but there are some major ones which are bound to affect the ecology of the country sooner or later.

In spite of the efforts of the present Minister of Agriculture to improve the conditions of life of the farm workers, the flight from the land to industry continues at a rate which is far too rapid for comfort. It is estimated that, last year alone, over 200,000 left the land for the towns. This has brought with it major difficulties for both agriculture and industry. It is now almost impossible to get workers for the farms, unless it is at fantastic wages. The cities have had to expand to house these new inhabitants, and practically everywhere city refuse disposal has become a major problem with little or no hope of a satisfactory solution.

In most cases this refuse is merely dumped a few miles out of the city, where it rots, and in some cases burns, causing foul smells for miles around and dirty, oily smoke, which drifts across the city when the wind is right.

More than one Municipal Authority has declared that there is no visible solution to this problem, mainly because the special disposal plants to process city waste are very expensive and do not deal with the complete problem, since the plastic, iron etc. in city refuse do not break down. One town of 250,000 inhabitants gave as the estimate for one of these plants the enormous sum of eighty million pesetas!

There are many major problems connected with recent or projected legislation. The Ministry of Finance has decreed a re-adjustment of the Urban District Boundaries in many cities. The result is that farmers whose lands fall within the new boundaries have to pay land tax at Urban instead of Rural rates—something like a 100 per cent or even more.

To pay the Social Security increases there is also another new tax, which is extremely complicated, but what it comes to more or less is this: the farmer will be expected to pay tax on the number of workers he is judged to

need on his land, even though he may not, in fact, employ that many. He will also have to pay on farm machines, animals, motors for irrigation and other things.

All this adds up to a burden which is almost impossible. The purpose seems to be to drive out the small family farmer and encourage the setting up of large co-operatives. We shall have more to say about the effects of this later, but the general intention is clear enough in another law concerning farms which are deemed to be capable of improvement. The Ministry of Agriculture can demand that the farmer carries out such improvements, and step in if he does not comply with the order. The Government is also toying with the idea of making sure by compulsory sale and purchase, that those who work the lands are also those who own them. This may sound very attractive at first reading, but it is not so easy, as we shall see later, when we try to assess the long-term results of this rather complicated agricultural policy.

To begin with, there are already serious changes in the methods of agriculture, since the large Co-operatives always tend toward monoculture as being cheaper and easier to harvest with machines. This will lead to vast changes in the ecology of certain areas of Spain, without any doubt; and they will not be changes for the better!

Irrigation and ecology

The new irrigation schemes, some of them on a vast scale, have given rise to a good deal of controversy. This has been mainly due to the fact that scientific and ecological advice was either not asked for or not heeded before the operations were put into practice. In the case of the Badajoz Plan, for example, the Ministry was warned that the costs would mount to something like £800 a hectare, and that about 40,000 hectares would not benefit from the scheme. The ignored advice was proved true, but only after the scheme was finished.

Another example of this lack of appreciation for the science of ecology reminds us once again of the infamous Aswan Dam project. The Tajo-Segura scheme, even more ambitious than that of Badajoz, will almost certainly destroy the ecological balance of vast areas in the south of Spain. We have

already witnessed the destruction of several bird sanctuaries through this type of thing, and at least two more are threatened, one of them a stopping-off place for aquatic migratory species, already very rare. This does not seem to cause any concern, except to the members of ADENA, the Wild Life Preservation Society of Spain, which is not large enough or important enough to bring any real influence to bear on policy in general.

Another problem is that not enough money is spent in Spain on agricultural research, in spite of one impressive building on the outskirts of Madrid, now in the process of building. It is almost impossible for any private agricultural research laboratory to get a grant for its work, not merely from the Ministry, but also from the many trust funds set up in Spain for this kind of thing. They really are not interested. A project was submitted recently to one of these funds which concerns a new biological insecticide of great power, but entirely non-toxic to animals and men. The scientists concerned needed only £3,000 to complete their work on this substance, but their application was refused. It would appear that these funds are open to the arts and letters, but not to agricultural research.

This caused not merely resentment among Spanish scientists, but also a 'brain-drain'—they simply go elsewhere, if they can. There is no future in scientific agricultural research in Spain at the moment. The men in charge of local and provincial pest control departments are, consequently, not efficient and not interested enough to carry out trials with new material. This, in its turn, means that the local farmer is simply not instructed in time about local pests or diseases and methods of defeating them.

We have seen recently a case in point—a virulent attack of *Plasmopara viticola*, which has already destroyed about 45 per cent of the grape harvest in one of the best wine areas of Spain. A simple laboratory test of this mildew should have made it plain to the local Department of the Ministry that that particular strain was resistant to the copper sulphate solutions usually used to combat it. Other methods were necessary. Instead the farmers were induced to hire helicopters at a high price to spray their vines with a substance which, in this case, was quite useless.

The present Minister of Agriculture is a man one can only admire, because he is himself a practical farmer, of wide experience, who knows his subject from A-Z; but he is up against certain fundamental difficulties, which have also been the curse of his predecessors in office. He has inherited the Orphan Child of Spain, as so often happens in other countries, together with an enormous bureaucracy at all levels of his Department. He has to try to protect farmers against the all-powerful Ministry of Finance, which is out to obtain the maximum possible taxation from lands—the one source of taxation where evasion is difficult, if not impossible.

The business man, shop-keeper or industrialist has his ways of evading taxation, but the land is something stable; it can be measured, and taxed accordingly.

The Ministry of Agriculture also has to contend with the fact that no one wants to invest money in farming nowadays, as opposed to industry, which brings in fat dividends. One day someone will write a book on the Ecology of Investment, which would be most interesting; but meanwhile one thing is certain. The farmers' syndicate, equivalent to a trade union in Britain, is the poorest of them all, with a deficit balance every year. All the other syndicates have more money than they know what to do with; in fact, they are one of the most powerful sources of investment in Spain today, with, it would seem, no obligation to produce a balance sheet every year! This could well be a source of political danger in the future, but at the moment it represents a constant threat to agriculture—the Orphan Child of the Trades Unions.

Does all this imply that in the near or distant future the agriculture of Spain may be taken over entirely by the State?

This is, possibly, the most interesting ecological aspect of things as they stand at the moment, for several reasons; First of all, it is being talked about and written about. A recent book has suggested just this as a solution to the whole problem. Also Spanish experts in the drift of population have been quite plain in their statements concerning the near future. They say that the population is tending to leave the central regions of the country and move towards the sea, and

that, in the visible future, the central areas might be well deserted and could be taken over by special Government stations or colonies, for exploitation on a monoculture system for agricultural purposes.

This may or may not be true, because the Spaniard is traditionally loathe to leave his locality and settle elsewhere—with the single exception of the inhabitants of Galicia, who are normally anywhere but in their native land! But there is an element of truth in the statement, due to the other factors we have mentioned in the report. Excessive taxation—and agriculture is certainly submitted to this—can drive a man away from his lands into other occupations, and then the state can step in.

Rural decline

In any case, the central regions of Spain are certainly doomed to drastic changes very shortly, because they cannot compete with the more fertile regions in prices or production, and also because they are ideal for monoculture, especially of grain crops. They are not suitable for open pastures, although they can support small family units very well. However, this does not become viable any longer when the younger generation does not want to work on farms, in spite of high wages, with the result that many villages, formerly prosperous centres of agriculture, are now nearly deserted.

Goldsmith's *Deserted Village* is now a fact in Spain also. There was a shot on television recently of one village, once of 500 inhabitants, and now the only persons living in it are two sisters of advanced age, waiting until they can sell their flock of sheep at a reasonable price and then get out!

The changes brought about by the tourist boom and by the steady decrease in land fertility must also be mentioned as elements affecting the change in ecology of the country.

In the 'good old days' every Spanish farm had its mules, a cow or two, some pigs and hens. However, the idea of truly mixed farming has never really caught on. With the advent of monocultures, tractors and other machines, there is now little or no natural manure going back into the soil and you would have to travel a very long way before you see a compost heap! Instead there is an increasing use of chemical fertilizers at very

high prices. It is a common site to see the stubble being burnt on the ground, instead of being ploughed in, although the Ministry of Agriculture has repeatedly condemned this practice.

The drastic results of this can be clearly seen in the less fertile regions, where soil erosion is common and where it is becoming more and more frequent to find deficiencies in trace elements in the course of any soil analysis. Yet there is no attempt to use the vast quantities of seaweed available round Spain's coasts, which could correct this at a reasonable price.

Carnivorous tourists

The tourist 'trade'—possibly the greatest source of income at the moment—is also a mixed blessing. We can pass over the exploitation of tourists which goes on in the more popular resorts, and confine ourselves to the effect of this trade on the farmer.

Most of those who come to Spain for a holiday are inveterate meat-eaters, and many of them do their own cooking! It is a common sight to see them coming out of a local butcher's shop with large parcels of meat under their arms. As usual, the tourist areas are distributed round the coasts, and as a consequence, the central districts show signs of a shortage of meat, especially during the season, because most of it is going elsewhere! One of the results of this has been a steady rise in the price of meat over the last few years; but the higher prices are not going to the farmers, even though the truly 'mixed' farm is the only solution for agriculture in many areas of Spain today, since meat at least brings a better price than grain and other crops.

Since the advent a few years ago of a severe attack of Asian Pest in pigs, many farmers have given up this once profitable source of income, and are now rather glad, because the rise in the price of combined foods for animals has risen sharply also. The Ministry argues that this is one more reason for encouraging large Co-operatives, where loss of one crop is off-set by gains on another; but meanwhile the small farmer suffers, at least in the central areas.

Milk production has gone up considerably in recent years, but again there is a serious snag. The farmers have to sell their milk to a Control

Reports

Centre, and the price they receive for it is very small. There is a way out of this, if the farmer has the money. He can set up a pedigree herd and market his own milk, untouched by hand, in plastic bags at a reasonably high price. The trouble is the money to finance this operation, which only pays if done on a large scale.

How does all this affect the ecology of the country? Simply because the tendency in all agriculture is to produce near a ready market—in this case, the tourist trade—will this induce farmers to change their crops in the tourist zones and concentrate on meat, hens, eggs, milk, as opposed to grain crops? The signs are that it will.

However, the main curse of the farmer's life, at the moment is direct taxation of his lands, due mainly to the fact that the Ministry of Agriculture has no control over the Ministry of Finance. The result is that direct taxation of lands has gone up by 500% since 1965, and is liable to rise still higher shortly—and this is only direct taxation. If one takes into consideration the extraordinary difficulties farmers have to make a living in many areas of Spain, this burden can only be termed an unjust one.

When are these people going to realise that one cannot eat motor cars and television sets?

David Greenstock

The rude truth

Comments on a conference on environment and health

This conference was held at Reading University, July 6-8. Modern perspectives in human ecology was the subtitle and that made this conference different from most of the others held on this theme. The essential questions as to what constitutes evidence was a constant theme.

If a chemical was in use that could be shown as dangerous, then it should be treated as guilty until it could prove itself innocent, as Dr Ken Hassall said, illustrating this with the interactions between pesticides and many drugs commonly taken. Prof. Bryce-Smith (Inorganic Chemistry, Reading) indicated inorganic lead in petrol as public

enemy number one on account of the lifelong brain damage it could do to children and the depression that it could cause adults. The petrol companies, he said, were under a moral obligation to do something about it. Would most of us willingly allow these hazards if we were aware of them for the sake of petrol that did not 'knock'?

Surely it must sooner or later occur to every intelligent M.O.H. that our health services are like garages on a road strewn with tintacks, and that it would be better to remove the tintacks than increase the number of garages? Some of these tintacks like pesticides and inorganic petrol were defined at the conference. The M.O.H. for Reading is both intelligent and a determined enthusiastic public official: He wants to infuse local government with the philosophy of human ecology. He knows that we must do two things: get our aims right and then make use of science to help us realise them. He sees that chemistry should now tend more towards environmental chemistry and less toward satisfying short-term economic goals. Prof. Bryce-Smith indeed thought that we should call a halt to science that is not concerned with health and environment. But to put these aims into practice we must get together. So Dr. Gatherer, the M.O.H., persuaded the Reading Corporation and the University to join with him in convening a conference of scientists, doctors, planners, local government officials and members to exchange ideas and knowledge. On the first morning we had the Mayor, the Vice Chancellor and Sir Frank Fraser Darling—an achievement in multi-discipline in this busy world that, it is to be hoped, has set a precedent. The only disappointment in this successful conference was that so few people concerned with local government turned up. This clearly indicates that they do not yet understand that human ecology, as the Vice Chancellor, Dr. Pitt put it, is more than the most important subject: it isn't a subject at all, but an all pervading influence on all subjects. Everything should be planned round it.

We must refuse to drop man out of the picture to suit any kind of interest. All over the Commonwealth this principle is being advanced by the members of the Commonwealth Human Ecology Council (CHEC) who provided some of the speakers at Reading.

One of these was Prof. Busuttill, an economist from the Royal University of Malta and Chairman of the island's Environment Council. He is also in charge of the Malta Case Study, a human ecological investigation into 1,400 families, a pioneer work that CHEC is hoping to foster in many other countries. Busuttill told me that he had been depressed by the inhuman atmosphere of conferences on the human environment held on the continent, so often dominated by political ideologies, including our own growth ideology. Unless we decide upon what being human means, we shall lose ourselves in relativities, he said. Being human surely includes feeling at one with our environment. The Malta Case Study had revealed that only 18 per cent of the population approved of the building developments that were going on and that the dislike was most concentrated among those who had only had a primary education. Isn't it likely that the same is true of our own country? Almost everyone dislikes the ugly packing case buildings or standardised multiple stores that are being erected in the centre of our old towns. Yet these are permitted by the local authorities we have elected to act for us! How can such things be?

Prof. Denman (Land Economy, Cambridge) had an answer to that. Local authorities tend to treat the land as if they were landowners whose first obligation was to make a profit. Is this the right motive for those who are the trustees of a tradition and the guardians of a community that has far more complex aims than simply increasing its wealth? Prof. Denman dug deeper than that. He suggested that if we look deeply enough into the processes of decision, we find that most local authorities have no motives at all! For lack of motive important principles go by default. This is revealed by the fact that the town plans which are displayed totally lack any purpose behind them. No, 'Why'—just 'You must'. How can we control growth, he asked, if we don't know the purpose of it? This is not defined in the Town and Country Planning Act. There is a total lack of a specified purpose in our legislation. This is where human ecology comes in to act as a guide. Why shouldn't wholeness and health provide the criteria for planning decisions in the future? Land use planning must have human ecology as a

Reports

test. When we see what is happening to the environment through development, we realise that government, national, regional and local must have control over the continuous process, not just over the jumps that take place when planning permission is requested. Government by 'Thou shalt not' gives no positive direction, such as those directions to good husbandry which were once upon a time embodied in the leases of tenant farmers and which were written into the Agricultural Act, 1947.

Yet the intention behind this Act failed because nobody liked enforcing it. What can you do about disobedience? You can only expropriate the property and either put in someone who is more obedient or run it yourself. In a free country this goes against the grain. Yet some such directives will some day have to be written into the law if the environment is to be saved. Some day the regional and

national planners will have to get to grips with those who make the daily decisions. If this is to be done under conditions of freedom then there will have to be a lot more consultation and cooperation. We must know, said Prof. Denman, the motives and intentions of those whose actions affect the environment, however rude it may be to ask them.

This proved Dr. Gatherer's point and was in itself sufficient justification for this conference: there must be an understanding of intention and motive on every level: Prof. Denman enlarged on this, for, by implication, he pointed out that the developers themselves had been left out. The farmers, the builders, the manufacturers, they are the people whose decisions change the world. The community has to get to grips with them every day. They must be at the conferences.

Mr. Amos (Town Planner, Liverpool) filled in some of this new approach in practical detail when he described what his town was doing. Town planning, he said, had fallen from its original humane intentions partly because it had proved too complex and difficult: to cope it had been frag-

mented. There was now a demand for integration, as the guiding hand of Providence had failed in this mystical task: so we must do it ourselves. Mr. Amos agreed with Prof. Denman that there were lots of powers but no objectives. These objectives must be found in two ways, by an overall policy committee—as recommended by the Maud Report—and by consultation with the community.

The town planners like the animal nutritionists usually forget to ask their victims what they want. Cities, said Mr. Amos, should be planned socially in the same way as they are planned physically. There should be an overall social strategy which was an applied human ecology. He gives as an example that when new techniques are introduced into industry it usually means that many older unskilled workers are dismissed. Yet the local authorities have no structure for dealing with this anguished human problem. Dr. Airie, consultant in social medicine, gave another example: when people are retired they often feel totally functionless, lose all dignity and will to live and either die or head for the mental hospital. What was society doing about

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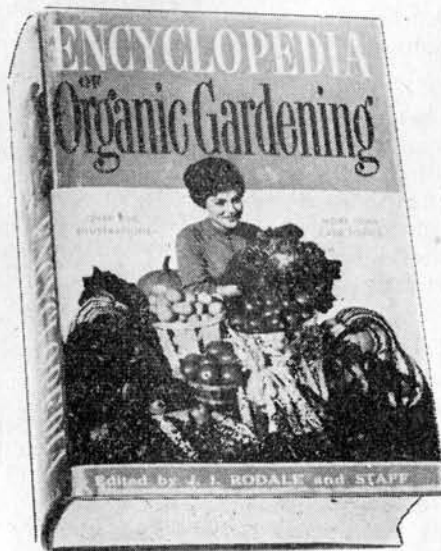
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this except providing more beds in mental hospitals? In the words of Mr. Amos, things now need attention which local authorities have not dealt with in the past, while many things are done which it is no longer necessary to do. The ecology of house development demanded that people should be asked whether they want to be moved from their antiquated slums into high rise dwellings. It had been found in Liverpool, too late, that young families hate high rise dwellings and as a result ten such blocks are falling into dereliction. This was bad social management more than anything else. There were some people who did not mind high rise blocks.

Means of consulting with the community in every area were vital: another speaker, Prof. Howe (geographer from Strathclyde Univ.) illustrated how every area of a city had its own geography of disease that could be mapped—which is not really surprising, he said, when we think how differently people live in different boroughs of a great city; the variations in incidence of each disease was often greater than that between whole regions. Liverpool had now set up 17 community settlements and four community development centres as well as cooperating with voluntary bodies such as SNAP (Shelter's Neighbourhood Action Project). These should ultimately help to make the local authority and the people one community.

In this conference we can see a new social philosophy emerging which takes account of the effects on every individual citizen of his total environment—which was the aim of the late lamented Peckham Health Experiment, which surely must come to life again one of these days. At the last day of the Conference, Sir Hugh Springer Chairman of CHEC, suggested that we needed a national human ecological council—or whatever name we cared to give it—which would work in liaison with the groups to be set up in the Commonwealth by CHEC. Dr. Gatherer has offered to be organising secretary of a steering committee for this purpose.

All those who are interested should write to:

Dr A. Gatherer, Medical Officer of Health, Reading County Borough, Bristol and West House, 173/4 Friar Street, Reading RG1 1JB.

Robert Waller

OECD and Biodegradability of synthetic detergents

A delegate group has produced two common tests for the calculation of biodegradability in synthetic detergents. The group has duly reported to the OECD Environmental Committee, who have already set a minimum biodegradability level. If, and when, the various member countries agree to the tests OECD will have both the specification and means of control to protect the quality of water, at least as far as detergent pollution is concerned. As a point of detail, the proposed tests

refer only to some eighty per cent of detergents and further tests will have to be devised for the rest—the non-ionics rapidly becoming popular. As a further point of detail, twenty-nine laboratories co-operated in the production of the tests, so there should be little difficulty in getting the member countries to accept. With any luck we could have a common test and a common tolerance throughout most of the world, which will remove tariff barriers and promote international sales.

Whether the motivation is sales promotion or a feeling that something should be done about polluted water is not clear and it could be largely academic. The Governments of Member Countries are asked to inform the Organisation 'After a Two Year Period' about measures taken. Much dirty water will pass under bridges in two years.

Allen Jones

In the next issue of The Ecologist

The dangers of chemical and biological warfare, by Judith Nottingham. The public is aware of the risks involved in chemical and biological warfare, but how safe is the development, testing, production and stockpiling of the weapons themselves?

Environmental problems facing Japan, by Peter C. Smith. The Japanese "economic miracle" has created environmental problems of such magnitude that today we can see in that country the consequences of unbridled growth. Japan provides an example to the West in more ways than one!

Structure of the soil under stress, by Neiton Pilpel. What is soil structure, how has it been affected by modern farming systems and why is this important?

We need these soil tillers, by Cleeland Bean. Not everyone realises the role of the 37 species of common earthworm in maintaining the fertility of our soils.

Ethnoecide, by Robert Jaulin. Societies, like ecosystems, are kept in balance by an intricate network of relationships. If these are disturbed the society may become unstable and collapse. The Motilone Indians, who live on the borders of Colombia and Venezuela, were moved from their *bohios*—large communal dwellings—and resettled in concrete houses. The intentions were admirable, the results disastrous.

Coming events

Correction to the October issue

1-5 November—National Society for Clean Air Folkestone Conference. Speakers will be Sir Eric Ashby and Mr. Stanley E. Cohen, President of the Society. Details from the National Society for Clean Air, 134/137 North Street, Brighton BN1 1RG.

6 November—Royal Society for the Protection of Birds Film Show. "The Lonely Level" and "Kites are Flying" at the Royal Festival Hall, London. Tickets from RFH or booking agents.

18 November—Discussion of Central Advisory Water Committee. Report and White Paper (East Midlands Branch) 2.30 p.m. Victoria Hotel, Nottingham. Details: contact Institute of Water Pollution Control, Ledson House, 53 London Road, Maidstone, Kent.

27 November—Symposium on Badgers—2.30 till 7 p.m. at The Irish Club, 82 Eaton Square, London, S.W.1. Entrance by Ticket only obtainable from: Animal Defence Society, Ascot House, 52 Dean Street, London, W.1.

1 December—Discussion on Paper "The River Severn: Stocktaking in a Time of Change", H.C.E. Gatehouse, Severn R.A. (West Midlands Branch. Institute of Water Pollution Control. For details: contact the latter at Ledson House, 53 London Road, Maidstone, Kent.)

30 December—"Heavy Metals as an Environmental Hazard to Fish, Birds and Man". American Fisheries Society. Arranged by Gerald J. Lauer of New York University.

ecology action

Homes before roads

The "Homes before Roads" movement was formed in 1970 for one purpose only, to publicise more widely the Greater London Development Plan. At that time it was felt by many in the environment lobby that only very few Londoners realised the appalling implications within the Greater London Development Plan. The story of HBR is to be publicised elsewhere although much mention was made of it in an article by Michael Gurstein "Environmental Politics in Britain" (Ecologist-April 1971).

Nevertheless the success of the HBR campaign in 1970 should not be underestimated. The economics staff of one national newspaper estimated privately the cash value of the campaign at £1,670,000. This was an estimate based upon the cost of all the space in the local and national press and on the television networks. The two major political parties were forced at this election to discuss the plan and the motorway proposals before the TV cameras and in public.

Many HBR people decided that it was worthwhile continuing with the movement after the election was over, since it had become almost overnight a nationally known campaign and was synonymous with the motorways fight.

Accordingly in the last twenty months HBR has developed and widened its sphere of operation. HBR members have been particularly pre-occupied with the Inquiry in the London Plan but have nevertheless been able to help and advise others as far a field as Warwickshire, Herts, Suffolk, Hants and Kent.

One of the problems is that people get in touch with HBR when it is almost too late. The constant refrain is, "Why didn't they get in touch before?"

The problems which HBR have helped with have not been confined to Motorways. The operation has gone further afield into almost every aspect

of planning. Most of the problems which have been considered by HBR would better have been fought on the broader base rather than the parochial. The planners' tactics, like those of the road engineer, are to fragment the opposition by presenting the problem in small pieces. In the case of a road this is done village by village, town by town along the line of the proposed motorway, rather than face an Inquiry into the logic or desirability of the whole. Oddly enough when the whole is considered, more often than not there is very good reason to believe that the road proposed is the wrong road, in the wrong place and at the wrong time.

In the writer's experience this has happened more than once. In these instances what has happened is that thirty years ago someone thought it would be a good idea to widen a particular road. The idea is then carried forward, into "present trend planning logic", to imply that there must be a motorway along this line on the map. In fact no more thought has gone into it than just that.

HBR have provided speakers for meetings, expert witnesses for Inquiries and have arranged local, national and

TV coverage for problems both inside and out of the London area. There can be no guarantee to be able to help everyone. HBR is, after all, an *ad hoc* collection of friends, acquaintances and likeminded people, some 150 in number who believe passionately in their declared defence of the environment and the quality of life.

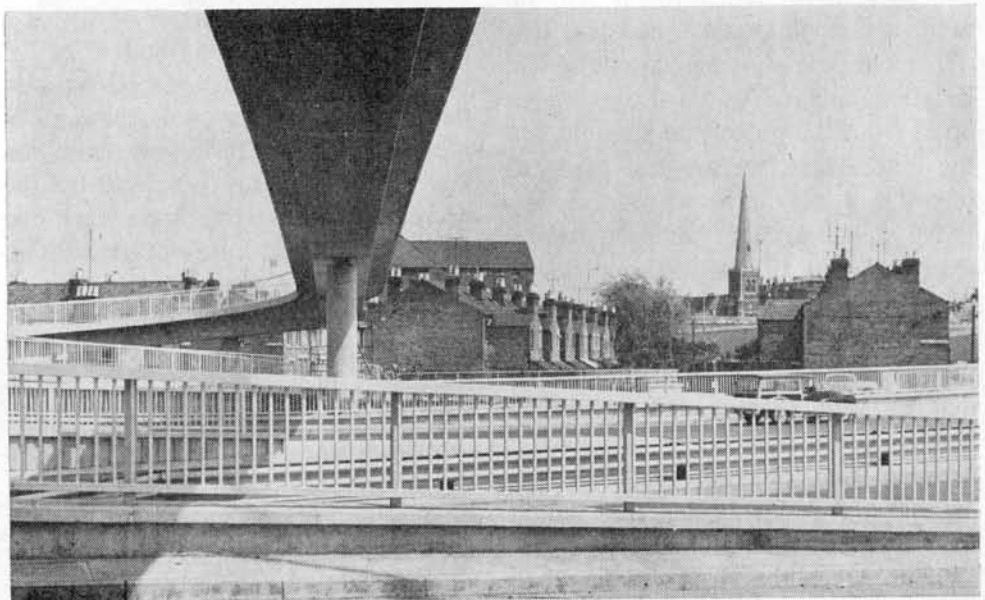
Members of HBR pay their own expenses since there is no national funding or public subscription. If the growth of activity continues some other arrangement may become necessary. The strength of HBR may well lie in this since there is no individual search for power.

"Homes before Roads" welcomes all who may have a "similar fight on their hands". They can use the HBR banner and have other HBR friends beside them rather than continue their fight in hopeless isolation.

Anyone or any group, who feel that their case could be strengthened, could do with publicity or technical assistance, are always welcome to get in touch with HBR through Derrick Beecham, 28 Grove Park Gardens, Chiswick, London W.4.

Derrick Beecham

Motorway development at Reading.





Towards a unified science

The development of the Ecosphere as a single process

The Hellenic philosophers assumed that the world could be explained in terms of one all-embracing theory. They built general models that may appear naive today, but many of which were probably, at different moments in time, the best that could be built with the available knowledge. Since then, the tendency has been for science to split into ever more specialised fields, each using its own method and terminology. Only in the last decade has a movement arisen to link the various fields into one general science. The principle involved, however, is still little understood, and the necessity for such a general science is only recognised by a minority of enlightened people.

Owing to our tendency towards subjective classification, we recognise that certain events among which a connexion can be made within our immediate experience can be regarded as forming one process, while, on the other hand, we refuse to admit that this can be the case with events whose connecting bond lies outside our experience.

Thus, we are willing to admit that the development of a foetus into an adult is a single process, and that it is difficult to examine, separately and in isolation, any of its particular stages apart from the process as a whole. On the other hand, we are less ready to regard evolution in this way.

We still imply that radical frontiers exist between life at different levels of complexity, in spite of the fact that they are part of the same evolutionary process. Yet, it can be demonstrated that no such frontiers obtain. When Kohler synthesised urea, the barrier between the 'organic' and the 'inorganic' was suddenly shattered, as did that between the 'animate' and 'inanimate' when the virus was found to

manifest certain conditions associated with life on being confronted with a source of protein, and at other periods to display the normal behaviour pattern of a crystal. Again, it has been demonstrated repeatedly that no barrier exists separating men from the simpler animals. He is more 'intelligent'; and that is about all that can be said. (see *Towards a Unified Science The Ecologist* Vol. 1. No. 7.)

If this is so, we should be able to establish laws of development applying to the process as a whole, i.e., it should be possible to build a general behavioural model that will be applicable to behaviour to all levels of complexity.

It is only when one attempts to do this that we realise the necessity for such a model.

Thus, it can be shown that any principles that appear to apply in the initial and more general stages of development, must also apply at the later, and more particular ones. The best illustration of this is the applicability of the laws of physics not only to inanimate objects, but also to the most sophisticated organisms, such as a human being.

Thus, if you drop a rock and a university Professor from the top of a tower, in both cases the way they fall will be predictable in terms of the same physical laws. They will both obey the law of gravity, for instance. This essential principle I refer to as the *accumulation principle*. It follows from the fact that behaviour proceeds by the accretion of successive strata, each one of which will constitute a differentiation of the preceding one.

The accumulation principle is apparent, also, from the following consideration. In its development from the simple to the complex, matter passes through certain critical stages, where the possibilities of a particular type or organisation are exhausted and further advance can only be achieved by the development of a new type.

Thus, an atom can be developed only up to a certain point. This point will vary with different types of atoms, some of which, such as the tungsten atom, are relatively large.

Beyond this critical point, however, development can occur only by associating several atoms together to form a molecule. As soon as the latter stage is reached, the constituent atoms undergo a considerable change, in that a radical division of labour occurs, in accordance with the law of economy.

To explain their behaviour now requires the introduction of new principles. These, however, do not replace those required to explain the behaviour of the atoms before their association rather they complement them. An accumulation has occurred.

The same thing happens when we pass to the next level of complexity, the cell, which is made up of associated and differentiated molecules, and so on. In each case, as we proceed to a higher level of complexity, there must be an increase in the number of disciplines required to explain behaviour. The sociologist who deals with behaviour at the highest level should thus understand behaviour at all the preceding ones: for a society is made up of men, made up of organs and tissues, in turn made up of cells, in turn made up of molecules, atomic particles, etc.

The accumulation principle is also apparent from yet another consideration. The genetic instructions transmitted from one generation to the next are not determined by the experience of the previous generation. If they were, modern science would not condemn so radically the notion of the inheritance of acquired characteristics. On the contrary, that part of the instructions, that can be ascribed to the experience of the preceding generation is but a minute fraction of the total instructions contained in the genetic material.

The latter in fact, will reflect the

experience of the unit of phylogeny taken as a whole, i.e., of the species to which the system belongs, taken four-dimensionally. From that it must follow that if we are to understand the process of phylogeny, it is the latter that must be taken as behaving, and not one of its differentiated parts.

The same principle is infinitely easier to understand in the case of ontogenetic development. Each step in the embryological process is not regarded as separate. The embryo as a whole is taken as the unit of behaviour.

Thus, the accumulation principle makes it clear that to understand a process one must not only take into account the unit of behaviour that appears to be directly involved, but the vast four-dimensional system of which it is an integral part, from which it derives its general instructions, and of which it constitutes but a differentiated part.

For this reason, sociologists, who attempt to explain behaviour without reference to the preceding stages of development, are like neuro-physiologists who seek to understand the development of the cerebral cortex in a child without reference to the mid-brain, the brain-stem, and the other parts of the nervous system. The study of processes, which are but part of much larger processes, in an artificial vacuum can give rise only to the most superficial understanding.

Another principle of development that emerges from such an approach can be referred to as *the sequential principle*, or the principle of succession as it is known in ecology. All behaviour is made up of a sequence of steps. These steps must occur in the right order. If one step in the sequence does not occur, the sequence can proceed no further. In addition, the environmental situation to which they constitute adaptive reactions, and to which each one is therefore linked, must also occur in exactly the right order.

Thus, if a given step does not occur at the 'right time', it will not occur at all, or will occur imperfectly. Once more, embryology furnishes us with a very clear illustration of this principle.

Behavioural reactions, though they may occur spontaneously, are also 'triggered off', by corresponding environmental situations. The latter are said to act as 'stimuli'. The less discriminating the system concerned, the

more specific will be the stimulus required to determine a given reaction.

Discriminatory ability is low in an embryological system, where the cytoplasm constitutes a very highly ordered environment. In such a situation, environmental situation 'A' triggers off reaction 'a', which in turn gives rise to a modified environment, 'B', which in turn triggers off specific reaction 'b', etc. It is evident that in these conditions any departure from the correct sequence of environmental situations and of behavioural reactions, will prevent the total process from occurring.

This sequential principle is also apparent in everyday behaviour. If a man is hungry, he goes to the kitchen to make a sandwich. He cannot possibly perform the steps in reverse, i.e., eat the sandwich before he has made it, and before he has gone to the kitchen to collect the ingredients. The correct sequence of steps must be observed.

Similarly, in the development of an eco-system, or of the ecosphere as a whole, the steps must occur in the right order. An eco-system cannot support carnivores until it has first given rise to herbivores, and the latter cannot possibly come into being unless the requisite vegetation has first appeared. Only a fixed sequence of events, from which but slight deviations can be tolerated, can account for the development of the highly complex biosphere of which we are part. This principle once more confirms the need for a general behavioural model. There is every reason to believe that this principle must apply to all behavioural processes. A third principle of behaviour is worth considering. In embryology, Van Baer's law states that development is from the general to the particular, from which it must follow that the earlier an interference occurs the greater the damage it will do. The reason for this is that development occurs by differentiation.

Van Baer's law can be shown to apply equally well to everyday behaviour.

When a man decides to eat a sandwich, a general instruction is issued by that particular centre in the brain that mediates eating behaviour. This message is differentiated at more and more particular strata, at each of which the instructions are adapted to specific environmental requirements. Similarly, when a General issues an order at Army HQ, the instructions will be

differentiated at each echelon, i.e., at divisional HQ, brigade HQ, battalion HQ, company HQ, platoon HQ, etc., and further adapted to local systemic requirements.

It is also evident that as we pass from the amoeba, whose single cell fulfils all those functions that are necessary to the maintenance of life, such as the seizing of prey, its digestion, the excretion of waste matter, respiration, reproduction, locomotion, etc., to the complex multi-cellular organism into which it eventually evolves, these same functions are fulfilled in an infinitely more differentiated manner.

Specialised mechanisms have developed, perfectly adapted to fulfilling functions that were previously fulfilled in a more general way by a single cell. The same is also true as the artisanal workshop evolves into the large commercial enterprise, or a tribal society into a large centralised kingdom.

If those processes occurring at a particular level of development are but a differentiation of the more general processes occurring at the previous level, it is impossible to understand the former without reference to the latter. Once more, we find ourselves faced with the necessity for a general behavioural model in order to understand any of the differentiated parts of the process ensuring the development of the total eco-system.

Edward Goldsmith

Poem

MEADOW ROAD

I could see it now
With a half-brick gladness;
The concrete strangeness of those fine
fields
Pebble-dashed and double-glazed.

And yet not a tear for the old,
The pitied hope of soon insistent daffodils
Laid flat and sown knowingly over
In the planned clay
Of this sadly over tenanted spring.

The council's keenness crawling for some
compromise
Of equality and peace,
Thus instilling the seed again
Among suburban spades
Contributing to some war effort
Which they know nothing of ...
Save that the spring looks invasive today
Among the uncompleted.

MAURICE McVEY, 1970.

Down to Earth



by Lawrence D. Hills

Personal Pollution

Smokers and cigarette manufacturers insist that the link between smoking and lung cancer is purely statistical—there is no *direct* evidence good enough to convince those who stand to lose millions if the verdict is that their product is guilty. Or the smoker who is determined to blame diesel fumes, car exhausts, pesticides or pollution rather than give up what Dr Donald Gould calls “cancer sticks”.

This is because we cannot teach experimental mice and rats to smoke and inhale as we do. They are always *smoked at* as non-smokers are, and so there is better direct evidence for the harm that smokers do to others, than for the harm that statistics show they may be doing themselves. The evidence is that smokers may be killing and injuring as many people as drinkers do in drunken brawls.

In 1967, Dr R. J. C. Harris of the Imperial Cancer Research Institute induced lung cancer in 4 per cent of his experimental mice by letting them breathe cigarette smoke for only 12 minutes a day for their normal life span. His results, published in the *British Medical Journal* (4, 637-641, 16.12.69) are of far-reaching importance for they could explain many of the anomalies in the statistical evidence on which smokers and cigarette manufacturers prefer to dwell.

The Australian lung cancer rate is about 40 per cent lower than ours with nearly the same consumption of cigarettes, South Africa is 21 per cent lower, again for nearly the same consumption, while the United States smoking a third more than we do has half our mortality. In Britain townsmen are more than twice as likely to die from lung cancer as countrymen.

Leaving out the fact that farm workers' wages in all countries are lower than those in towns, so they cannot afford to buy so many cigarettes, there could be a difference from more people working in the open air and

fewer cooped up in shops, factories and offices with heavily smoking colleagues, like experimental mice in cages but for far longer than 12 minutes a day.

Australia, South Africa, the United States and Canada are all outdoor countries, and open-air drive-in cinemas, or the indoor ones where smoking is entirely forbidden, as in Spain and parts of Australia, could well be healthier than the smoke-filled Odeons of England. Our 60-70 deaths per 100,000 a year is the highest in the world, and it goes with the worst mannered smokers of all.

The Continental respect for good food, as an example, lowers the exposure rate in restaurants compared with Britain where even smoking between courses is common. Smokers themselves are breathing the smoke from their fellows in between cigarettes, though they do not notice the smell. The *direct* evidence is that the lung cancer risk goes up in confined spaces for smoker and non-smoker alike.

The evidence that cigarette smokers can cause bronchitis in others is even stronger, because of the work of Dr D. Lamb and Professor Lynne Reid of the Institute of Diseases of the Chest (*British Medical Journal* 3.1.1969) with rats “smoked at” for five days a week by an autosmoker puffing the smoke in through holes in the tops of their cages. After six weeks all the rats were killed and their lungs examined and in every case ranging from rats on the receiving end of five cigarettes a day up to 20, or the equivalent in pipe tobacco or cigars, there was a significant increase in the number of mucus producing cells in the windpipe and lung passages. The same kind of increase in these goblet shaped cells occurs in patients with chronic bronchitis, and when cells increase into the smaller air passages of the lung and produce quantities of phlegm, this brings severe bronchial attacks in winter.

Though the Census forms asked re-sented questions about race, the Government lacked the courage to include one to find just how many non-smokers there are in Britain. So the only figure can be a guess of about 20 million out of 55 millions, which may well be too low as it must include babies and most children under 14. Of this total perhaps 5 per cent, a million people for whom the smoker's pleasure means misery (apart from the health

risk) are the “smoke sensitives”.

These unfortunates suffer nausea, headaches and dizziness like a boy with his first cigarette whenever they are forced to breathe tobacco smoke. The symptoms vary but in many cases exposure to smoke, as in a political meeting, an aircraft or in any public room on a passenger liner other than the library (where smoking is usually prohibited) is followed by insomnia. Very few smokers realise how unpleasant their habit is for others, and still fewer have the decency to ask “Do you mind if I smoke” when they may well be near someone to whom their smoking is worse than the spitting which was banished from our hotels with sawdust and spittoons by the social disapproval of a more considerate age.

In June it was announced that London Transport were about to increase their proportion of non-smoking cars from half to three-quarters and prohibit smoking in single decker buses, while British Rail planned to increase their non-smokers' accommodation from 40 per cent to 50 per cent. This change of policy by the nationalised industries was stated to be inspired by the report in January 1971 from the Royal College of Physicians “Smoking and Health”.

Yet long distance trains still provide up to nine hours continuous fumigation for unfortunate smoke sensitives. Trains like the Royal Scot are composed entirely of vestibule carriages, one half smoking and the other non-smoking, but with *no door between them* so the smoke blows up and down the carriage. It would cost almost nothing to remove the “no smoking” discs from the outsides of the windows of half the carriages and put them on the other halves, so that the doors at the ends of each complete vestibule carriage could be shut.

When smokers and cigarette manufacturers are faced with the direct evidence they demand instead of the statistics which would justify banning any other form of pollution completely a hundred times over, they insist that “men are not mice”. They are not. It is up to the 20 million non-smokers including the million smoke sensitives to show them we are not mice, and attack those who practise and profit by a habit that is harmful to others as well as their selfish selves. Smoking, in a permissive society, should be like homosexuality—practised in private by consenting adults.



Gulliver in Automobilia

In which the Author Discourses of City Life

I had always supposed that London, under the Rule of our present Sovereign King George, had achieved the utmost Extent of which any City could be capable. Between the Meadows of Chelsea and the Farms of Bethnal Green, from the Village of Islington to the Marshes and Gardens of Lambeth, lies, I had fondly imagined, the greatest Concourse of human Souls ever gathered into one Place since the Decay of Rome herself. Far different is my Opinion, since I was enabled to view the Cities of Automobilia, many of which contain more Persons than a whole Realm in Christendom. But my Experience of them has led me to conclude that in this, as in other Matters, Bigness and Worth are seldom conjoined. Nay, all the Defects, with which Cities here are afflicted, spring at Bottom from this one Cause, that they are swoln beyond the Limits set by Nature to the reasonable Congregation and Assemblage of Humankind.

I sojourned some Weeks in a City, which, since it might be matched a hundred Times throughout the Land, may serve as a Type for them all. My Host, a prosperous Man of Business, dwelt in the inner Parts of the City, at no great Distance from his place of Employment, and herein counted himself most fortunate: his Dwelling consisted of some few Rooms within an immense Edifice, like a Cathedral for Size, but in Aspect more resembling a Prison. This Pile housed upwards of a hundred Families, stacked in Apartments one above another like Gulls on a Cliff, with not a Rod of Land to call their own: so that the poorest Peasant in England would scorn to change with them, and as soon lodge in a Belfry as in such an unnatural Abode as theirs. Yet my Friend counted himself

fortunate that his Rent each Week was a Sum no greater than would suffice to maintain a labouring Man and his Family in all the Necessities of Life.

The most Part of the Citizens, to be sure, reside willy-nilly in the Outskirts and Suburbs, whence every Morning they migrate to work in the inner City. Their daily Passage is attended with such Discomforts and Frustrations, as it were painful to dwell upon: for the Majority make use of the publick Conveyances, wherein they must stand for many Miles, powerless to escape the Press and Stink of their Fellows. I once attempted such a Ride myself; but overpowered by the Proximity of so many Bodies, stifled by the close and foetid Air, and nauseated by the uneven Motion of the Vehicle, I was compelled to make a premature Descent and complete my Journey on Foot. It is marvellous that free Men will endure such Treatment, which is among us the unhappy Prerogative of Convicts and Slaves.

This Indignity my Friend escaped: but his own Situation could scarcely be judged more fortunate. For even in his own Home not all his Gold could purchase him a Minute's Silence, amid the Bellowing of Carriages in the Street, the Scream of Vessels in Flight across the Sky, and all the lesser Noises which inevitably attend the Confinement of several hundred Persons under a Single Roof. The Automobilians have moreover the Ability to shut up Musick in a Box, and release it at Will; and Devices whereby they may see and hear what is happening at a great Distance: all which Contrivances, though no doubt remarkable enough, are a sorry Trial to him whose one Desire is to sit at Peace by his own fireside. Nor is Nature's Solace easy to find: he who craves Woods and Green Fields must go a Day's Journey to find them, or content himself with a mean Substitute,

where a Plot of scrannel Grass and a few sooty Trees are dignified with the Title of a Park. The very Rivers of Automobilia are tainted and lifeless wherever they pass by a Town: for the Accumulations of Muck and Ordure which might enrich the Land, are used instead to impoverish the Waters. Wherein these Worthies resemble Hercules, who had no better Use for the River Alpheus than to cleanse King Augeas' filthy Stables withal.

It is a sad Aberration that a People who so much pride themselves upon their Practicality should choose to herd together in Places so little conducive to human Felicity: but the Automobilians have long been accustomed to sacrifice Happiness for Efficiency, and often so doing to lose both together. Their monstrous Cities are like certain Rocks which may be seen upon our Moors, whose ponderous Bulk is so nicely balanced that a Child's Hand or a mere Breath of Wind sets them a-swaying: for where so many Folk depend for their every Need upon the Services of a Multitude of Intermediaries, Malice or Accident may create an Effect out of all Proportion greater than the Cause. Thus during my Sojourn the Citizens were deprived of all Lights in the Streets and Houses during a Period of some Nights; and on another Occasion, the Carters of Refuse and Cleansers of the common Sewers, withholding their Labour, the whole Metropolis seemed like to be buried under its own Rubbish and drowned in its own Excrements; and I bethought me of the Words of Zephaniah the Prophet, "Woe to her that is filthy and polluted, to the oppressing City". But such Inconveniences are, I opine, but as the first unheeded Cracks in a Wall, which to the wise Observer betoken the imminent Collapse of the entire Building.

Nicholas Gould

Ecotechnics

by Arthur J. Puffett

Preventing soil erosion with rubber

Since time began, man has waged a constant battle against the elements to increase or maintain both the productivity and often the very existence of his lands and crops.

In many parts of the world, much of this battle has been won, but success has brought other problems in husbandry. In too many areas however, the battle still rages. In areas of under development, large tracts of land lie idle and barren under the blazing sun—the victims of both the elements and the ignorance of man.

Perhaps one of the most dramatic—and obvious—forms of soil erosion is that caused by the ravages of the wind. The basic cause is in the removal or depletion of cover vegetation which normally protects the land against these attacks. This is the legacy of ignorance—ignorance of the need for the right equipment, used in the right way and at the right season; ignorance which led to the burning of crop residues and excessive grazing of livestock. Additionally, land has been cultivated which because of various limiting factors in climate, soil structure and equipment should, perhaps, not have been tilled at all. If the basic cause of wind erosion lies in this lack of vegetation, then the cure must lie in the restoration of sufficient vegetative cover to resist the ravages of the wind. From this base, land may be developed to become a useful productive area once again, but wherever large tracts of land have soil which is fine or loose or dry, wherever it is smooth and the vegetative cover is sparse, wherever the wind is strong enough to start movement of the soil, then the hazard remains.

It is against this background that the International Synthetic Rubber Company Ltd. (I.S.R.) have, over the past three years, developed a man-made process which can make a significant contribution to man's fight against the

problems of wind erosion. It is firmly rooted in the concept of the rapid restoration of vegetative cover, and in achieving this with the minimum of time and labour. The materials used are in no way toxic and require the minimum amount of application equipment. The process is adaptable to meet the requirements of the five main sectors where restoration of vegetative cover either in the form of grassland or subsequently created crop producing land is concerned.

- 1) The reclamation of large tracts of waste agricultural desert land.
- 2) The conversion of this created marginal land into productive use without mechanical ploughing.
- 3) The stabilisation of coastal sand dunes.
- 4) The reclamation of industrial waste land.
- 5) The reclamation of land for leisure activities.

The material used in this work is called Unisol 91—a special blend of oil/latex, based on one of I.S.R.'s styrene butadiene latices. A given area is well prepared before treatment by as much levelling as possible, followed by the normal agricultural practice of harrowing, seeding and fertilising. When this has been completed the area is then sprayed with Unisol 91 at the appropriate level of application either by hydro-seeding, hand sprayers or tractor-mounted sprayers.

The Unisol 91 treatment will continue to bind the sand together well past the germination period of the grass sown, but in due course the root growth of the grasses will take control beneath the surface of the soil or sand. In addition, the existence of a 4-inch growth of grass above the surface will deflect the wind from its normal course of destruction. In fact, the Unisol 91 coating will last for periods of up to eight months before being broken down by bacterial action. The success of the treatment depends on two vital factors:

- a) The process cannot succeed where growth of vegetation is impossible for reasons other than wind erosion, since for its success the technique clearly depends on the ability of the soil or sand to support growth.
- b) The land area must be correctly and efficiently prepared before spraying.

Before carrying out field trials, a number of laboratory tests were undertaken to prove the various factors.

These included wind tunnel experiments, water penetration observations, water evaporation measurements, germination counts, and exterior weathering. After successful completion of the tests (full results are available from I.S.R. at Southampton), the first field trial was conducted at Scolt Head Island, a nature reserve run by the Nature Conservancy on the east coast, where the sand dunes are subject to erosion by wind and tide. A study was made of the life of the film, its resistance to wind erosion, and its effect on the growth of the natural plant life of the Island. During its life the film withstood the prevailing winds, allowing the natural grasses to grow strongly. The film has no adverse effect on the plant life, and a number of typical shore plants were observed growing through the film. It was then decided to carry out scaled tests under even more extreme conditions.

Southport, had a serious problem caused by drifting sand blowing into a marine lake. The lake is separated from the beach only by a promenade, and the sand was blown by the prevailing winds across the road and into the lake. Between the road and the lake was an expanse of sand about 12 acres in size. Dredging of the lake two or three times a year was costly, and it was decided to see whether the oil/latex blend would stabilise the area between the road and the lake. It was also hoped that the sand blowing from the beach would be caught by the growing grass.

In two trials, the whole 12 acres were treated with complete success. Further trials were then carried out, both in the Negev Desert and in conjunction with the Soil Conservation Authority of the State of Victoria, on Mornington Peninsula, in Australia. In the latter area, 80 m.p.h. winds were frequent, and some 10 acres of top-soil were eroded annually. Successful completion of these trials has both proved the method and the results. The latest project has been to spray 450 acres of desert with some 90,000 gallons of Unisol 91, mixed with about 200,000 gallons of water, in a successful effort to stabilise an area of hand-planted eucalyptus trees about sixty miles from Tripoli.

I.S.R. have recently made their first sale of Unisol 91, and as the success of the process becomes more widespread, more must surely follow.

Feedback

1 Mice invade Chelsea

A "dramatic" increase in confirmed mouse infestations (1,863 in 1970 as against 551 in 1965) is announced by the medical officer of health of the Royal Borough of Kensington and Chelsea.

Source: *Daily Telegraph*, 25 September.

2 Even the experts learn (slowly)

No tower blocks have been approved this year. Only five of more than 10 storeys are under way in tenders approved last year. According to a housing expert, the reason is growing dissatisfaction among tenants who feel "isolated". The undesirability of tower blocks for sociological reasons has been common knowledge for many years. (See "Tall Storeys for Children", Anthony Redding, in *The Ecologist*, February 1971.) But now the Department of the Environment has been presented with an unanswerable argument: They cost more to build than ordinary houses. (This too has been common knowledge for many years.) However, now we have some figures:

The average cost per square foot in high developments was £5.88 last year, and may now be £6.82 compared with an average of £4.24 last year for all types of homes—houses, bungalows and flats.

A flat in a high building costs an average of £4,021 to build against £2,937 in two to four storey constructions and £3,197 for houses and bungalows.

Source: *Daily Telegraph*, 17 September, and editorial comment.

3 Communotherapy for drug-addicts

For the second year running, drug-addicts have been isolated with a small staff on the little island of Rõgrund near Stockholm. Living

there, they gain a strong feeling of togetherness, and go on helping each other after they leave the island.

According to the Stockholm City Temperance Board, 21 of the 26 sent there last summer have been completely cured. The group there now appears to be doing equally well.

Since it is clear that drug-addiction is but one of the numerous forms of retreatism that people, deprived of their normal social environment in a disintegrating society, tend to resort to, providing them in this way with a new social environment must be the obvious remedy.

Source: *News from Sweden*, 22 September, Release No. 4 and editorial comment.

4 Tree Stamps

Forests represent but 7 per cent of the surface of these islands, compared to 69 per cent of Finland.

It is suggested that we might follow the lead of Israel to remedy this deficiency, and issue redeemable stamps to pay for trees.

"Green Tree Stamps, available at Post Offices, would undoubtedly do the trick. They might even come to rival the other variety. But, more than that, they would encourage children not only to take an interest in ecology but also to play their part in the environment."

This excellent suggestion comes from the editor of the *Hampstead and Highgate Express and News*, 24 September.

5 Long-term effects of oil pollution

Experts are mainly interested in observable effects. Pollutants are bad if they kill animals immediately. More subtle effects go unnoticed until they give rise to mortality. An example has just come to light.

Small amounts of coal tar have

been found to have startling effects on the growth of a small polyzoan known as *Schizoporella Unicornis* to be found in the commercial beds of the Pacific oyster. The cancer-like abnormality known as hyperplasia is considered by Dr N. A. Powell of the National Museum of Natural Sciences, Canada and his colleagues to be caused by carcinogens in the coal tar such as 1,2,5,6 dibenzanthracene, 3,4-benzopyrene and methylcholanthrene.

They are concerned that other undetected abnormalities might be being induced in other groups of invertebrates.

Source: *Marine Pollution Bulletin*, Vol. 2, No. 8, August 1971 and editorial comment.

6 Victory for conservationists

The much debated plan to build a hydro-electric power station at Murchison Falls, on the Nile, has been scrapped. President Amin of Uganda who has made this announcement has given his backing to conservationists who pointed out that the adoption of this project would have meant the destruction of a unique haven of African wildlife. President Amin must be congratulated on his courage and long sightedness in resisting what must have been very considerable pressure from technologically orientated advisers and engineering interests.

Source: *Sunday Times*, 26.9.71.

7 Urbanisation in America

Seven out of every 10 people in the US live in towns with a population of 2,500 or more. Three-quarters of the people live on 2 per cent of the nation's land surface. If present trends continue 80 to 90 per cent of the US population will be living in urban areas by the year 2000.

Source: *Science News*, 21 August 1971.



Capital against Man

MAN AND LAND, *the fundamental issue in development*. Erich H. Jacoby with Charlotte E. Jacoby. Andre Deutsch. £4.75.

While reading this book I was reminded of a paper delivered at a conference in 1967 on *Economic Change and Agriculture* (published by Oliver & Boyd) by Prof. Cooper, Dean of the Faculty of Agriculture at Newcastle University. His point of view was shared by many of the contributors to the conference. As a consequence of his brain, he said, Man had become the virtual master of his environment, but the question which faces him today is whether that brain can devise the means of saving him from his fecundity, longevity and greed.

I found this romantic treatment of the brain irritating. Has Man really achieved so much, for good or evil, only with his brain and can he depend solely on his brain to rescue him from his troubles? Those who think in this way tend to stress more and better technology as the solution to everything. Prof. Cooper cited the situation in the Argentine where wheat yields have remained stationary for 30 years, because the farming is purely extractive. He attributed this to lack of good agricultural advisers and the constant inflation of the currency driving interest rates up to 20 per cent. Yet production could be doubled in five years merely by applying existing knowledge. "The world is likely to talk about the potential of this region without seeing it realised unless there is a complete revolution in agricultural education and in attitudes to land use by those who manage the country's economy".

This is a typical situation that Prof. Jacoby tackles in *Man and Land*: he argues that people who make statements like the above have their prior-

ities wrong. For him, food shortages are not so much an agricultural problem as a human problem that will not be solved without land reform. He agrees that yields could be doubled and that attention is distracted from this by concentration on birth control and education. We shall not solve the race between population and food output, unless we have a comprehensive policy based upon the human factory—the socio-economic factors, as he puts it. The example of the Argentine shows where he is right. Are the Argentinians such fools that they do not know that yields are low and that the means exist for raising them? Of course not: for reasons of self-interest the most powerful section of the community does not want a "complete revolution".

Thirty-six per cent of the land farmed in the Argentine is taken up by 0.8 per cent of the farm units. The small units—farms not large enough to maintain two people in full employment—are worked by 43.2 per cent of the people on the land but occupy only 3.4 per cent of the land area. Great prestige attaches to land-ownership on a large scale and the owners have a sumptuous way of life based on Western models with fine houses, cars, yachts, antiques and, of course, famous paintings, the cowrie shells of the modern millionaire. The landowners find it most agreeable to preserve this way of life with the minimum of investment and personal interest in the management of their estates. Tenancy reforms are met with violence and blackmail: and often enough the landlords are the money-lenders. As a result, ownership concentrates while population expands. The agricultural ladder is a chute downward as the peasants have to sell their land and become tenants and the landless worker drifts to the town slums. Prof. Jacoby shows that the problem of doubling yields in South

America is a psychological one: he also shows that if yields are doubled without land reform first the human consequences are no better. A 15,000 hectares estate in Ecuador, owned by a Swedish interest, improved its technology so much it was able to send half its resident staff away to join the multitudes in the shanty towns.

The solution then is not more *brains*, but more *heart*: though lack of feeling is also a sign of inferior intelligence. But inferior intelligence can make a great deal of money and acquire a great deal of power in this world, where rationality is equated with self-interest. It may be "rational" to be efficient at the expense of other human beings, but it is not reasonable. For society as a whole, it must lead to disaster. Everywhere authority is marvellously "rational" and the world heads ever faster into problems beyond human solving. Prof. Jacoby, by putting the human factor first, exposes our bogus rationality with great clarity. He has worked in under-developed countries all over the globe, for he was chief of the Land Reform Branch of the FAO before becoming a professor at the Institute of International Economic Studies in Stockholm. His exhaustive study of land reform problems, both in general terms and as exemplified in different countries, is moved by a passionate concern for the worldwide exploitation of the peasants by their own countrymen and by Western nations whose aid and advice policy has only served to worsen their lot. The United Nations and the agricultural experts have failed to see this because they have put food before people. If they had put the interests of the people first, as Prof. Jacoby does, then they would have had a lot more food.

This is a typical error of a technology-dazzled age in alliance with hyper-commercial interests using reactionary governments as their agents.

The influence of the West has been degrading: however much we liberals may deplore the revolution in Cuba, it was a human necessity from the point of view of the labourers on the many US owned sugar plantations. They are the real benefactors from the revolution. Again, taking the point of view of the peasants, who make up such a large number of the human race, it is Communist China that has tackled their problems best. For here is to be found the world's rural revolution. As Prof. Jacoby shows, we have failed to understand the significance of this because we have an urban mentality and have long ago lost sight of the peasant mentality with its ancient agrarian creed.

Soviet Russia is urban minded: it crushed the peasant in the interests of industry, following the Western pattern because it did not feel it had "arrived" until its productivity exceeded that of the United States. But we now realise that American material standards on a universal scale are impossible. The earth's resources wouldn't stand it. So, as Jacoby perceptively deduces, we may boast as much as we like about our Western agriculture in which

capital is substituted for labour so that we have land without men, but in the long run the future lies with the peasant. Progressive agriculture demands a concentration of resources—fossil fuels, chemicals and machinery—that will become scarcer not more abundant. Lin Pao, speaking for Chinese Communism, has shown their awareness that a vast peasant world encircles the urban world of Western man and that in the end it could engulf it.

Prof. Jacoby puts man and the land into the context of human ecology and gives us a broader view than we would ever get from a specialist book on agriculture or from political and social studies that leave agriculture out of account. We are left with a clear recognition that every agricultural problem must do justice to the land and to man alike. In this country we are still suffering from the social effects of bungling the breakdown of the Open Fields System and allowing enclosures to solve the fertility problem at the expense of human justice: the rich minority exploited a necessity for their own advantage. All over the world where the Mediaeval or Feudal

System is in jeopardy the same mistakes are being repeated. The West, despite its long experience and history, teaches the rest of the world—for which it is a model—the wrong lessons. Even the oceans, which are common grazing under the law of the Freedom of the Seas, are not managed as a problem of conservation in communal terms, but are either enclosed or allowed to be depleted by over-fishing.

The most interesting of the many examples given by Prof. Jacoby of necessity being exploited by the few is the use of the "miracle seeds" in India—the new dwarf varieties of cereals that are said to herald a Green Revolution. A considerable criticism of the biological effects of using these seeds has now made even the FAO apprehensive—the need to use excessive quantities of fertiliser and water and their untested susceptibility to disease may put a time limit on their effectiveness. But Prof. Jacoby takes this criticism further. He points out that, in addition to all this, only the wealthy landowners can afford to undertake the husbandry involved in making the best use of these crops—for with normal peasant husbandry they yield

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less than the traditional varieties. Consequently they widen the gap between the rich and the poor still further. As in the case of the *hacienda* in Ecuador, capital displaces labour and the redundant peasants have to join the starving families on the streets of Calcutta. This is the Green Revolution in fact rather than in theory. The Chinese have not made this mistake. They have grasped that labour is capital and saved themselves becoming the debtors of the West.

Are we really to suppose that agricultural efficiency can only be gained at such a cost in human misery? Is it to be supposed that we can only grow more food by strengthening unjust social systems with Western aid or capital investment? Must technical assistance be "the aid which poor people in rich countries give to rich people in poor countries?" Unfortunately, the Western dread of Communism—which it treats as one monolithic enterprise—fails to make the important distinction between urban and rural based socialist states. Mao broke from the Comintern 35 years ago. Those who consider rural and peasant problems on the grand scale that they demand, cannot view China in the same hostile light as the Western politicians whose thoughts are always focused on industrial investments, armaments, GUP and the like. Land reform and an agricultural technology suitable to the peasant are, in some ways, the major problem of the world in respect of numbers of human beings. The Chinese are experimenting with the methods of intermediate technology now advocated by Dr. E. F. Schumacher and his group in this country—and they are certainly not Communists. The Chinese also have, according to Jacoby, a philosophy of ruralising the urban and urbanising the rural which is advanced by Sir George Stapledon in his book *Human Ecology*. Those who turn a blind eye to all this are in for a rude awakening, perhaps already anticipated by the enthusiasm of young extremists for Maoism and by the growing realisation of the American soldiers in Vietnam that the enemy have as much justice on their side as the Allies, a fact that has been concealed from the Americans by their belief that history begins and ends in New York or Washington. The fantastic ability of the peasant army of

North Vietnam to stand up to the massive technological armoury of the Americans is partly explained in this book. Where the peasant receives justice through land reform he is transfigured. It is not surprising if he also becomes somewhat arrogant, fanatical, and obdurate in his relations to those who continue to oppress him and support the landlordism of the old order. Nor is it surprising that as religions have sanctified caste, and landlords have represented themselves as part of the divine order, the revolutionary is iconoclastic. If Communism and Capitalism are to be humanized, the peasant problem must be understood in human terms.

Prof. Jacoby remarks that impartial descriptions of cooperative and collective farming (he draws an important distinction between the two) have only recently appeared in official circles. His own study of the farming in socialist countries underlines its variety and indicates that socialist and capitalist organisations can well exist side by side as in other industries. The value of the communal farms, according to Jacoby, is just the opposite to what we might suppose, provided the peasants are taken into partnership and not commanded from above. The peasant who was previously struggling to feed himself and his family on a pocket handkerchief of land feels a greater sense of possession sharing a much larger area of land that brings results. The best size for a farming unit depends upon its human organisation as well as the nature of the soil and we should be careful not to be dogmatic about the size of the farms. Large farms tend to be relatively unproductive for the reasons given in the case of the *hacienda*. The kibbutzim in Israel are the most impressive example of what can be done by collective farming, sterile land bought from the feudal Arab estates was miraculously transformed by men and women who had never farmed before.

For the West the hard lesson that Jacoby draws is that we should not give aid unless land reform takes place first—a hard lesson because it is difficult to interfere in the politics of other people: secondly, that those who advise and administer should be trained in their own country and not in the West where they are turned into an elite which exploits the peasant in the

nationalist cause but who are out of sympathy with him.

No doubt, Prof. Jacoby rides the horse of land reform rather too hard and reads into it more than it can actually achieve. But at this moment I feel he has selected the most important of all the issues in man's relation to the land and it is to be hoped that he will be read seriously in official quarters.

Robert Waller

Planning Catastrophe

SUPERHIGHWAY — SUPERHOAX by Helen Leavitt. Ballantine Books, New York 95c. Paperback 310pp.

This is a book for anyone who has any lingering doubts that the Americans have gone any way towards 'solving' their urban traffic problems. What they have done very clearly demonstrates that the avenue, or motorway, they have explored is worse than useless.

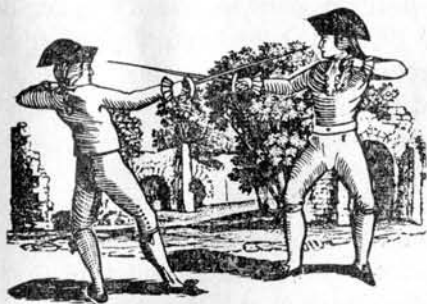
This is a thoroughly documented study of the US Interstate Highway programme. Though written with the passion of someone who has seen the awfulness of what has been, and still is being, done, the book deserves a better title than the eye catcher it has been given. This is a serious study of an appalling catastrophe in urban planning: the Americans have wrecked their cities and they have done it with the motorcar.

There is a Greek tragedy's inevitability about the story. The highway fund raised from motorists can only be used for roads. The more roads, the more cars, the more taxes, the more roads and so it goes on. There is graft, corruption, greed, ignorance.

Contrary to what is often thought here there has been ferocious citizen objection to many highway projects in the United States. In some cases notable victories have been won. But the whole picture is frightening. This is a book which is very useful for those of us here who are trying to prevent our own planners following the suicidal path of America's. It gives facts, statistics, pictures and very little hope that the cities will recover in our time from the awful wounds inflicted on them in little more than the past twenty-five years: a period of urban destruction unparalleled in human history.

Gerald Foley

Letters



Milk bottles or cartons? (1)

Sir,

Just a point I would like to make about non-returnable bottles. Have you ever tried to return a deposit bottle? Much as one has to deplore the increasing use of throw-away bottles, a lot of the blame must lie with the shops and supermarkets, as well as the consumer. Time and time again I have tramped round liquor, off-licences, shops, trying to get rid of my returnable bottles. The usual reply is "that's not my bottle", "you didn't buy that here" and so on. They won't even take them for nothing half the time. Usually you have to resort to buying more products from the shop in order to persuade them to take back the bottles.

Apart from the shops not being interested in this time-consuming and expensive business of collecting returnable bottles, how many consumers want the bother of carrying empty bottles around in order to return them? It's quite a problem.

I can speak on behalf of the many bedsit dwellers in London regarding the collection of empty milk bottles. You say don't buy milk in cartons. Fine—but how many milkmen will collect empty bottles that haven't specifically been delivered by them, even if they belong to the same dairy? It's no use saying, "in that case, have the milk delivered each morning, so that the bottle will be collected and returned to the dairy". The majority of bedsits haven't got fridges. Therefore it is uneconomical to have milk delivered in the morning when it will probably be off or sour by the evening. Most furnished tenants buy their milk on the way home, using it in the evening and the next morning. Now no matter what good intentions you may have, it is impractical to expect people to remember or have the time to drop their empty milk bottles into the local

supplier on the way to work in the morning—or carry the bottle around all day until they purchase a fresh bottle of milk in the evening. And if you wait until the weekend, you end up with six or seven bottles to return.

So rather than throw away good bottles into the dustbin—which you will find is what the majority of bedsit dwellers do—you buy milk in cartons, which doesn't seem so wasteful somehow. Why milkmen won't collect empties, even if they didn't directly supply the full bottles, I don't know—especially if the bottles do belong to the same dairy. At my last bedsit in W10, at least 30 to 40 milk bottles were discarded in the dustbins each week. Now I have my own flat, with a fridge, and have my milk delivered each morning—so my conscience is at last absolved of this great weight of guilt at the waste of throwing away good bottles or discarded cartons.

This still doesn't help with regard to other drinks, such as beer and soft drinks. If we are not to buy non-returnables, what is the solution when more and more soft drinks and beers are bottled in this type of container? The same would apply, and has always applied to my knowledge, to wine bottles and flagons. What do we do with them if we are "ecology-conscious" and shops won't take them back?

So I would ask *The Ecologist* not just to give advice, but to suggest practical ways of putting this advice in practice.

Yours faithfully,

Pat Cardle,

61, Romney Court, Shepherds Bush Green, London W12 8PY.

Milk bottles or cartons? (2)

Sir,

As one of the world's leading companies in the supply of plant and packaging material for single service containers for consumer milk, we would like to put forward certain facts and comments concerning the problems of environmental pollution. We must

face the fact that the disposal of any material is a problem that should concern everybody in Europe today and that the people who should be most concerned are those companies such as ours who are foremost suppliers of the supposedly offending materials.

You advise (*Ecology action*, Vol. 1. No. 14, p. 29) that it is preferable to buy milk in a conventional glass bottle rather than to purchase it in a carton. Do not let us forget that glass bottles, even if used many times, are eventually discarded and produce waste in one form or another, and broken and discarded glass bottles are not only a very dangerous waste product but a waste product that can never deteriorate by exposure either to atmosphere or to soil acids.

I refer to and quote from a report entitled *Survey of the Methods of Packaging Milk and their Associated Machinery*, which was issued by the Department of Trade and Industry in January 1971:

"The number of pints of milk packaged daily in glass bottles in the UK is in the order of 30 million... the loss in breakages and non-returns amounts to about 120,000 tons of glass per annum... this is based on a trippage (usage) rate of 40. Although in some residential areas trippage rates of over 60 are still acclaimed, the general consensus of opinion suggests that typical rates for average suburban areas are nearer 30 and decreasing. In Scotland an overall average of 25 has been suggested with notorious pockets in town areas of under 10."

As you will appreciate, if the average trippage rate reduces to 20, as it will in all probability by the end of this decade, then the amount of cullet (broken glass) will increase to 240,000 tons per annum.

A typical one pint paper/plastic carton weighs in the order of 20 grams. This means that an average family consuming $2\frac{1}{2}$ pints of milk a day would have a total waste approximating 10 oz a week should all their milk be in these single service containers, and I again quote the report:

"Total plastic waste and litter is

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currently reported to account for 250,000 tons per years in the UK and is estimated to rise to 1.25 million tons in 1980. If all milk were packaged in one-trip containers, then the quantity of waste produced in the UK from this source would amount only to some 120,000 tons annually (less than 10 per cent of the total estimated tonnage by the end of the 70s). A major problem of disposability occurs in the case of plastic bottles . . . plastic coated cartons present a lesser problem . . . recent publicity has drawn attention to work being carried out at the University of Aston and at Tetra Pak in Sweden concerning the addition of certain dyes to plastic materials which cause them to break down under the action of ultra-violet light and soil bacteria".

It would appear, therefore, that there are fewer problems concerning the disposal of paper/plastic single service containers than the glass bottle in that the overall weight in the UK of waste from these two sources is comparable and in the long term will probably favour the single service container, and that even without developments in the field of controlled deterioration of the waste, paper/plastic containers will eventually break down whilst glass will never do so and therefore remains a potential hazard for ever.

Yours sincerely,

M. J. Pleeth,
Managing Director, Tetra Pak Ltd.,
Orchard Road, Lower Richmond
Road, Richmond, Surrey.

Robert Allen replies:

If one assumes as Mr Pleeth does, that returnable bottles will not be returned, then obviously there is little in their favour. However, it is the business of those concerned with environmental quality not to meekly accept current trends but to try and reverse them. If they were positively responsible, dairies and bottle manufacturers would go out of their way to persuade people to buy their milk in bottles and return them. Rather than sit back and watch the average trippage rate decline to 20, perhaps they could boost it to 60. We know it's possible—and then the non-returnables will be non-starters.

In the end, of course, as Mr Pleeth points out, bottles break, but this is not the problem he makes of it. Glass cullet makes an excellent anti-skid road

surface, and with a little governmental encouragement its use as such could help reduce the rate at which we dig up the countryside for gravel. It is certainly less problematical than the degradability of plastics, which could lead us down some treacherous paths towards ecological backlash.

As for Miss Cardle, I think she has been unlucky. I buy my beer and soft drinks in returnable bottles, from either a pub or an off-licence. I have no difficulty remembering which is which, and I get the money back on the bottles! I buy a pint of milk every other day, which I used to get from the local Express Dairy store, until they succumbed entirely to the carton. Now I catch the United Dairy milkman when I can! It's not easy and returning the bottles is a bore, but it's surely naive to hope that denying oneself convenience products for one's principles is going to be convenient. Insisting on returnables is perfectly practical, but let nobody pretend that this or any other form of ecological responsibility is easy. See 'Living Soil' by Michael Allaby, page 18 of this issue.

DDT lunacy

Sir,

I have just read your report in the June 1971 issue (p. 26) commenting on the defence of DDT by Dr Robert White-Stevens. You express alarm that someone in his position whose job it should be to contribute to the protection of our environment against such poisons as DDT should write as he does.

Do not be misled by his byline of "Bureau of Conservation and Environment, Rutgers University, New Brunswick, N.J." According to the Eleventh Edition of American Men of Science (1967), there is nothing in his background to suggest competence in the field of conservation and environment, but considerable evidence of his connections with the agro-chemical industrial complex.

His general area of competence is listed as "Agriculture". His field of specialisation is given as "animal and plant nutrition in relation to disease; experimental design and biometrics". His PhD is in the area of "physiology, biochemistry and genetics". His former positions include "assistant horticulturalist; assistant in vegetable crops; director of foods and nutrition, Hos-

pital Bureau of Standards, N.Y.; research director of Kentucky Chemical Industries, Inc. and then four successive positions with American Cyanamid Co., the last being Assistant to the Director of Research and Development. Finally, his address is given as: "Agricultural Division, American Cyanamid Co., Princeton, N.J."

If this is really one and the same Dr Robert White-Stevens, one wonders about the procedure of selecting staff for the Bureau of Conservation and Environment of Rutgers University and what qualifications in the field of conservation and environment are sought in their prospective faculty.

Yours sincerely,

Wayne H. Davies,
Professor of Zoology, College of Arts
and Sciences, University of Kentucky,
Lexington, Kentucky 40506, USA.

Bus-only Lanes

Sir,

With reference to your report of a "bus-only" lane introduced in a congested traffic route in America and the resultant effect of car users turning to bus transport, with the further effect of reduced pollution and congestion, London Transport are asking for support from members of the public for a plan to have a bus-only lane in Piccadilly. On a thin end of the wedge policy, i.e. if it's successful it could snowball, can we have lots of support from readers. The address to write to is: The Public Relations Officer, London Transport, 55 Broadway, SW1.

Yours faithfully,

Mary Lunan,
17 Highbury New Park,
London N5.

Progress?

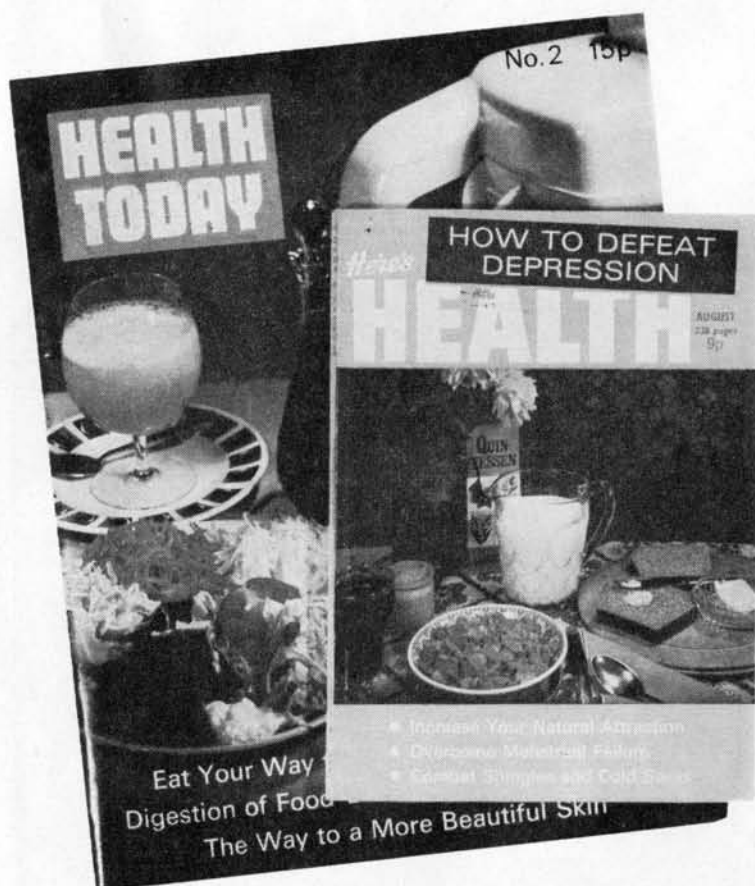
Sir,

While sympathising with the point which Mr Sones of Stevenage is making (see Letters, Vol. 1. No. 14. p. 40), I find it hard to call to mind the name of any hunter-gatherer to put alongside those of Beethoven, Shakespeare, Michelangelo, da Vinci and Voltaire.

Yours faithfully,

Stephen O. Clegg,
21 West Street, Hertford.

Or of Hitler, Beria, Mussolini, McCarthy, Judge Jeffries, etc. What you lose on the roundabouts, you gain on the swings.—Ed.



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