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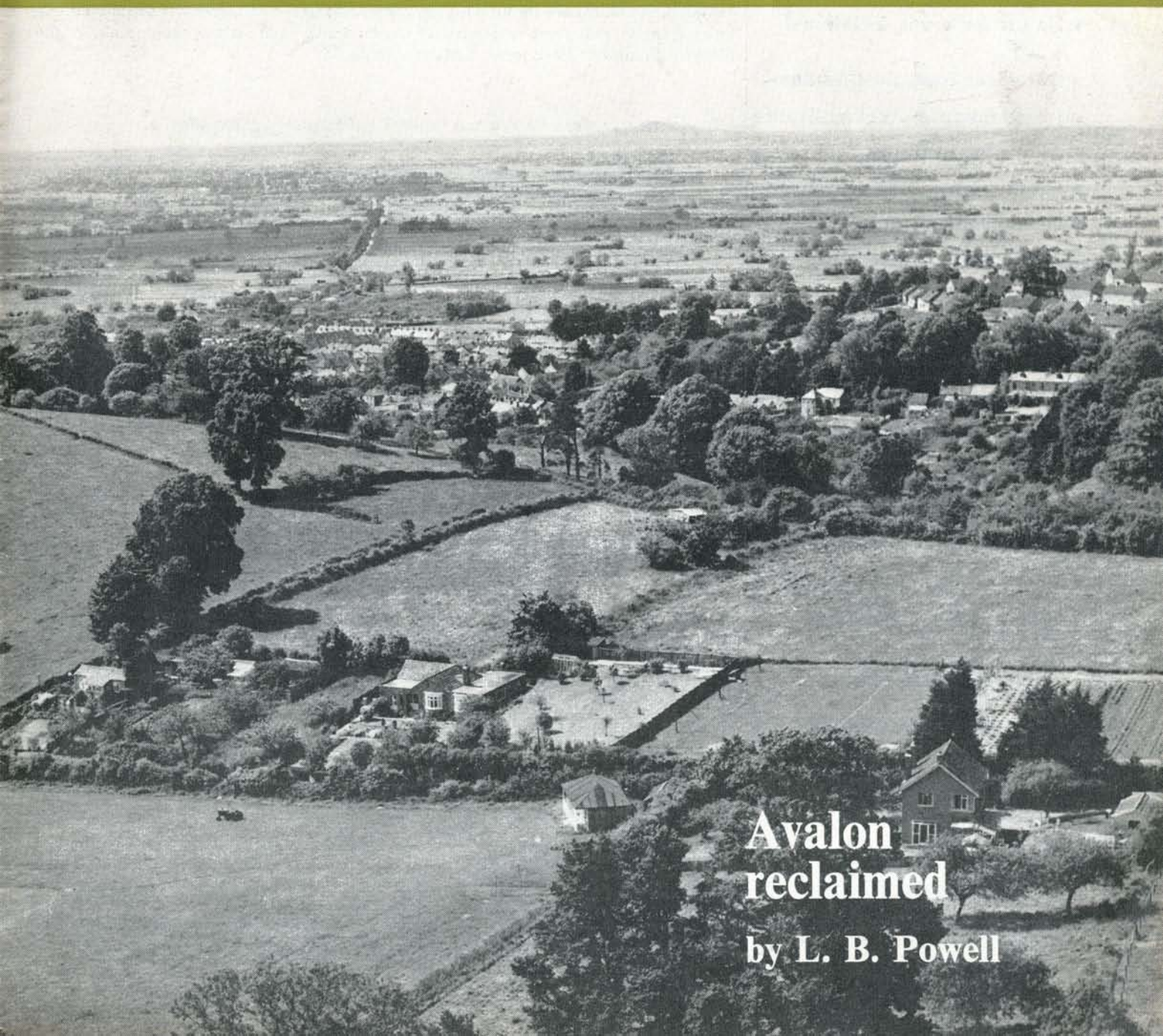
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Vol. 1. No. 14

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Alternatives to catastrophe ■ Insects—key conservationists

Violence and social disorganisation ■ How many work on the land?



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reclaimed

by L. B. Powell

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Editorial

The vessel without a pilot

It is sheer illusion to suppose that our Government is controlling this society.

Yet unless it is controlled, it cannot remain stable, which is the same as saying that it cannot survive.

Control is the process of keeping a system on its right course. This implies that it has a right course. The fact that it has is one of the most important and least recognised scientific principles. All systems including social ones are goal-directed and their goal being spatio-temporal is in fact a course or trajectory—a “creode” as Professor Waddington calls it. This course leads towards continued or in some cases increased stability which is to say that it is the one most favouring survival.

Unfortunately, control mechanisms can occasionally break down, and this is what has happened to our society, which is increasingly out of control, and which can be likened to a vessel without a pilot whose aimless course is determined by the random play of winds and currents.

Absence of control is evident in everything our Government does.

Thus, we know that vast cities are undesirable. The example of America is only too eloquent. Yet do we try to prevent further urbanisation? No, we simply set up bodies like the Centre of Environmental Studies to devise means of overcoming the countless social and ecological problems that arise as society becomes increasingly urbanised.

We know that this country is grossly over-populated, but do we try to work out and implement ways of reducing the population? No, instead we lodge people in housing developments which we know to be socially undesirable, and feed them on mass produced food containing an ever-increasing number of potentially dangerous chemical additives.

We know that there are already far too many motor-cars in this country,

but do we try to limit their number to the present 11 million? No, instead we plan to build ever more motorways which will eventually make our cities uninhabitable, as is the case in Los Angeles where they are said to occupy over 60 per cent of the total city area.

We know that cancer is to a large extent caused by environmental factors—at least 80 per cent of all cases, according to Dr Sam Epstein, one of the leading American experts on the subject, but do we try to create a healthier environment? No, we prefer to spend millions on cancer research to find ways of treating diseases we should never have been suffering from.

We know that the world is about to run out of fuel and other key resources without which our industrial society cannot possibly continue, but do we try to reduce our dependence on these inputs which we shall very soon have to do without? Not a bit of it; we are as busy as ever developing our industries and even seeking to industrialise the rest of the world that has so far had no need for these ever-rarer resources, and we justify this on the fake assumption that human ingenuity will always enable us to find satisfactory substitutes.

In this way we are undoubtedly adapting, but in the same way that our pilotless vessel adapts when it yields to the winds that blow it against the rocks.

In fact our Government is controlling nothing. It is merely seeking to accommodate pressures which it is incapable of controlling, and as society as a result becomes increasingly unstable, so the unsoundness of and hence the damage done by each new expedient used to accommodate increasingly undesirable pressures must increase. Eventually, new pressures can no longer be accommodated and society breaks down.

The process of moving to a series of equilibrium positions involving ever lower stability is referred to by Stephen Boyden as “pseudo-adaptation”. I

suggest we use the term “heterotelic” adaptation as opposed to real or “homeotelic” adaptation.¹

The trouble, of course, is that heterotelic adaptation can only lead to further heterotelic adaptation. It gives rise to a positive-feedback situation from which there seems to be no escape.

Thus to accommodate ever more motor-cars we build more motorways. People can now live further from their work. Residential suburbs come into being that would have no *raison d'être* save for the motor-car. Cities become designed around it. More and more people find employment either in making, selling, repairing motor-cars, or in activities dependent in some way on their continued use, such as motels and businesses built along motorways, or simply in hospitals looking after people suffering from diseases caused by the air pollution they give rise to or treating victims of road accidents. The more motor-cars we succeed in accommodating, the more dependent on them—one might say addicted to them—our society becomes, until eventually to do away with them must mean its total collapse, just as the society of the Herero pastoralists collapsed when the German colonialists in South West Africa deprived them of the cattle around which their entire life revolved.

To break out of the vicious circle that heterotelic adaptation has led us into and bring our society once more under control can only be done very gradually indeed, and must take a long time. We must start now reversing that host of closely-related trends that are leading us to ecological disaster, and not when it is practically upon us, when only the most radical and socially disrupting measures can save us from it.

¹ From hetero=different, homeo=same, and telos=goal or end. Heterotelic adaptation establishes a system's equilibrium in a position which does not favour the survival or stability of the larger system of which it is part.

Alternatives to Catastrophe

Understanding the counterintuitive behaviour of Social systems*

Part One

by

Jay W. Forrester

System dynamics has demonstrated how companies and how urban systems behave in ways that run against most of what man would do to correct their ills. Now the same obtuse behaviour can be assigned to the largest social issues which confront the world. Although this article is written with the United States in mind, the analytical techniques described and the conclusions derived from them can be applied to all industrialised countries

This paper addresses several issues of broad concern in the United States: population trends; the quality of urban life; national policy for urban growth; and the unexpected, ineffective, or detrimental results often generated by government programmes in these areas.

The nation exhibits a growing sense of futility as it repeatedly attacks deficiencies in our social system while the symptoms continue to worsen. Legislation is debated and passed with

great promise and hope. But many programmes prove to be ineffective. Results often seem unrelated to those expected when the programmes were planned. At times programmes cause exactly the reverse of desired results.

It is now possible to explain how such contrary results can happen. There are fundamental reasons why people misjudge the behaviour of social systems. There are orderly processes at work in the creation of human judgment and intuition that frequently lead people to wrong decisions when faced with complex and highly interacting systems. Until we come to a much better understanding of social systems, we should expect that attempts to develop corrective programmes will continue to disappoint us.

The purpose of this paper is to leave with its readers a sense of caution about continuing to depend on the same past approaches that have led to our present feeling of frustration and to suggest an approach which can eventually lead to a better understanding of our social systems and thereby to more effective policies for guiding the future.

A New Approach to Social Systems

It is my basic theme that the human

mind is not adapted to interpreting how social systems behave. Our social systems belong to the class called multi-loop nonlinear feedback systems. In the long history of evolution it has not been necessary for man to understand these systems until very recent historical times. Evolutionary processes have not given us the mental skill needed to properly interpret the dynamic behaviour of the systems of which we have now become a part.

In addition, the social sciences have fallen into some mistaken "scientific" practices which compound man's natural shortcomings. Computers are often being used for what the computer does poorly and the human mind does well. At the same time the human mind is being used for what the human mind does poorly and the computer does well. Even worse, impossible tasks are attempted while achievable and important goals are ignored.

Until recently there has been no way to estimate the behaviour of social

* This paper is copyright 1971 by Jay W. Forrester. It is based on testimony for the Subcommittee on Urban Growth of the Committee on Banking and Currency, US House of Representatives, on October 7, 1970. This text has appeared in the January 1971 issue of the *Technology Review* published by the Alumni Association of the Massachusetts Institute of Technology.

systems except by contemplation, discussion, argument, and guesswork. To point a way out of our present dilemma about social systems, I will sketch an approach that combines the strength of the human mind and the strength of today's computers. The approach is an outgrowth of developments over the last 40 years, in which much of the research has been at the Massachusetts Institute of Technology. The concepts of feedback system behaviour apply sweepingly from physical systems through social systems. The ideas were first developed and applied to engineering systems. They have now reached practical usefulness in major aspects of our social systems.

I am speaking of what has come to be called industrial dynamics. The name is a misnomer because the methods apply to complex systems regardless of the field in which they are located. A more appropriate name would be *system dynamics*. In our own work, applications have been made to corporate policy, to the dynamics of diabetes as a medical system, to the growth and stagnation of an urban area, and most recently to world dynamics representing the interactions of population, pollution, industrialisation, natural resources, and food. System dynamics, as an extension of the earlier design of physical systems, has been under development at MIT since 1956. The approach is easy to understand but difficult to practice. Few people have a high level of skill; but preliminary work is developing all over the world. Some European countries and especially Japan have begun centres of education and research.

Computer Models of Social Systems

People would never attempt to send a space ship to the moon without first testing the equipment by constructing prototype models and by computer simulation of the anticipated space trajectories. No company would put a new kind of household appliance or electronic computer into production without first making laboratory tests. Such models and laboratory tests do not guarantee against failure, but they do identify many weaknesses which can then be corrected before they cause full-scale disasters.

Our social systems are far more complex and harder to understand than our technological systems. Why, then, do

we not use the same approach of making models of social systems and conducting laboratory experiments on those models before we try new laws and government programmes in real life? The answer is often stated that our knowledge of social systems is insufficient for constructing useful models. But what justification can there be for the apparent assumption that we do not know enough to construct models but believe we do know enough to directly design new social systems by passing laws and starting new social programmes? I am suggesting that we now do know enough to make useful models of social systems. Conversely, we do not know enough to design the most effective social systems directly without first going through a model-building experimental phase. But I am confident, and substantial supporting evidence is beginning to accumulate, that the proper use of models of social systems can lead to far better systems, laws, and programmes.

It is now possible to construct in the laboratory realistic models of social systems. Such models are simplifications of the actual social system but can be far more comprehensive than the mental models that we otherwise use as the basis for debating governmental action.

Before going further, I should emphasise that there is nothing new in the use of models to represent social systems. Each of us uses models constantly. Every person in his private life and in his business life instinctively uses models for decision making. The mental image of the world around you which you carry in your head is a model. One does not have a city or a government or a country in his head. He has only selected concepts and relationships which he uses to represent the real system. A mental image is a model. All of our decisions are taken on the basis of models. All of our laws are passed on the basis of models. All executive actions are taken on the basis of models. The question is not to use or ignore models. The question is only a choice among alternative models.

The mental model is fuzzy. It is incomplete. It is imprecisely stated. Furthermore, within one individual, a mental model changes with time and even during the flow of a single conversation. The human mind assembles a few relationships to fit the context of a discussion. As the subject shifts so

does the model. When only a single topic is being discussed, each participant in a conversation employs a different mental model to interpret the subject. Fundamental assumptions differ but are never brought into the open. Goals are different and are left unstated. It is little wonder that compromise takes so long. And it is not surprising that consensus leads to laws and programmes that fail in their objectives or produce new difficulties greater than those that have been relieved.

For these reasons we stress the importance of being explicit about assumptions and interrelating them in a computer model. Any concept or assumption that can be clearly described in words can be incorporated in a computer model. When done, the ideas become clear. Assumptions are exposed so they may be discussed and debated.

But the most important difference between the properly conceived computer model and the mental model is in the ability to determine the dynamic consequences when the assumptions within the model interact with one another. The human mind is not adapted to sensing correctly the consequences of a mental model. The mental model may be correct in structure and assumptions but, even so, the human mind—either individually or as a group consensus—is most apt to draw the wrong conclusions. There is no doubt about the digital computer routinely and accurately tracing through the sequences of actions that result from following the statements of behaviour for individual points in the model system. This inability of the human mind to use its own mental models is clearly shown when a computer model is constructed to reproduce the assumptions held by a single person. In other words, the model is refined until it is fully agreeable in all its assumptions to the perceptions and ideas of a particular person. Then, it usually happens that the system that has been described does not act the way the person anticipated. Usually there is an internal contradiction in mental models between the assumed structure and the assumed future consequences. Ordinarily the assumptions about structure and internal motivations are more nearly correct than are the assumptions about the implied behaviour.

The kind of computer models that I

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am discussing are strikingly similar to mental models. They are derived from the same sources. They may be discussed in the same terms. But computer models differ from mental models in important ways. The computer models are stated explicitly. The "mathematical" notation that is used for describing the model is unambiguous. It is a language that is clearer, simpler, and more precise than such spoken languages as English or French. Its advantage is in the clarity of meaning and the simplicity of the language syntax. The language of a computer model can be understood by almost anyone, regardless of educational background. Furthermore, any concept and relationship that can be clearly stated in ordinary language can be translated into computer model language.

There are many approaches to computer models. Some are naive. Some are conceptually and structurally inconsistent with the nature of actual systems. Some are based on methodologies for obtaining input data that commit the models to omitting major concepts and relationships in the psychological and human reaction areas that we all know to be crucial. With so much activity in computer models and with the same terminology having different meanings in the different approaches, the situation must be confusing to the casual observer. The key to success is not in having a computer; the important thing is how the computer is used. With respect to models, the key is not to computerise a model, but to have a model structure and relationships which properly represent the system that is being considered.

I am speaking here of a kind of computer model that is very different from the models that are now most common in the social sciences. Such a computer model is not derived statistically from time-series data. Instead, the kind of computer model I am discussing is a statement of system structure. It contains the assumptions being made about the system. The model is only as good as the expertise which lies behind its formulation. Great and correct theories in physics or in economics are few and

far between. A great computer model is distinguished from a poor one by the degree to which it captures more of the essence of the social system that it presumes to represent. Many mathematical models are limited because they are formulated by techniques and according to a conceptual structure that will not accept the multiple-feedback-loop and nonlinear nature of real systems. Other models are defective because of lack of knowledge or deficiencies of perception on the part of the persons who have formulated them.

But a recently developed kind of computer modelling is now beginning to show the characteristics of behaviour of actual systems. These models explain why we are having the present difficulties with our actual social systems and furthermore explain why so many efforts to improve social systems have failed. In spite of their shortcomings, models can now be constructed that are far superior to the intuitive models in our heads on which we are now basing national social programmes.

This approach to the dynamics of social systems differs in two important ways from common practice in social sciences and government. There seems to be a common attitude that the major difficulty is shortage of information and data. Once data is collected, people then feel confident in interpreting the implications. I differ on both of these attitudes. The problem is not shortage of data but rather our inability to perceive the consequences of the information we already possess. The system dynamics approach starts with the concepts and information on which people are already acting. Generally these are sufficient. The available perceptions are then assembled in a computer model which can show the consequences of the well-known and properly perceived parts of the system. Generally, the consequences are unexpected.

Counterintuitive Nature of Social Systems

Our first insights into complex social systems came from our corporate work. Time after time we have gone into a corporation which is having severe and well-known difficulties. The difficulties can be major and obvious such as a falling market share, low profitability, or instability of employment. Such difficulties are known throughout the com-

pany and by anyone outside who reads the management press. One can enter such a company and discuss with people in key decision points what they are doing to solve the problem. Generally speaking we find that people perceive correctly their immediate environment. They know what they are trying to accomplish. They know the crises which will force certain actions. They are sensitive to the power structure of the organisation, to traditions, and to their own personal goals and welfare. In general, when circumstances are conducive to frank disclosure, people can state what they are doing and can give rational reasons for their actions. In a troubled company, people are usually trying in good conscience and to the best of their abilities to solve the major difficulties. Policies are being followed at the various points in the organisation on the presumption that they will alleviate the difficulties. One can combine these policies into a computer model to show the consequences of how the policies interact with one another. In many instances it then emerges that the known policies describe a system which actually causes the troubles. In other words, the known and intended practices of the organisation are fully sufficient to create the difficulty, regardless of what happens outside the company or in the marketplace. In fact, a downward spiral develops in which the presumed solution makes the difficulty worse and thereby causes redoubling of the presumed solution.

The same downward spiral frequently develops in government. Judgment and debate lead to a programme that appears to be sound. Commitment increases to the apparent solution. If the presumed solution actually makes matters worse, the process by which this happens is not evident. So, when the troubles increase, the efforts are intensified that are actually worsening the problem.

Dynamics of Urban Systems

Our first major excursion outside of corporate policy began in February, 1968, when John F. Collins, former mayor of Boston, became Professor of Urban Affairs at MIT. He and I discussed my work in industrial dynamics and his experience with urban difficulties. A close collaboration led to applying to the dynamics of the city the same methods that had been created for

understanding the social and policy structure of the corporation. A model structure was developed to represent the fundamental urban processes. The proposed structure shows how industry, housing, and people interact with each other as a city grows and decays. The results are described in my book *Urban Dynamics*, and some were summarised in *Technology Review* (April, 1969, pp. 21-31).

I had not previously been involved with urban behaviour or urban policies. But the emerging story was strikingly similar to what we had seen in the corporation. Actions taken to alleviate the difficulties of a city can actually make matters worse. We examined four common programmes for improving the depressed nature of the central city. One is the creation of jobs as by bussing the unemployed to the suburbs or through governmental jobs as employer of last resort. Second was a training programme to increase the skills of the lowest-income group. Third was financial aid to the depressed city as by federal subsidy. Fourth was the construction of low-cost housing. All of these are shown to lie between neutral and detrimental almost irrespective of the criteria used for judgment. They range from ineffective to harmful judged either by their effect on the economic health of the city or by their long-range effect on the low-income population of the city.

The results both confirm and explain much of what has been happening over the last several decades in our cities.

In fact, it emerges that the fundamental cause of depressed areas in the cities comes from *excess* housing in the low-income category rather than the commonly presumed housing shortage. The legal and tax structures have combined to give incentives for keeping old buildings in place. As industrial buildings age, the employment opportunities decline. As residential buildings age, they are used by lower-income groups who are forced to use them at a higher population density. Therefore, jobs decline and population rises while buildings age. Housing, at the higher

population densities, accommodates more low-income urban population than can find jobs. A social trap is created where excess low-cost housing beckons low-income people inward because of the available housing. They continue coming to the city until their numbers so far exceed the available income opportunities that the standard of living declines far enough to stop further inflow. Income to the area is then too low to maintain all of the housing. Excess housing falls into disrepair and is abandoned. One can simultaneously have extreme crowding in those buildings that are occupied, while other buildings become excess and are abandoned because the economy of the area cannot support all of the residential structures. But the excess residential buildings threaten the area in two ways—they occupy the land so that it cannot be used for job-creating buildings, and they stand ready to accept a rise in population if the area should start to improve economically.

Any change which would otherwise raise the standard of living only takes off the economic pressure momentarily and causes the population to rise enough that the standard of living again falls to the barely tolerable level. A self-regulating system is thereby at work which drives the condition of the depressed area down far enough to stop the increase in people.

At any time, a near-equilibrium exists affecting population mobility between the different areas of the country. To the extent that there is disequilibrium, it means that some area is slightly more attractive than others and population begins to move in the direction of the more attractive area. This movement continues until the rising population drives the more attractive area down in attractiveness until the area is again in equilibrium with its surroundings. Other things being equal, an increase in population of a city crowds housing, overloads job opportunities, causes congestion, increases pollution, encourages crime, and reduces almost every component of the quality of life.

This powerful dynamic force to re-establish an equilibrium in total attractiveness means that any social programme must take into account the eventual shifts that will occur in the many components of *attractiveness*. As used here, attractiveness is the composite effect of all factors that cause

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population movement towards or away from an area. Most areas in a country have nearly equal attractiveness most of the time, with only sufficient disequilibrium in attractiveness to account for the shifts in population. But areas can have the same composite attractiveness with different mixes in the components of attractiveness. In one area component A could be high and B low, while the reverse could be true in another area that nevertheless had the same total composite attractiveness. If a programme makes some aspect of an area more attractive than its neighbour's, and thereby makes total attractiveness higher momentarily, population of that area rises until other components of attractiveness are driven down far enough to again establish an equilibrium. This means that efforts to improve the condition of our cities will result primarily in increasing the population of the cities and causing the population of the country to concentrate in the cities. The overall condition of urban life, for any particular economic class of population, cannot be appreciably better or worse than that of the remainder of the country to and from which people may come. Programmes aimed at improving the city can succeed only if they result in eventually raising the average quality of life for the country as a whole.

On Raising the Quality of Life

But there is substantial doubt that our urban programmes have been contributing to the national quality of life. By concentrating total population, and especially low-income population, in urban locations, undermining the strength and cohesiveness of the community, and making government and bureaucracy so big that the individual feels powerless to influence the system within which he is increasingly constrained, the quality of life is being reduced. In fact, if they have any effect, our efforts to improve our urban areas will in the long run tend to delay the concern about rising total population and thereby contribute directly to the eventual overcrowding of the country and the world.

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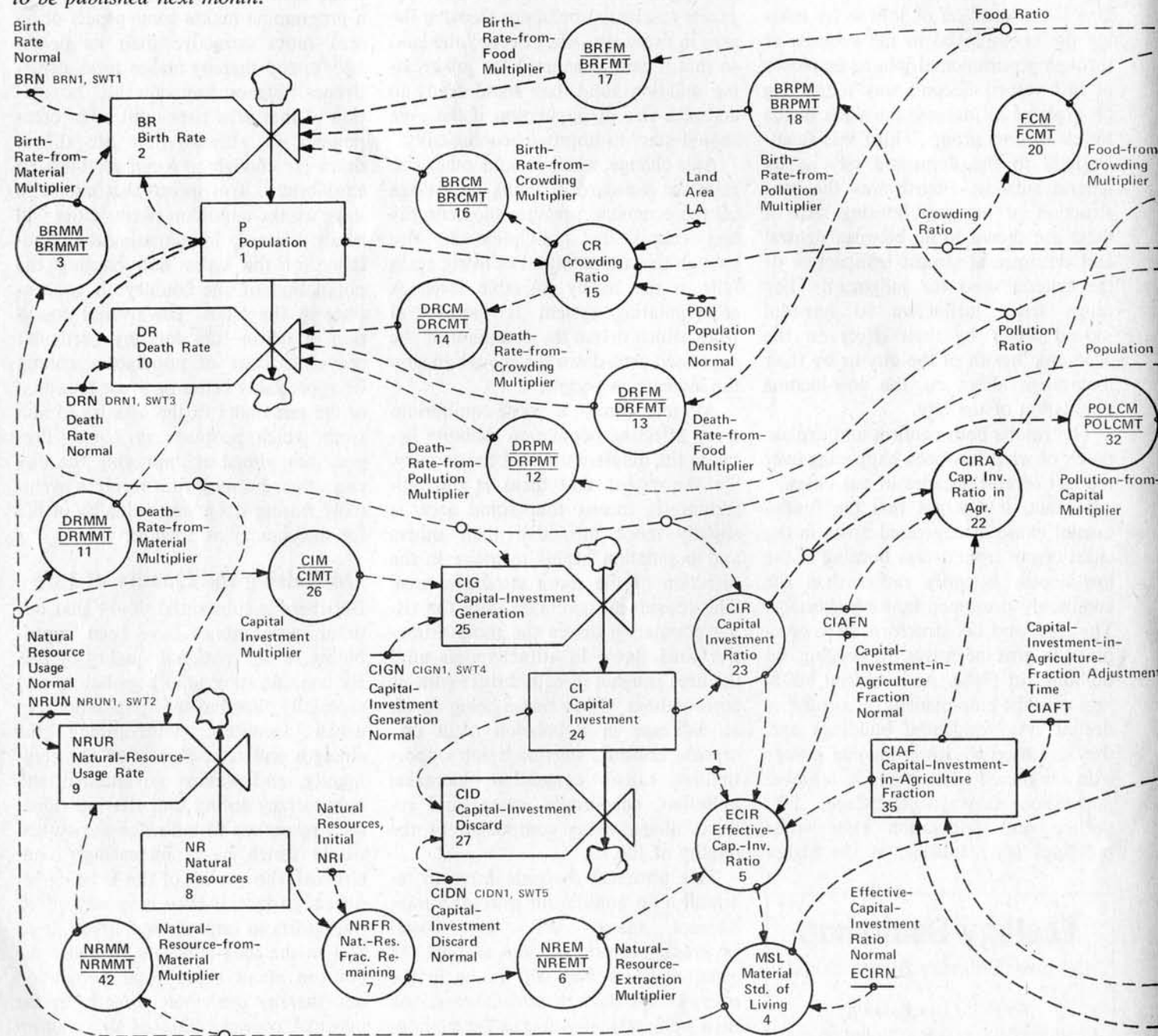
Any proposed programme must deal with both the quality of life and the factors affecting population. "Raising the quality of life" means releasing stress and pressures, reducing crowding, reducing pollution, alleviating hunger, and treating ill health. But these pressures are exactly the sources of concern and action aimed at controlling total population to keep it within the bounds of the fixed world within which we live. If the pressures are relaxed, so is the concern about how we impinge on the environment. Population will then rise further until the pressures reappear with an intensity that can no longer be relieved. To try to

raise quality of life without intentionally creating compensating pressures to prevent a rise in population density will be self-defeating.

Consider the meaning of these interacting attractiveness components as they affect a depressed ghetto area of a city. First we must be clear on the way population density is, in fact, now being controlled. There is some set of forces determining that the density is not far higher or lower than it is. But there are many possible combinations of forces that an urban area can exert. The particular combination will determine the population mix of the area and the economic health of the city. I

suggest that the depressed areas of most American cities are created by a combination of forces in which there is a job shortage and a housing excess. The availability of housing draws the lowest-income group until they so far exceed the opportunities of the area that the low standard of living, the frustration, and the crime rate counterbalance the housing availability. Until the pool of excess housing is reduced, little can be done to improve the economic condition of the city. A low-cost housing programme alone moves exactly in the wrong direction. It draws more low-income people. It makes the area differentially more attractive to

Flow diagram of world. Levels are represented by rectangles; rates by valves; auxiliaries (significant components of rates) by circles; dotted lines indicate directions, shown by arrows. A fuller explanation is given in Part Two, to be published next month.



the poor who need jobs and less attractive to those who create jobs. In the new population equilibrium that develops, some characteristic of the social system must compensate for the additional attractiveness created by the low-cost housing. The counterbalance is a further decline of the economic condition for the area. But as the area becomes more destitute, pressures rise for more low-cost housing. The consequence is a downward spiral that draws in the low-income population, depresses their condition, prevents escape, and reduces hope. All of this is done with the best of intentions.

My paper, "Systems Analysis as a

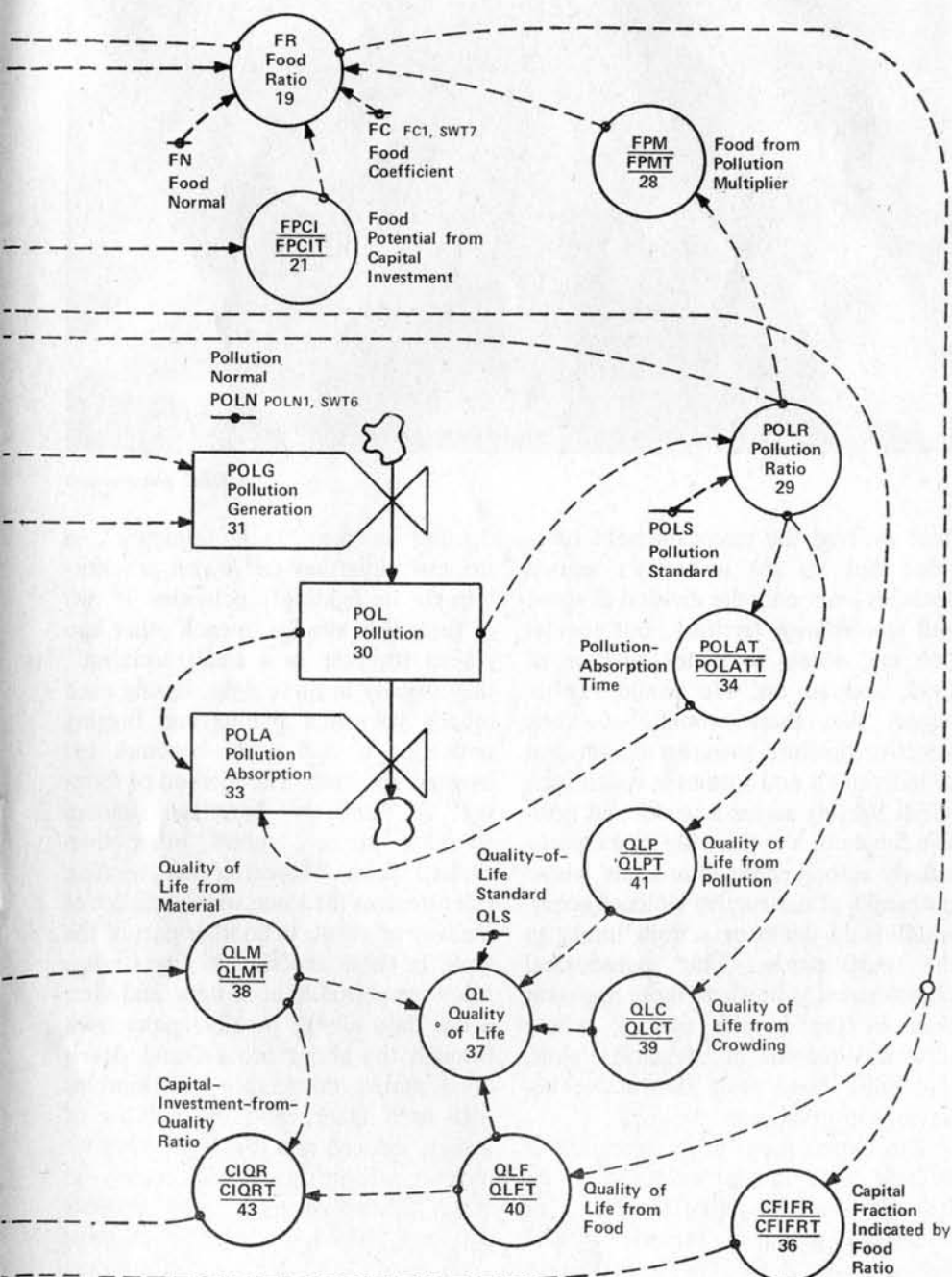
Tool for Urban Planning" from a symposium in October, 1969, at the National Academy of Engineering, suggests a reversal of present practice in order to simultaneously reduce the aging housing in our cities and allocate land to income-earning opportunities. The land shifted to industry permits the "balance of trade" of the area to be corrected by allowing labour to create and export a product to generate an income stream with which to buy the necessities of modern life from the outside. But the concurrent reduction of excess housing is absolutely essential. It supplies the land for new jobs. Equally important, the resulting hous-

ing shortage creates the population-stabilising pressure that allows economic revival to proceed without being inundated by rising population. This can all be done without driving the present low-income residents out of the area. It can create *upward economic mobility* to convert the low-income population to a self-supporting basis.

The first reaction of many people to these ideas is to believe that they will never be accepted by elected officials or by residents of depressed urban areas. But some of our strongest support and encouragement is coming from those very groups who are closest to the problems, who see the symptoms first-hand, who have lived through the failures of the past, and who must live with the present conditions until enduring solutions are found.

Over the last several decades the country has slipped into a set of attitudes about our cities that are leading to actions that have become an integral part of the system that is generating greater troubles. If we were malicious and wanted to create urban slums, trap low-income people in ghetto areas, and increase the number of people on welfare, we could do little better than follow the present policies. The trend towards stressing income and sales taxes and away from the real estate tax encourages old buildings to remain in place and block self-renewal. The concessions in the income tax laws to encourage low-income housing will in the long run actually increase the total low-income population of the country. The highway expenditures and the government loans for suburban housing have made it easier for higher-income groups to abandon urban areas than to revive them. The pressures to expand the areas incorporated by urban government, in an effort to expand the revenue base, have been more than offset by lowered administrative efficiency, more citizen frustration, and the accelerated decline that is triggered in the annexed areas. The belief that more money will solve urban problems has taken attention away from correcting the underlying causes and has instead allowed the problems to grow to the limit of the available money, whatever that amount might be.*

* Our continuing examination of urban behaviour has been made possible through a grant to MIT from the Independence Foundation of Philadelphia.



Violence and social disorganisation

by J. P. Scott and Richard F. Gottier

Experiments with animals tend to show that if the organisation of a society is disturbed by overcrowding or by introducing foreigners who are not differentiated parts of the same social system, violence tends to increase. Social disorganisation, the author of this article suggests, is in fact the basic cause of violence. There is no reason why the same principle should not apply to human societies, so it would seem to provide a much needed explanation for the growth of violence in our disintegrating urban society.



A BBC photograph

As we look at the phenomenon of social fighting in the animal kingdom, it is immediately apparent that it occurs chiefly among the so-called higher animals, the vertebrates and arthropods. It has a variety of functions, none of which are universal, but the most common one is that of regulating the use of space. The easiest way to avoid the punishment of an attack is to move away from the attacker. Depending on the nature of fighting, the result may be that individuals stay a few feet apart, as in the case of goats and many common herd animals, or become almost solitary as adults, as in the case of raccoons.

Such behaviour probably evolved originally from defensive fighting. The "cornered rat" reaction is almost universal among animals that have any capacity for defence and is useful not only against predators but also against accidental injury from members of the same species. Beginning with these latter contacts, social fighting could

have evolved the many different functions that we see in today's animal societies—not only the division of space and (sometimes) territory, but regulation and access to mates, division of food, and so on. We would further expect that there would be strong selective pressure towards the survival of individuals and species in which such social fighting serves a useful and positive function. Yet there are cases, particularly among confined animals, where outbreaks of destructive violence occur, resulting in death or serious injury to the participants. This paradoxical phenomenon is nowhere more apparent than in the human species, where historical records of massacres, riots, and other large scale destructive behaviour are common.

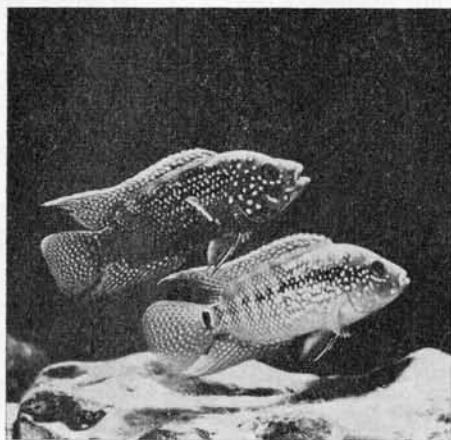
The explanation of this paradox is twofold. One line of evidence comes from studies of fighting behaviour of non-human animals in relation to social disorganisation. One of us (Gottier) recently made an extensive study of

fighting in the "Jack Dempsey", a tropical aquarium fish which is notorious for its fighting proclivities. If two of these fish, strange to each other, are placed together in a small aquarium, they usually begin to fight, seizing each other's jaws and pulling and tugging until one or the other becomes exhausted and flees. The method of fighting is relatively harmless, seldom resulting in any injury other than bruised jaws. Thereafter the winning fish threatens the loser, which gets out of the way or swims to another part of the tank. In these experiments five strange fish were placed in each tank, and after a few days all the possible pairs went through the above process and developed stable dominance relationships with each other, with the number of threats reduced to a low level. Thus we have a well-organised fish society in which fighting occurs in small amounts and does little harm even when most vigorous. This is what we would expect from evolutionary theory.



*Above: Baboon family. N.F.D.
Samburu Reserve*

*Photograph: Donald Paterson/Bruce
Coleman Ltd*



*Left: Adult pair of Jack Dempsey fish
Photograph: Jane Burton/Bruce Coleman
Ltd*

The function of fighting

The social function of fighting in this species was made obvious by another experiment in which the size of the aquarium was varied. The number of threats and fights was directly proportional to the volume of the aquarium. We would expect that in a free-living situation fighting behaviour would result in the fish spreading out until fighting was reduced to near zero. On the other hand, if a large number of fish are confined in a small area the fighting does become destructive and injurious, as the fish begin to bite and tear at each other's fins as well as going through their more usual jaw-locking fights. Also, if we deliberately disorganise the population by the introduction of strangers, the number of fights and threats increases by two or three hundred per cent. Thus it is possible to disorganise the population in two different ways, by rendering the function of the behaviour impossible, since in a small aquarium the fish are unable

to spread out away from each other as in a natural situation, and by the replacement of familiar individuals with strangers. Wherever this kind of experiment has been done the results are similar. Guhl and Allee showed that flocks of hens that were kept continually disturbed by shifting the members laid fewer eggs and lost weight. The destructive effects of fighting under conditions of social disorganisation are even more apparent in groups of primates. Zuckerman long ago recorded the violent fighting and numerous deaths that occurred among a zoo population of hamadryas baboons whose social organisation was distorted by lack of space, overabundance of males in relation to females, and the introduction of strangers. Recently Sugiyama studied the relationships between troops of Indian langur monkeys in the wild. Removal of the dominant male in a troop resulted in attacks by a neighbouring all-male troop that not only resulted in their taking over the

females but in the killing of their infants. Animals in this area were probably also somewhat affected by overpopulation.

From these examples and other evidence we can derive certain principles of social organisation. One of these is that organisation normally leads to stability, and in fact in any highly social animal the social environment is the most stable part of its environment, fluctuating very little from generation to generation in comparison to the biotic and physical environment. In a primate society such as that of the savannah baboons studied by Washburn and DeVore, the young baboon is born into, lives, and dies within a group of other baboons. As it grows up, it normally engages in playful fighting with its peers. If this becomes rough and one animal cries out, the contestants are immediately threatened by one of the older males. In this way the young baboons presumably learn the acceptable limits of aggressive behav-

our and are also assigned their positions in the dominance order of the group. Such organisation is very stable, changing only as older individuals die or disappear and so allow the young to move slowly upward.

Inertia, or homeostasis

This stability, or social inertia as Guhl has called it, is related to a general phenomenon of biological systems, that of homeostasis. What it means from an evolutionary viewpoint is that selection pressures originating in the social environment should remain stable over long periods of time, with the result of selecting individuals whose behaviour is adapted for existence in that particular social environment. Social fighting in any given species should therefore contribute to the survival of the individuals and populations rather than resulting in destructive behaviour. In any stable society, fighting is virtually always reduced to "ritualised" threats, or threats that chiefly serve a signalling function. On the other hand, it does not follow that such behaviour will necessarily remain on a low level or be adaptive in social environments other than the normally stable one in which evolution has occurred. We can

thus develop the theory that social disorganisation is a major cause of destructive violence.

We cannot apply this theory by direct analogy to man, since every species has a unique genetic basis, but it does provide a working hypothesis. When we examine the occurrence of destructive violence in human societies we find that it is indeed associated with social disorganisation—with areas into which there have been large influxes of strangers, with individuals from broken homes, with the time in life when young people in our society are breaking away from their own family groups and have not yet acquired others, with the disturbance of spatial relationships associated with overcrowding, and with historical periods when there have been gross changes in organisation associated with changes in energy sources as in the relationships associated with overcrowding, and with historical periods when there have been gross changes in organisation associated with changes in energy sources as in the Industrial Revolution. Even on the international level, the hypothesis of social disorganisation would predict that where stable relationships have been devel-

oped between adjoining societies, wars are unlikely.

This brings us to the second major factor conducive to destructive violence, one which is found only in human societies. This is the deliberate use of organised violence as a tool for obtaining certain ends which are seen as desirable, whether they are loot, land, economic advantage, or even changing the beliefs of one's neighbours.

Seen from an overall ecological viewpoint, man is a dominant factor in the ecosystem of which he is a part. From the viewpoint of an individual, the most important feature of the environment is other men, i.e., the social system of which he is a unit. As we have indicated above, the two factors that bring about destructive violence are both related to organisation. If we are ever able to deliberately control our social environment we must understand its organisation. This should lead us to discover how to bring about social change without incurring the penalties of disrupting stability and, by implication, the range of optimal spacing among human individuals that will be a realistic guide to population policy. Without such understanding, violence becomes mysterious, frightening, and inevitable.

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Avalon reclaimed

by
L. B. Powell

The Vale of Avalon, near Glastonbury in Somerset, is the centre for a peat extraction industry that has existed for centuries. Once a peasant occupation, providing fuel for cottage hearths and bedding for cattle, it is now Big Business. At the same time, the plans for dealing with areas from which the peat is exhausted give this part of Somerset an exceptionally high ecological interest.



Somerset's Bridgwater Bay not only has the highest spring tides in Europe and the second highest in the world—the highest being at the head of the Bay of Fundy, New Brunswick. It also has the largest area in Britain of that unique soil-building species of grass *Spartina Townsendii*, which affords a habitat to many forms of wildlife. The planting of this grass was begun 43 years ago. Since then it has been the means of raising the foreshore by an average of 5 ft over about 300 acres. This is one of the most conspicuous examples to be found anywhere of how nature can be enlisted to arrest coastal erosion. And *Spartina* is still spreading. This and new plans which probably will occupy half a century for dealing with areas where peat extraction is exhausted give Somerset an exceptionally high ecological interest.

The extraction of peat is confined to the central Somerset Levels, where the raised peat deposits of prehistoric time occur. For centuries it was a peasant occupation, giving fuel for cottage hearths and bedding for cattle. Now it is Big Business, with nationwide sales and even a small but significant export trade. Seen in its worst manifestation, in areas where the gouged earth is littered with stumps of uprooted trees amid pallid pools of stagnant water, peat extraction invites comparison with that famous landscape of No Man's Land in World War I by Paul Nash, to which he gave the grimly ironic title: "We are making a New World."

That title is apposite, however, in a more hopeful context to what is beginning to happen in the peat lands of Somerset, and in this first article we will consider the background of the Somerset peat story and what is proposed for reclamation of the peat areas as they are worked out. A second article will recount the story of *Spartina* grass and tell of the benefits to wildlife that have ensued from its use.

The peat deposits where extraction is being carried on occur in the plain between the Mendip and Polden Hills, through which the Rivers Brue and Axe flow to the Bristol Channel. The largest area, south of the village of Meare, comprises some 3,700 acres, and the second, north of Meare, about 2,200 acres.

Thousands of years ago the whole area lay beneath the sea which slowly

receded from the Levels, a process which it is estimated terminated by about 4,300 BC. This was followed by a transition to fresh water conditions which led to the appearance of vast reed swamps. With the passage of centuries the fenwoods alder, birch, and willow invaded the swamps, and their eventual decay resulted in a deposit of wood peat overlaying the looser textured fen peat left by the reeds.

Smaller vegetation occurred in variety, including *Sphagnum* moss which creates its own moisture from the atmosphere and was therefore able to survive periods of dryness during the long succession of climatic changes. Other species were ling, heather and deer grass, the root systems of which established a series of raised deposits several feet above the level of surrounding land.

Identification of plant remains and pollen analysis tell us what diversity of botanical interest was to be found in the Somerset peat bogs—a diversity which, as we shall see, continues today with the survival of rare species.

In addition to the trees mentioned, ash, Scots pine, oak, lime, elm and beech established themselves with an undergrowth of hazel. Among flowering plants were marsh marigold, goosefoot, dropwort, dog's mercury, the lesser celandine and common tormentil, coltsfoot and breckland wormwood. Bracken, fern royal, and common polypody flourished, and in addition to common reed and cotton grass there were purple moor grass, brown cyperus, white beak sedge, wavy hair grass, matt grass and deer grass.

Three areas, Catcott Heath, Westhay Moor and Shapwick, are of exceptional botanical interest today, having colonies of bog plants which include the very rare brown beak sedge, saprophytic liverwort, great sundew and marsh pea, while a dozen or more relatively rare species are to be found there.

If worked-out peat areas are left with no attempt at reclamation, the plants most likely to colonise them will be rushes and common sedge, brown-bent grass, marsh cinquefoil, yellow loosestrife, milk parsley, heather and pennywort, and they will be followed by typical fenwood scrub, producing cover of small economic value (i.e. shooting) and little amenity value, though it does provide, of course, a habitat for various species of birds, mammals and insects.



Removal of top-soil along the line of cut prior to extraction of the peat

Before mechanisation came to revolutionise the industry, peat extraction was a slow and strenuous task, and still is for the small operators who must rely on traditional methods. Hay knives with an effective depth of 2 ft are used for cutting the "mumps", as the pieces are called, and a peat barrow reminiscent of the primitive man-operated plough is the means of conveying the mumps to stacks where they are dried.

It follows that the areas worked by such methods are small, and the problem of dereliction was far from having the magnitude it has assumed today.

In contrast with the hay knife, the modern peat cutting machine is as the combine harvester is to the scythe. Of German manufacture and costing over £5,000, each of these monster excavators will do the work of 15 men, cutting trenches 3 ft deep and over 2 ft wide.

Such machines are used by the two largest operators, the Eclipse Peat Company (a subsidiary of Fisons), and E. J. Godwin (Peat Industries) Ltd. The former has also its own rail track covering 15 miles with 13 locomotives and has an output of about 60,000 tons a year.

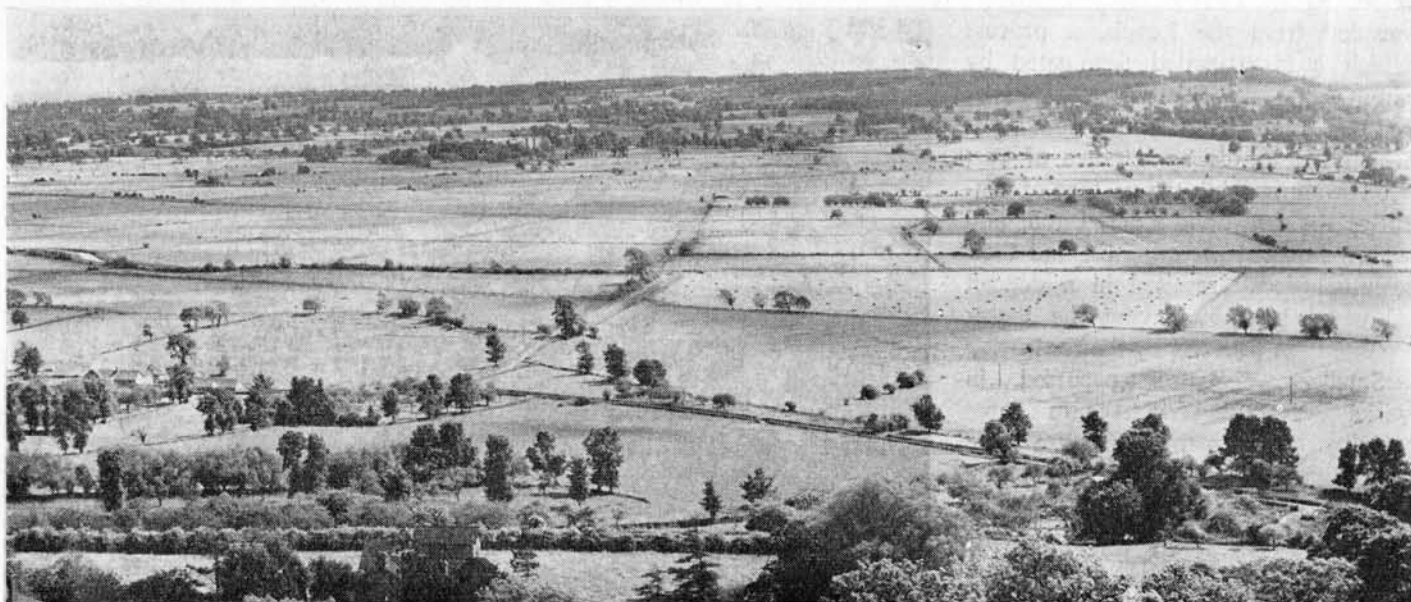
The most immediate problems created by the greatly accelerated expansion of the peat industry lie, of course, at the door of that organisation which has the perpetual responsibility of saving much of Somerset from the sea

(the county's vulnerability to inundation is comparable with that of the Fenlands) and of storing water in times of drought and disposing of it in times of flood: namely, the Somerset River Authority.

Then there are the claims of the Nature Conservancy, Somerset Archaeological Society, the Somerset Trust for the Nature Conservation, and various scientific and amenity bodies. With the larger peat area the Nature Conservancy has its own nature reserve and is much concerned over the increasing rate of peat extraction, the progressive lowering of the water table, and the combined effect of these on the ecology of the region. The nature reserve contains at least five prehistoric trackways, along which from time to time finds of great archaeological interest have been made.

The peat moors have also been designated by the International Union for Conservation of Nature as a wetland site of considerable importance, while in some of the smaller peat areas there are sites designated as of special scientific interest. We thus have, over a region as a whole, a combination of interests and pressures on land use of an uncommonly diverse character.

This is greatly accentuated by the steeply rising demand for peat by the horticultural industry and private gardeners which undoubtedly will go on increasing. In 1954 total output for all purposes, which include the prepara-



The Vale of Avalon

tion of cattle food, gas purification and the malting of whisky, was about 16,000 tons, but by 1966 this had risen to 63,000 tons. The two firms mentioned expect output to increase at the rate of 5 per cent a year. Concurrently with increased demand, the price of land where permission for extraction has been granted has risen steeply and is now between £600 and £700 an acre, compared with from £150 to £200 for agricultural land in the vicinity.

In 1967 concern over the future of the peat lands resulted in the publication of "Peat in Central Somerset: a Planning Study", by the county planning officer, R. W. Dale, and a highly informative document it is, from which much of the data in this article is derived.

In its vertical classification of the deposits the study shows seven layers in all before the marine blue clay is reached at a depth of 10 feet or more. In an assessment of the economic life of the deposits, an average yield of four layers over the whole area is assumed, each giving some 450 tons per acre-layer. On this basis the total area of the deposits, 5,900 acres, could be expected to yield some 10,620,000 tons, and if production continues to expand at five per cent a year, exhaustion of the total supply could be expected in about 45 years' time. The study points out, however, that this estimate is of doubtful value for a variety of reasons.

The question of depth of working is

of course vital in its relation to the water table and to attempts at reclamation. To quote again from the study, "attempts to achieve reclamation by small fragmented schemes are unlikely to be successful or economically viable".

According to the study, the worked out land could in places be 10 to 12 feet below the water table over areas of 150 acres and more. The cost of draining the land appears to be very little, however; and the major operating company was draining 300 acres at the time of the report by pumping 24 hours a day at a cost of about 6d an hour. It was their intention to continue this until the area is worked out, when it would be reinstated to agricultural use with grazing rights rented to local farmers.

Understandably, the report says nothing of the cost of reinstating worked out land for agricultural use, but over the larger areas of maximum depth this clearly would be very considerable. Where, one wonders, would sufficient soil of good structure and adequate fertility be available, and who would be willing to part with it.

In contrast, the scheme which Mr E. Louis Kelting, Engineer to Somerset River Authority, has persuaded the Authority to adopt is one which commends itself by taking full advantage of the natural factors involved. What he proposes is the transformation of the worked out peat lands into a minia-

ture lake district, to be known as the Avalon Lakes. The name is Mr Kelting's own suggestion.

There would be 10 lakes in all, covering some 2,000 acres. Each would be given a sylvan setting of shrubs and trees with perhaps some pasture land and picnic reservations, and they would provide new wild life habitats and a variety of amenity facilities.

From the River Authority's point of view the scheme is one of enlightened self interest, for with the installation of additional pumping stations where needed the primary functions of water conservation and irrigation for adjacent farms would be expedited. The supply of water to the complex system of rhines which extend over the whole area and serve as cattle fences in the absence of hedges would also be much improved.

There is more to the scheme than practical self-interest, however, for Louis Kelting himself is a devoted ornithologist and conservationist, with a keen appreciation of aesthetic values in landscape engineering. On the eve of retirement he may justly regard this scheme as a happy culmination of his life's work. It has the blessing of the County Planning Department, the Nature Conservancy, and the amenity and scientific bodies concerned.

As the major operator, the Eclipse Peat Company have shown a public-spirited response, proof of which is that they have agreed to sell 117 acres

at £10 an acre with vacant possession within 10 years. The River Authority has also acquired from British Rail the disused track which runs through the peat land from Edington to Sharpham for a distance of about eight miles. Conversion of this to a footpath-cum-bridlepath will be an integral part of the scheme, giving access to the lakes.

In addition, the Authority will purchase boundary strips around the lakes to widths of between 100 and 150 feet. These are costing much more—up to £400 an acre—and will be planted to serve as windbreaks.

The first instalment of the scheme will be conversion of the area of 117 acres sold by the Eclipse Peat Company and this will be known as Noah's Lake. Conversion of the other areas as they become available will be spread over a long period, possibly 40 or 50 years, depending on the rate of exhaustion of peat extraction. Boating, sailing, fishing and nature study are all envisaged. It is Mr Kelting's hope that the Nature Conservancy will take over such warden supervision as may be needed.

An enthusiastic supporter of the scheme is Mr Peter Tolson, one of the founders and vice-chairman of Somerset Trust for Nature Conservation, of which Lord Waldegrave is President.

Mr Tolson stresses the great potential educational value of the scheme and the ornithological importance it will have in conjunction with the reclaimed foreshore of Bridgewater Bay a few miles distant. The two areas, he points out, lie directly within the great migratory route from the far North down to equatorial Africa, and thus provide valuable resting and feeding grounds for many species of birds.

At present the Somerset Trust is urgently concerned with preserving 40 acres at Shapwick Heath and 32 at Westhay from peat extraction in view of their unique botanical interest. Fortunately, Fisons Ltd as controllers of the Eclipse Peat Company, have shown themselves "most helpful" in Mr Tolson's words. They have agreed to a moratorium on these two areas until November next, and the Trust hopes to raise the requisite funds to save them.

Finally but certainly not the least merit of the project is that agriculture will derive much actual and potential benefit from it. It will make piped water more widely available in a region where there are still holdings which are without it. Flood risks from the River Brue, already reduced by the Authority's main south drain, will be further minimised. As for the potential benefit, this will be realised by the extent to which farmers improve their own existing drains or provide new ones as the scheme progresses.

How the farmers will respond remains to be seen. A lowering of the water table by about six inches well might become feasible in areas which at present can only be used for summer grazing, and this would result in greatly improved pasture, permitting higher stocking. Farmers of the wiser sort will not wish to see in the Somerset Levels any repetition of the Folly of the Fens, where continuous arable cropping plus hedgerow removal has resulted in blowing of the soil. They will counsel the traditional pattern of alternate husbandry instead.

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The rural iceberg

by **Ralph Baker and Masry MacGregor**

The efficiency of farming is often measured in terms of output per man. How independent of labour are Britain's farmers? The answer to this question will give us an idea of the true productivity per man, but it can be found only if we can define clearly what we mean by "agricultural worker". Ralph Baker, a farmer and an active member of the Somerset Branch of the National Farmers' Union, and Masry MacGregor, a sociologist who has studied rural communities, conducted a small study of the part of Somerset in which they live to find out whether the reduction in the agricultural labour force represents as much of an advance as is claimed, or whether at least a proportion of the workers displaced have been replaced by industrial workers producing the labour-saving equipment on which the modern farmer depends.

British farming is probably the most highly mechanised in the world. In 1968, according to figures published by the Netherlands Ministry of Agriculture, only 2.9 per cent of our working population was employed in agriculture, compared with 4.8 per cent in the US, 7.7 in Holland, 5.3 in Belgium, 11.4 in Luxembourg, 10.0 in W. Germany, 23.2 in Italy, 15.5 in France and 11.7 in Denmark. The average for the countries of the EEC was then 14.6 per cent. That was three years ago. Now less than 2 per cent of Britain's labour force works on the farms or in the market gardens or the forests that nevertheless between them still occupy some 80 per cent of our land area.

Productivity, measured in terms of output per man, is high. It is not the world's highest, but it is among the first few. There are many British farms that employ only the farmer and his family and the trend now is towards amalgamations that are forcing out the smaller farmers themselves.

Where have all the farm workers gone? Many of them have left to work in factory industry where wages are higher and conditions better. They are now counted as part of the urban population. What do they do there? Clearly, some of them must be employed in manufacturing the machinery and technological aids that have made it possible for the farmer to dispense with their labour. Many of the "scientific" aids to farming are, in fact, labour-saving devices. A tractor can pull a plough faster than could a team of horses, so less men are required at ploughing time. Combine harvesters have replaced armies of labourers with scythes. Herbicides kill the weeds that were once removed by men with hoes. Synthetic fertilisers are designed for ease of handling and application. The most common argument against the use of farmyard manure and organic-based, bulky, fertilisers is that they make more work.

If machines and chemicals have replaced men, should we not include the labour of the men engaged in their manufacture and marketing with the agricultural labour force? A man assembling a harvester is wholly dependent for his living on farming; the machine has no other use. The fertiliser salesman driving from farmer to farmer is equally dependent on his customers. Even the executive in the advertising agency that handles the

Fison or Massey-Ferguson account is dependent on farming at least for a part of his time. If all these workers are added back into the agricultural working population the picture that emerges of agricultural productivity per man may change.

How can this be done? The task is immense and complex, but it should not be impossible. We conducted a small pilot study in an area of 12 square miles in central Somerset and we have found that although the agricultural working population has declined, the numbers employed in ancillary and agro-allied trade has increased.

In 1880, Francis George Heath* wrote that there was a surplus of agricultural labour in Somerset, compared to the Midlands and the North, where the rival claims of industry were attracting labour from the countryside, and at the same time forcing up the agricultural wage. At that time, the average farm labourer in the Midlands and the North earned 13s 6d per week, while the West Country labourer was paid only 7s. In North West Somerset at that time farm wages had been forced up to 9s a week by the competition for labour from a new railway that was being constructed from Watchet to Minehead and which entailed the felling of trees and some local mining.

In the past hundred years, even an agricultural county like Somerset has seen a proliferation of light industries, centred on the market towns. These have provided employment not only for people in those towns, but also for those living in the rural areas round about. The remarkable re-growth of village life is often attributed to the increased ownership of cars and the willingness of people to travel longer and longer distances to work, in exchange for a house in the country. With all due respect, we would suggest that this picture is influenced by the experience of the commuter belt around London and other cities. Being the most accessible villages, they have tended to be those most frequently studied. But when one moves into the rural areas that are further removed from the cities, the increasing rural populations are not composed of commuters who travel very long distances to work, but of people who travel no more than 3 or 4 miles. The economic support for the people in these villages comes from

* *The West Country Peasant* by F. G. Heath, published London 1883.

the light industries in small towns, employment in services to the community, and what we would like to discuss here: employment directly dependent on agriculture, but which is classified under other headings because production takes place away from the farm premises. The presence of agriculture provides employment and economic support in a district for nearly twice as many people as are classified officially as "employed in agriculture".

The agricultural contribution of Somerset is large. In 1968 the county contained:

168,028 acres permanent grass (for dairy and sheep farming).

150,000 acres of cereals.

8,687 acres of orchard.

4,870 acres of leys (i.e. grass planted for only a few years).

4,000 acres for digging peat.

Even so, the mechanisation of agriculture has accounted for a steady drop in the number employed on the land, and the numbers employed in agriculture in Somerset reflect the national trend. If one takes those in regular full-time employment in agriculture over the past 15 years, the numbers are:

1955	13,491
1960	11,792
1965	8,892
1968	7,753

This emphasis on declining numbers in agriculture, in contrast to the growing numbers employed in other industries and services, can be misleading. The smaller numbers would suggest that a smaller proportion of the population is now dependent on agricultural production for its income. But is this true? Have the people who used to be employed in agriculture moved into completely different forms of production, or have they merely moved sideways into industries and services that are ancillary to agriculture?

Two hundred years ago small scale production in the home became less and less economic, and factory production took its place. In this century small scale production in individual farms has become less and less economic, and one sees the growth of large scale production—cheese-making, chicken packing, egg packing, cider-making, etc.—all off the farm premises and therefore not classified as "agricultural production" because it takes place in small

factory units. Again, farm produce is now often sold on the retail market in a packaged form that involves the employment of labour. Before the war the farmer would sell his peas in pods directly to the retail market. Now the peas are prepared, packaged, frozen, and distributed from the factory to the retail market, the farmer collecting only 16½ per cent of the retail price, the rest going to those employed in these intermediary processes between farm and shop. The people employed in such factory units are still dependent on agricultural production for their income.

If one considers the range of employment generated by agriculture, grain-milling, animal and poultry food production, production and maintenance of farm machinery, bacon curing, contract milking, technical and advisory services, etc., one sees that the classified agricultural labour is only the tip of the iceberg, and an area with an agricultural economy is providing employment for others as well.

We have taken a small area in central Somerset, approximately 12 square miles, the area covered by the Department of Employment and Productivity employment exchanges at Street and Wells, and we propose to quote labour figures in this area as an illustration of this supporting employment provided by agriculture.

The area includes the low-lying Vale of Avalon, with its rich dairy pasture, and also the peat beds around Meare. The three market towns for the area are the cathedral city of Wells, which has some light industry, Glastonbury, which is the centre for Moorland's sheepskins, and Street, the centre for Clark's shoe industry.

The total number of those employed full-time in agriculture for the area, in the latest Department figures available, (1969), are 714. We can quote a further 621 in employment dependent on agriculture in this small area. The figures can be broken down thus: (a) Numbers obtained from DEP classified lists:

milk and milk products	237
bacon curing	36
animal and poultry food and seeds	98
agricultural machinery (mainly maintenance)	73
	—
	444
	—

(b) Numbers obtained from local firms, or personally identified by us:

relief milking	6
contract milking	10
hay baling, tractor work, hedging and ditching by contract	3
specialist ditchers who do drainage work, pipelaying, trenching, etc.	4
3 farmhouse cheesemakers (i.e. taking from 3 or less farms), employing approximately 2 each)	6
egg packing	20
2 farmhouse cider makers, employing 2 each	4
agricultural food merchants employing—	
sales staff	6
transport drivers	6
clerical staff	2
workers employed drying and digging peat (with a further 50 in summer months)	124
clerical staff for peat work	25
technicians and clerical staff employed in the area by the Min. of Ag. (approx.)	15
	—
	231
	—

This means that besides the 724 classified as employed in agriculture in the area, there are further identified:

(a) in the DEP classifications	444
(b) personal knowledge	231
	—
	675
	—

These numbers do not include those who travel outside the area for similar employment. For example, at Shepton Mallet, just outside the area, there is Showerings Ltd. cider factory. This employs approximately 700 people, mainly from the Shepton Mallet/Wells area, though a certain number travel from the Bath/Bristol area. The firm has its own orchards in the Petherton/Taunton area and it also buys apples from Ireland and Kent and pears from Gloucestershire.

Thus, if one did an analysis of labour over a wider area and on a larger scale, one would find the same pattern. If one goes into a smaller area, one village, Meare, the same labour pattern emerges. Meare is situated on the low lying land between Wedmore and

Glastonbury, a centre for peat and dairy farming. There are 650 on the electoral roll of the village, of whom 258 are now employed. If one breaks down the nature of employment among the villagers (not counting female employment) the following profile emerges for 10 years ago and today:

ten years ago

farming	66 (24.2%)
employment support-	
ing agriculture	31
peat	84
non agricultural	54
leather	38

1971

farming	49 (19%)
employment support-	
ing agriculture	32
peat	85
non agricultural	56
leather	36

Thus, while numbers employed in agriculture have declined, numbers in supporting employment and in peat digging and packing have increased.

Nor, in discussing this, have we taken into account the extra work which agriculture provides for local builders,

fence makers, fuel merchants, etc. Classification by man power is not necessarily classification by economic value. It is our contention that classification by man power may not even be accurate, unless one accounts for those who have moved, not out of agriculture, but sideways into its subsidiary forms.

In the end, what is a farm worker? Should we alter our methods of classification? By confining the definition of a farm worker to one who works on a farm we are perpetuating a concept that dates from the days before industrialised farming. Surely, when we boast of the degree of intensification and mechanisation on our farms it would be appropriate to include in the labour force involved all those whose income is dependent mainly on farming, regardless of where they live and work? If we can accept that the man in the village who repairs farm implements is dependent on agriculture, why not the industrial worker in Birmingham, Dagenham or Ipswich who makes the machines and implements in the first place?

This is not to say that productivity

per man is low. Clearly, it is not. If we were to treble the numbers of those classified as agricultural workers to include those in the agro-allied industries, we would still be talking of only 6 per cent of the total working population. What we do say, however, is that in agriculture as in every other economic activity, if we are to assess accurately the achievements we have made and if we are to cost production accurately, then we must take cognizance of all the facts. We must keep our statistical techniques up to date.

The British farmer still employs fewer workers than his counterpart in most countries; but he does so because of the help he receives from urban factory workers. It is no disservice to him or to them to say so.

We would like to thank the following for information, while absolving them from any responsibility for interpretations we have placed upon it: Mr J. H. Tackle, Dept. of Employment and Productivity, Street; Mr Clive Scott, Min. of Agric., Fisheries and Food, Wells; Mr C. S. Taylor, Min. of Agric., Fisheries and Food, Taunton; Showerings Ltd.; Sheldon Jones Ltd.; Fisons Ltd. (Eclipse Peat Works); C. Puddy & Son; Coates Ltd.

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Insects— key conservationists

by
F. W. Service

Most animal populations are kept in check by a combination of controls such as disease, predation and food-shortage. It is only when there is a marked reduction in the efficiency of one or more of these controls that population can expand. Insects have played a major role in transmitting disease—and hence in exerting what has clearly been the major control on human population. They have also helped to protect large areas of the world from man's exploitation. With the introduction of pesticides and the development of modern medicine, their influence has greatly decreased.

Tsetse flies are blood-sucking flies a little larger than house-flies and are only found in certain parts of tropical Africa. In spite of their limited range they have had a greater impact on the civilisation and ecology of this continent than has any other group of insects in other areas. The reason for this is that tsetse flies are the hosts of trypanosome parasites. When infected flies bite man, domestic or wild animals, these parasites cause the disease trypanosomiasis. In man the disease is better known as Sleeping Sickness and results in lethargy, loss of weight, emaciation and in untreated cases, usually death. The disease has been known for a long time, the earliest records of it going back to the ancient kingdom of Mali in the 14th century. It has undoubtedly been responsible for tens of thousands of deaths in Africa, and in some instances has caused spectacular depopulation. An example is the devastating epidemic which struck Uganda at the beginning of the present century, killing some 200,000 people or nearly two-thirds of the population living around Lake Victoria. How the

disease reached the area is not known, but some say that it came from the Congo and was brought by H. M. Stanley's expedition in search of Emin Pasha. What we do know is that before the coming of the white man there were numerous tribal wars over most of Africa, and to obtain protection, people often lived in relatively large villages set in clearings in the bush. Such clearings also provided protection from the tsetse flies who do not like open country. With the advent of colonial law and order, large settlements were no longer necessary and people began to leave the larger villages to set up small scattered communities. The tsetse spread into these small villages and with it came sleeping sickness.

The tsetse also transmits Nagana, a related disease, to cattle, horses, and also various wild animals, and it was this that did most to prevent the economic development of Africa. For instance, Nagana was probably one of the more important factors in preventing the Arabs who had already invaded the East African coast from penetrating inland, by preventing the use of horses

and oxen as transport animals. Later with the introduction of firearms by the Europeans, wild animals, including the natural carriers of Nagana, were ruthlessly slaughtered, and this reduced the natural reservoir of the infection. The chances of horses and cattle getting the disease therefore lessened. This in turn permitted a few successful advances through tsetse infested country.

On the other side of the continent, in West Africa, similar conditions affected exploration. Europe has traded with the peoples of West Africa for some five centuries, but all trading posts were on the coast. It was only in the 19th century that there were any real attempts to explore inland from the coast through the rain forests, and then this was only achieved at the cost of great misery and loss of life. In contrast to this early lack of exploration from the coast to the north, there was an established two-way trade on the northern frontiers of West Africa by people from the Med. regions. They travelled south by caravan trail across the tsetse-free Sahara Desert bringing

salt, while in the opposite direction there was a traffic in gold and slaves.

Though the mighty Sahara proved no barrier, deeper penetration into the southern part of West Africa from the north was impossible because of the tsetse flies, who invariably caused the death of pack animals. It was owing to the impossibility of transporting loads by animals through much of tropical Africa that the custom of using porters with their head loads was developed. It seems a remarkable fact that before the coming of Europeans there was no ox-drawn plough or cart in Africa. The tsetse fly was directly responsible for this "backward" state of the continent.

Tsetse flies and game

A good example of the important part played by the tsetse fly in the ecology of Africa is provided by the great rinderpest epizootic of 1896 which killed large numbers of game animals in Rhodesia and The Transvaal. This was accompanied by the disappearance of tsetse from much of the affected area. What had happened was that rinderpest had killed off large numbers of animals such as kudu, bushpig, warthog, giraffe, eland and wildebeeste, all of which were the favoured hosts of the tsetses. The destruction of the tsetse fly's food supply inevitably led to a reduction in its numbers. When it was fully realised what an important role the tsetse fly was playing in preventing the spread of modern civilization in Africa, attention was turned to ways of controlling and eradicating it. An obvious answer seemed to lie in the elimination of the game animals which provided both the reservoir of infection of Nagana, and also the source of blood-meals necessary for the reproductive cycle of the tsetse.

This led to the widespread and indiscriminate destruction of game animals and thousands of square miles of land have been reclaimed.

The role of the tsetse fly in the ecology of Africa is clearly illustrated by an episode that occurred in the 1920's in Uganda. A reduction in the number of elephants together with the introduction of early grass burning to help check soil erosion, led to the development of dense growth of scrubby bush and the conversion of fly-free open grazing country into tsetse country. As a result, nearly 8,000 square miles of cattle country were

lost to the tsetse and the very existence of the cattle industry was threatened. To reverse the process, game animals were slaughtered and a system of late bush fires started. Eventually these measures resulted in some 6,000 square miles of country being reclaimed and stocked with cattle. As a result the cattle population of Uganda increased by as much as some 800,000 head.

Nowadays the indiscriminate and wasteful killing of game as a means of tsetse eradication is not so popular! It is being gradually realised that Africa's heritage lies in its wild life, and without careful and scientific management some species could soon be facing extinction.

Tourism and midges

Another insect that has influenced ecological history is the midge. The smallest of blood-sucking flies, some are so minute that they do not appear to be much larger than tobacco ash. What they lose in size, however, they make up for in numbers. Certain species are in fact vectors of disease but their main importance lies in their intolerable numbers, which are often sufficient to put a stop to harvesting and other out-door activities. It has even been suggested that because they can make work out of doors virtually impossible, they have, in part, been responsible for the poor croft farming methods practiced on the West coast of Scotland. They have also posed serious threats to the tourist industry in places as dissimilar as Scotland and the Caribbean and in certain areas contributed more than any other insect to keeping the public out of remote and ecologically interesting areas.

Mosquitoes, diseases and history

Mosquitoes have also been an important barrier to the spread of Western influence in Africa. Mosquitoes occur almost everywhere in the world, and are vectors of a variety of deadly diseases, such as malaria, yellow-fever, filariasis, etc. In both tropical and sub-tropical countries mosquito-borne diseases have, until recently, helped to prevent human overpopulation.

There is evidence that the earliest men suffered from malaria, and it has, until recently, taken a higher toll of human life than any other disease. It has contributed to the defeat of armies, sapped the strength of civilisations such as that of Greece, Assyria and Rome. In Europe, malaria was for-

merly endemic as far north as Scandinavia. It began to recede southwards with the coming of the industrial era due to a combination of factors, of which the main one was probably the reclamation of marshes and swamps which formed the breeding places of the vectors of malaria. It is interesting to note that the three important ages of political and intellectual activity in Italy, the 5th century A.D., the Renaissance and the present day coincide with periods when malaria was at a low level of activity.

Epidemics in Asia and Africa have sometimes caused the abandonment of large areas of farmland. In Mauritius the epidemic of the 1860's killed almost a fifth of the population of that island, while in 1930 probably two million people fell victim to it in India alone.

Yellow fever

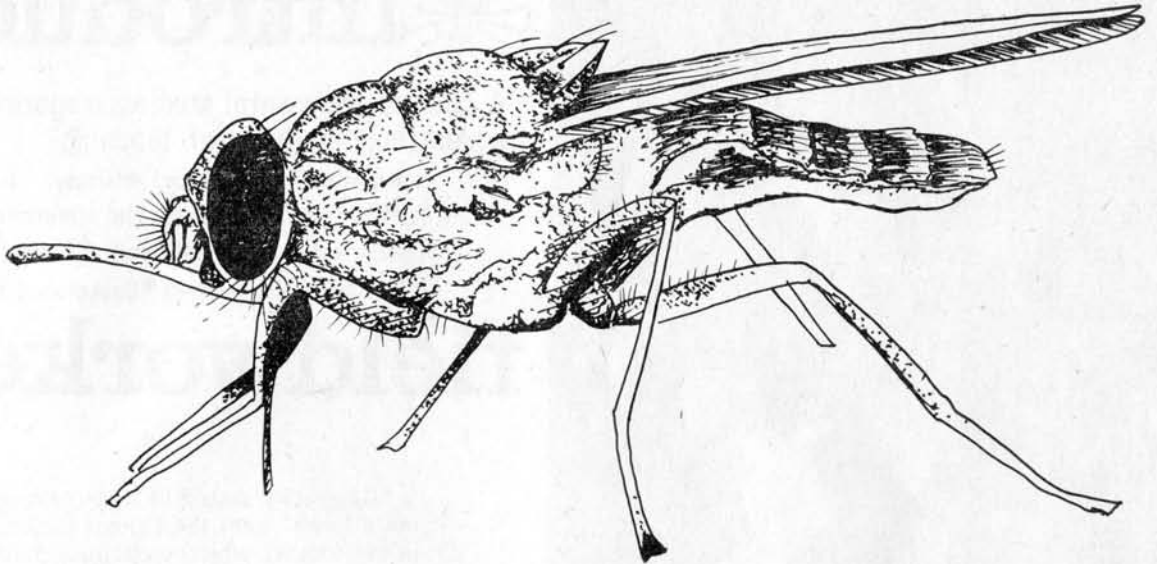
This is a virus disease transmitted by mosquitoes. It is widespread in Central and South America and in tropical Africa, where it can cause widespread epidemics. For more than 200 years yellow fever was one of the great plagues of the world. Its epidemics caused countless deaths in the Caribbean and Central and South America. Its presence in West Africa was one of the reasons why the region was termed the "white man's grave". It undoubtedly did much to prevent the spread of Western culture. At the same time, trade between Europe and the West Africa coast led to the introduction of yellow fever into Spain and Portugal. In 1857, 600 people died during a short epidemic in Lisbon. The disease even reached South Wales, and caused 13 deaths among dock workers.

Yellow fever was one of the major factors preventing de Lesseps from constructing the Panama Canal. It was only built once the mosquito vector was under control.

As recently as 1960 there was an epidemic in Ethiopia resulting in more than 30,000 deaths. The disease is unknown in Asia but its presence as far east as this serves as a warning that it may spread to that continent.

Urbanisation and diseases

Due to a combination of prophylactic measures and vigorous vector control campaigns, malaria and yellow fever are now not such a hindrance to the westernisation of tropical countries. But new problems are arising. What



appear to be completely new virus diseases of man have suddenly begun to appear in Africa and Asia. Apart from this, the epidemiology and ecology of some of the established and well known diseases appear to be changing. For example, dengue is a tropical virus disease of man in Africa, the Americas and Asia, which is transmitted mainly by mosquitoes. Before the 15th century, epidemics were usually restricted to seaports. During the 15th century, however, it began to affect the whole towns and in the latter half of the 19th century, it began to spread inland. Furthermore, until recently outbreaks were relatively unusual in south-east Asia but with the spread of the mosquito vector the epidemiology of dengue is changing. It is becoming an urban disease. In the 1950's, a new and more virulent form called haemorrhagic fever, was recorded for the first time in Manila and Bangkok, and later outbreaks occurred in India, Vietnam, Laos, Singapore and Malaya. What is even more alarming is that the disease appears to be spreading over much of Southern Asia. Unlike the classical form of dengue it is lethal, especially for children.

Another disease that is spreading is mosquito-borne filariasis which is widespread in the tropics. Recently there has been an alarming increase in the incidence of this disease. This may be due to two factors: First the rapid growth of towns in developing

countries gives rise to a corresponding increase in polluted water, which is the ideal breeding place for the mosquito-vector of this disease. Secondly, the widespread routine use of insecticides in towns has resulted in the destruction of harmless mosquito species, and this has then given an ecological advantage to the vector of filariasis, that is not very susceptible to insecticides.

The unholy Trinity

Fleas do not just visit man for a blood meal but actually spend much of their time attached to him. While only a few species of fleas commonly attack man, others which are not normally resident on man occupy a dominant position in the epidemiology of disease. For example, fleas of rodents maintain and cycle bubonic plague and murine typhus among animals. In certain circumstances they leave their normal hosts to feed on man and thus transmit their diseases.

Bubonic plague must be ranked as the disease that has had the greatest impact on the population of the Western world. It gave rise to two particularly devastating pandemics in Europe. One occurred in the 6th century during Justinian's reign, and the other was the infamous Black Death of 1348, which burnt itself out after killing about a quarter of the population of Europe. It flared up again in England after an interval to cause the Great Plague of 1665. Even as late as the

early 20th century it was still capable of taking a terrific toll in Asia, while as late as 1909 there was a limited outbreak in Essex.

Probably one of the most important ecological factors in the spread of plague was the invasion of Europe by the black rat from Asia. This rat lives in close association with man and thus the unholy trinity—the black rat, the plague bacillus and the flea—were brought in close contact with man. The reason for the subsequent disappearance of plague in Europe is not fully understood, but it seems that a major factor was the replacement of the black rat by the brown or sewer rat. This animal is not so common in buildings and therefore comes into less contact with man; also its fleas do not appear to bite man so readily.

The future

It is obvious that insect vectors have until recently played a very important part in helping to prevent overpopulation, but with the vigorous vector control measures now being practised in most countries their effect in this sphere is rapidly dwindling. It appears that it will largely be the responsibility of man himself to determine whether or not he continues to destroy much of his environment. However, with the rapid and drastic changes he is making to it there is also the danger of the appearance of new diseases or of new forms of existing disease.



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Reports

Mediterranean Resorts Fight Sea Pollution Threat

Some time ago, a press conference held at Pechiney Aluminium Works of Gardanne (southern France) called public attention to the acute problem faced by the works in disposing of the brownish-red wasted material resulting from extraction of the precious light metal from bauxite deposits.

For years, the residues had been dumped into a couple of gigantic artificial pits in the works' vicinity, but it was disclosed at the press conference that one of the pits had only about one million cubic meters of available space left, and that the other was nearing capacity with room for just 700,000 cubic meters of the red stuff.

A study conducted by the Works' management in conjunction with the Scientific and Technical Institutes for Marine Research and Commandant Cousteau's Department of Undersea Research reached the conclusion that the best disposal method for the "red muds" in the future consisted in dumping them into a 6,000-foot-deep offshore Mediterranean canyon located about five miles from the small fishing port and sea resort of Cassis.

It was therefore planned to build a 51-kilometre duct from the inland works to the projected offshore dumping grounds, running about 44 kilometres on land and the remainder undersea, with the scenic Port-Miou *calanque* (small fjord) as a starting point for the latter part of the pipeline.

Public reaction, however, proved a far cry from that expected by the hopeful industrialists. As a matter of fact, the "far cry" turned out to be a very close howl, for as soon as the project became known through the daily press, a vociferous protest rose from the whole Mediterranean population, led by tourist-trade unions, vacationist associations, municipal authorities, professional fishermen, anglers, welfare bodies, civic organisations and political leaders at all levels of representation in national affairs.

A protest meeting took place at Cassis, attended by the president of Marseilles' Tourist Office, the mayors or municipal delegates from numerous

other coastal-area towns (La Ciotat, Aubagne, Toulon, Roquevaire, Gardanne, Allauch, etc) as well as by Dr Alain Bombard, the famous solitary navigator.

All participants voted a decision to oppose the red-mud discharging project by every means at their disposal, on the grounds that the resulting water pollution would not only lead vacationists away from the Mediterranean coast at the very time when the whole world is taking major steps to woo holiday-makers, but also endanger the area's fish supply and the fisherman's livelihood.

"The sea must not become a trash can for all the garbage manufactured by the human race," said Dr Bombard in a forceful exposé. "Water is the last human capital: let us learn to preserve it."

A lawyer from Cassis stressed the probability of local beaches being polluted by red-mud "rise-out", on the strength of experience, which showed that offshore-dumped trash always washed back to the coast, no matter how far from the latter it was thrown. (In this connection, it is interesting to note, for instance, that during the course of a five-month period, municipal cleaners in Marseilles picked up 896 tons of miscellaneous refuse off the Prado beach.)

Another spokesman against the red-dumping project was Jean Bertrand, member of the regional Committee for Seasonal Hostelry and of the Thermic and Climatic Federation, who pointed out the nefarious consequences that a go-ahead on the scheme would have on the planned erection of a thalassotherapy (sea-bath healing) station in the Cassis area, as the hygienic requirements set up by the government for such stations were extremely strict, and water pollution would seriously jeopardise the project.

The meeting resulted in a petition filed with the central government through municipal and regional representatives, urging the authorities to find an alternative solution to the problem of red-mud disposal, and was followed shortly afterwards with a mass demonstration in the streets of Cassis, joined in by the whole town's population. The text of the protest became part of a 52-item bill on the general matter of water pollution in France which was presented to the National Assembly for enactment. But the subject was so vast and

complex (it covered river as well as seawater pollution) that 98 amendments were added to the bill, which came up for further consideration some time later.

Particularly objectionable to the red-mud dumping opponents was a clause that purported to classify the nation's waters into several categories with varying degrees of pollution tolerance, and let the government define that classification by degree. Opposition *députés* from the various regions concerned, and especially the Mediterranean coast representatives, considered this clause a deliberate intention on the part of the government to protect industrial interests. Some of them suggested the creation of an independent, consultative Water Council to which all matters concerning water pollution would be referred for debate on their individual measure of public interest, but this suggestion was countered by the Minister of Public Works who claimed that decisions on such matters rested on his ministry's authority, and overruled by a narrow-margin vote of the assembly. An amendment was nevertheless worked into the bill, to the effect that consultation should take place with municipal authorities, chambers of commerce and other local and regional representative organisations prior to classifying any body of water into a definite category.

On the specific matter of red-mud disposal, the Minister of Public Works recognised the importance of the problem, adding that an official investigation would soon be conducted, whose findings would be made public in due course.

Since no prohibitive action was taken by the assembly in connection with the dumping project, its opponents deemed it necessary to stage further protest meetings against it at various intervals during the following months, in order to keep public opinion aroused on the issue. In particular, the matter was brought up again at a session of the regional Mayors' Union council that took place in the Port of Seven Seas, whose Mayor Gaston Defferre suggested that a committee of impartial, technical experts be appointed to study the problem and search for an alternative solution likely to satisfy all parties involved. (That meeting was also attended by the mayors of Gardanne and of the communities surrounding that town, who favoured the Pechiney project for local economic reasons.)

Reports

M. Defferres's suggestion was unanimously approved by the participating mayors, and entrusted to the Préfet, a high official who represents the central government at the departmental level, for transmission to the Paris authorities. It specified that the experts' study would be financed by municipal and Mayors' Union funds, in order to ensure its independence from private (industrial) interests.

Dr Alain Bombard, who is also a technical counsellor on the French Committee for Water Protection, reiterated his concern at the threat constituted by industrial waste discharge into the sea, stressing his belief that not only would the red muds be dispersed over a wide coastal area by vertical and horizontal currents, thereby dealing a fatal blow to tourism in that region, but the unexpected chemical reactions resulting from contact of industrial residues with sea water might endanger marine fauna and flora, and jeopardise the fishing future of this Mediterranean sector.

"Moreover," Dr Bombard pointed out, "although we are primarily concerned with the Mediterranean right now, this is a universal problem, for the menace of water pollution is world-wide."

Meanwhile the investigation launched by the southern French Mayors' Union into the possibility of an alternative solution for the red-mud problem had kept progressing, and a communique recently released by the researchers disclosed that this waste material could be satisfactorily re-used for various industrial purposes. Especially noteworthy was the revelation that bauxite residues constitute an excellent raw material for the production of titanium, a metal even lighter than aluminium and destined to eventually replace the latter in the field of supersonic aircraft construction. Right now, titanium oxide is being expensively imported into France from India, the United States and Norway, whereas the controversial red muds, if exploited, would yield anywhere from 5 to 15 per cent of that raw material for titanium production. As a matter of fact, several patents had already been taken out in France for the extraction

process, including one that dated back to 1957, but no industrial concern seemed to have shown an interest in this potential so far.

The investigators also revealed that bauxite waste provides a useful ingredient for soil compaction, and in fact has already been used for such purposes in several countries for some time. It could therefore come in handy for the construction of a much needed French highway network. Moreover, it has excellent thermic and acoustic properties, which would make it valuable for brick-making and provide a cheap building material to satisfy the constantly growing demand for housing. In some countries, the red mud is even utilised as a colouring ingredient for paint making.

Investigation further revealed that the waste material which the Pechiney Works were so anxious to get rid of contained other non-negligible by-products, and that the projected dumping would amount to throwing away a daily quota of 645 tons of iron oxide, 300 tons of alumina, 30 tons of lime, 195 tons of silicon, as well as 83 tons of the precious titanium oxide.

To make sure that these findings got the widest publicity, the investigation promoters staged a summing-up meeting at the Isle of Bendor, near Bandol, whose owner Paul Ricard sent out invitations to all bodies and persons actively interested in the problem, including the northern *député* who heads the National Assembly's Water Committee. Of course Dr Bombard (the "Sea Apostle", as some people call him) also attended the meeting and took his usual important part in the verbal fight against the red-mud dumping project.

Furthermore, a circular describing the water pollution problem in detail and urging positive action against its threats on the welfare of mankind was mailed out to all political representatives in the central government prior to a further reading on the general water-health bill by the National Assembly.

In spite of all this action, however, the area's préfet later authorised the Pechiney organisation to purchase the plots of land necessary for construction of their waste disposal canal, which implied that the project had secured the governmental green light, as indeed it had through State Council decision.

François Pacqualini

Dustbin Day

The fertility of Sicily, they say, went down the sewers of Rome. A large urban-oriented civilisation fed on produce imported from a wide area. The city's wastes were disposed of in the most convenient way possible: mostly by emptying them into the street. Thus Sicily and parts of what is now Sahara were starved of the organic matter their soils needed, while Romans suffered the diseases harboured by their own pollution. It is a classic example (literally) of a waste disposal/soil depletion problem that could have been solved by recycling. It was a long time ago. We are wiser now.

All large urban areas face the same problems and if soil depletion has been masked by the use of synthetic plant foods, it is a masking nonetheless. Our soils need organic matter. A Government report has said so. But the problem of waste disposal remains and if we can persuade ourselves that there is no connection between declining soil structure and the organic matter we empty into our sewers and our dustbins, and so long as we maintain our faith in the bountiful earth that will supply all our mineral needs forever, we can forget recycling and concentrate on the dustbins.

This is not to say the dustbins do not present a problem: they do. In 1966/67 British local authorities collected and disposed of 13 million tons of household refuse and the trade refuse that was mixed with it. The cost was £13.5 million. This comes to about 34.2 lbs per household per week and an average cost of between 15p and 50p per head. By 1970 the total weight of refuse probably reached 14 million tons at a cost of 25p to 50p per head and by 1980 it is estimated that we will throw away some 17 million tons of rubbish at a cost no one cares to compute. 5,000 workers are employed in disposing of refuse, and this in an industry which aims to automate as much of its handling as possible.

In 1967 the then Minister of Housing and Local Government set up a Working Party to examine the whole problem of refuse disposal. Under the chairmanship of Mr J. Sumner its 16 members, two secretaries and four assessors met 16 times, set up two sub-committees, sent a questionnaire to 1,174 local authorities (of which 90 per cent replied), visited 15 local authorities in England, one in Wales and

Reports

three in Scotland, as well as six contractors, depots and tipping sites. Its Report, *Refuse Disposal*, has been published by HMSO at £1.15.

So what do we do with all that refuse? The answer, with a mass of statistics to prove it, is depressingly simple. We throw it away. We empty it into our dustbins, which are emptied into vehicles which take their loads either direct to a controlled tipping site (a convenient hole in the ground which needs to be made level) or to a rather nasty transit site from which it travels in bulk to its final resting place. Controlled tipping accounts for 90 per cent of refuse. Of the rest, 7.6 per cent is separated and incinerated, 0.7 per cent is incinerated without being separated, 1 per cent is pulverised and 0.3 per cent is composted: and then tipped.

Having considered all the possible alternatives, the Report concludes that controlled tipping is probably the best solution man can devise. There are dangers, however. When refuse is tipped and then covered with a layer of earth or other suitable material—this is what “controlled tipping” means—the mass compacts and the organic fraction decomposes, partly by aerobic fermentation, more by anaerobic putrefaction. There are health hazards. Groundwater or nearby waterways may be polluted. There may be rats. Light refuse, particularly paper and plastic wrappings, may blow about. There may be flies. Occasionally there are fires and very occasionally emissions of methane. Also, people with antisocial tendencies who happen to live close by may complain.

Nevertheless, the Working Party concludes that “the disposal of untreated house and similar refuse, subject to proper control on suitable sites, will continue to be satisfactory for the foreseeable future”. This, in spite of the preceding paragraph which states, “We found that failure to observe fully the tipping precautions recommended by the former Ministry of Housing and Local Government had in many instances resulted in difficulties and complaints. Often this failure arose from an unwillingness to spend sufficient money on the system to achieve a good standard”.

Of the alternatives, the Working Party considered pulverisation might be helpful in reducing the bulk to be tipped, but composting “can make little contribution” and there is “little justification for new installations of the separation/incinerator type”. It is a gloomy document.

What, then, of recycling? About a quarter of our refuse disposal workers spend most of their time salvaging. The Working Party would support an inquiry into the possible demand for recycled materials. During the year under consideration, 224,390 tons of waste paper was recovered, 45,315 tons of ferrous scrap, 10,901 tons of non-ferrous scrap, 4,776 tons of rags and 27,246 tons of other salvage.

Is not municipal composting a form of recycling? Most certainly, but only 41,791 tons of refuse were composted, out of a total 1,476,231 tons disposed of by mechanical methods. The question barely arises.

The character of our refuse is changing. The decline in the domestic consumption of coal means there is less ash and cinder, while the amount of vegetable matter has remained constant and the amount of garden waste has increased. The most significant change, however, is caused by the increase in packaging, which means an increase in paper and cardboard as well as metals and plastics. There has also been an increase in books, newspapers and magazines. The trend, therefore, seems to be toward a larger organic fraction and this would seem to suggest that composting might be the most appropriate method for reducing this material to a valuable friable humus.

It will not happen. London and Birmingham and Manchester and Glasgow will continue to import vegetable matter from the countryside and overseas, will use it and discard it to fill holes in the ground. The day will come when there are no holes left, but the Working Party was unable to think so far ahead. So Rome continues to mine the fertility of Sicily and the senators, two millennia later, nod wisely at a time-honoured custom. It was right then, so it must be righter now; we are that much wiser. London boroughs are seeking legislation to prevent restaurants and trade premises from dumping their refuse in the streets. That is a time-honoured custom, too.

Michael Allaby

DECADE OF DECISION 1970s

edited by **P. H. G. Hettena**
and **G. N. Syer**

*Members of the Governing Council
of The Conservation Society*

July 1971, 128pp., 60p. Paperback

All informed people will accept that we are confronted by a threat to the environment and that this threat will not decrease of its own accord. This concise book reviews the current world situation and soberly presents alternative futures, one burdened by over-population and drained of natural resources, the other achieving and maintaining an ecological equilibrium. The contributors place in perspective many of the problems of the Earth's teetering ecosystem, from the disappearance of wild-life on commonland to the imminent world shortage of food. We are reminded that we can abdicate our responsibility, but then future generations will be faced with irreversible damage.

Decade of Decision is the full report of The Conservation Society's conference 'Conservation 1970s'. It includes verbatim addresses and discussion, contributions by members unable to be present, and the draft document 'Conservation and the Environment' upon which the conference was based.

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J. Davoll: *Chairman's introduction*

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C. Hutchinson: *Planning for conservation*

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P. J. Newbould: *The cost of a good environment*

Selected later contributions

The Society's draft document:
Conservation and the environment

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Down to Earth



by Lawrence D. Hills

Rings of fertility

When every car was a carriage and pair and every lorry a dray, a ring of fertility spread round every city for the farm carts that brought in fruit and vegetables returned loaded with manure. Today the rings are growing again where far-sighted local authorities are reducing river pollution, lowering their sewage disposal costs and raising their water tables by welcome fractions by giving away free fertility in 2,700 gallon loads.

The pioneer in this field is the West Hertfordshire Main Drainage Authority which processes the sewage from 560,000 people and sends out 300,000 gallons a day of their liquid fertiliser, "Hydig", to 61 satisfied farmers mainly within a 10 mile radius. This is only a fraction of their total sewage flow of roughly 60 gallons a day for every citizen (not counting rain water which makes all figures approximate), but the balance is effluent, which has only 5 milligrams a litre biological oxygen demand (BOD).

This is one quarter of the current permitted level of 20mg/l, and 60 per cent of the sewage treatment plants in Britain do not reach this low standard, which is enough to "drown" all fish by demanding the oxygen they need. The river water is supposed to dilute it to a safe 8-10 mg/l, but if the next authority upstream is also discharging an oxygen-greedy effluent, the river dies. The West Herts effluent, and that of every local authority using the heated digestion system with equal skill, *dilutes* the rivers so they are cleaner below the outfall than above it.

Once, they lost £45 on every ton of sewage sludge they dried and sold, but this costly process has been replaced by a fleet of tankers spreading Hydig, an odourless liquid like thin tar, at the rate of 10-12,000 gallons an acre per year on grassland and stubble. It is about 3 per cent solids which average

6.7 per cent nitrogen, 4.7 per cent phosphorus and 0.15 per cent potash, and the new tankers now run a night shift to keep pace with the demand which has more than doubled in the past two years as farmers see the crops and the heavy stocking that this free fertility makes possible.

Ministry of Agriculture analysis on farms where Hydig has been used heavily for up to 15 years shows no trace of the accumulation of toxic metals which both fertiliser salesmen and NAAS officials warn that farmers risk. Modern detergents break down and the phosphates they release are merely added plant foods, while fears of antibiotics in sewage are equally unfounded. These are spent and lost among the anaerobic bacteria in the fortnight's composting at 70°F that produces the methane to drive the sewage works machinery, and destroys all viruses and disease bacteria. Hydig, like all sewage sludges, contains no organochlorines or other persistent pesticides for these are filtered out and concentrated in the body fats of the rate-payers.

Among many satisfied Hydig users is Mr John Keen of Alderbourne Farm, Iver Heath, whose land is stony, wet and steep, and used to feed 10-12 bullocks on 100 acres, but after 10 years treatment now feeds 50-60. The build-up of fertility makes it possible to sell good turf at £100 an acre every five to six years without loss to the following break-crop which is usually barley yielding 2-3 cwt more than the local chemical fertiliser-fed average.

Just how heavily land that has been generously liquid-sludged can be stocked is shown at Cottingham Farm, where 50 6-cwt bullocks went on 15 acres at Easter and enjoyed eight weeks grazing before the pasture was shut up for hay. This year another field has produced 240 tons of grass silage off 18 acres. The farm is owned by the Authority as an insurance against foot-and-mouth disease and strikes, and during the 1970 sewage workers strike, its near fields had far more Hydig than any local farmer is allowed.

There is still room inside the fertility rings round Aldershot, Bedford, East Kilbride, Leicester, Letchworth, Prestbury, Roxburgh, Stonehouse (Glos.), Swindon and Ware for more farmers, who are in some cases paying up to 55 pence a 1,000 gallons towards transporting and spreading this free fertility.

It is the only expandable source of cheap humus at low labour cost to restore Britain's clay land that has been overcropped with grain, and we as citizens should *demand* that our local authorities take on this system that saves our farms, our rivers, and our rates.

The West Herts' tankers are now on Guy concrete-mixer chassis, with very wide self-cleaning tyres and an inter-axle differential lock on the four double rear-wheels. This means that if one wheel slips it keeps the same speed instead of racing itself ever deeper into the mud, and these giant tankers can run on to pasture-land all through the winter without damaging the grass or bogging down. They have two still larger tankers, 32-tonners holding 4,400 gallons and these are economic for a 45-mile radius, providing they can discharge (in 3½ minutes) from a hard road into a pit like the many holding 60,000 gallons each owned by distant customers.

All the authorities supplying liquid sludge today, and the hundreds more we need tomorrow, are facing the same problems, answering the same questions from farmers and fighting the same prejudices, and it is important that they should link up for mutual help and better service to our country and our soil. As just one example of the advantage of co-operation, Mr S. Ferris, West Herts' distribution manager, considers that if only they could get together and standardise their tankers so these were "ready-made" rather than built singly, they would save thousands of pounds, and spare parts would be far easier.

What we need is a "Municipal Fertility Association" selling "MFA", a standard liquid sludge with a metal content well below ministry level, with publicity material and directions for farmers printed in quantity, a central information service for their problems, pooled advertising and pooled research. It should be possible for the 20 or 30 men concerned to get together and form a kind of National Farmers' Union for sewage disposal managers and engineers, to be financed out of the rates. This co-operation would save far more than it would spend, and these are the men who are more concerned with pollution than anyone else, since they have to deal with the 60 gallons a day for which *you* are personally responsible.

Ecology action

What you can do to cut down waste

Ecology action replaces student action and will be a regular column by different hands on the general theme of what the individual, whoever he or she may be, can do. There will be descriptions of group activities, suggestions for new ones, proposals for political campaigns (though generally this will be covered by the Ecopolitics column), ecological shopping guides, and suggestions for living in ways which do not conflict with ecological principles. Last month, Michael Denny described the first blow in the campaign against non-returnable bottles. This month, we give ideas on how the individual can reduce his contribution to the garbage problem.

Buy soft drinks and beer in returnable bottles and *return* them. Do not buy milk in cartons: buy it by the bottle and return it to the dairy or your milkman.

Do not buy pre-wrapped fruit and vegetables: buy them loose.

Keep food in re-usable, washable containers, not in plastic foil. Use aluminium foil sparingly, and re-use it.

If you have a garden, however small, do not throw away waste food (vegetable and fruit scraps, bits of unused fish or meat), tea leaves, coffee grounds, weeds, grass cuttings, etc. Start a compost heap, cover it with a layer of leaves or soil, turning it over every couple of weeks or so. *Don't* use a sink disposal unit: it increases the individual household load on the sewer system by 25 per cent. And don't pour grease, tea leaves or coffee grounds down the drain.

When you go shopping, make sure your purchases are put in paper bags or wrapped only when it is absolutely essential. Shops seem to use paper bags as if their lives depended on it: don't

let them do it to you. Remember it takes 17 trees to make a ton of paper. Some stores insist on wrapping goods, particularly large ones where there is a risk of shoplifting. Do not let them bully you: the cash-register slip or a receipt is proof of your innocence, and is much less wasteful. Take your custom elsewhere if necessary. Indeed, if you feel an item is already excessively packaged, present the rubbish to the assistant and explain why. Do not use carrier bags: buy a shopping bag which lasts. Re-use gift-wrapping paper, and if a present is already in a box, don't wrap it.

Never buy disposable goods. Avoid paper panties, nappies, handkerchiefs, dishcloths, napkins, plates, etc, and plastic cups. In all such cases, use the real thing—and use it again and again.

Never leave litter: if there is no rubbish bin nearby wait until you find one—or take it home.

If your local authority has a separate paper collection service, bundle your old newspapers and large cartons together. If not, pester it.

Never leave heaters on unnecessarily or lights on when you are out of the room.

Use water as sparingly as possible. Don't run the taps when you can use a basin or other container.

Some of these suggestions may seem unnecessary, futile or embarrassing. But they are worth following for three reasons:

1. They reduce pressure on public services, whether sewerage, refuse disposal, water supply, or power supply.
2. They have good propaganda value, and may make at least your friends think.
3. Ultimately our survival as harmonious communities in a stable en-

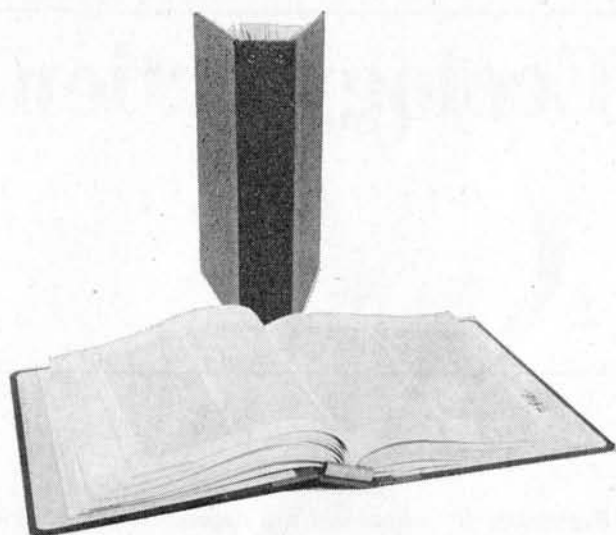
vironment will depend on a philosophy whose daily expression will be precisely such "little" things as taking care not to waste water or power and reducing waste to the minimum. The sooner we behave as we will be forced to behave by circumstances in the future, the easier the period of transition from growth to equilibrium will be.

These three arguments apply even if you are the only one in the neighbourhood behaving "environmentally", so don't be deterred. The attitude "we are few, so there's nothing we can do" is self-fulfilling. If you act as you believe, you will be there for others to join. Peaceful revolutions were never won by the faint-hearted—they merely gave way to violent revolutions by the desperate.

I hope readers will forgive these simple homilies, but from the letters we receive there seem to be a lot of people desperately anxious to "do something" but who yet regard political action as impossible and domestic action as futile. This column is designed to bludgeon people into gritting their teeth and fighting against insuperable odds for as long as it takes them to win—whether the battle be great or small.

One issue which requires persistence and action at various levels is transport. At the political level, we must campaign for increasing restrictions on the private car, more pedestrians-only zones, and subsidies and traffic priorities for public transport. At the individual level, cars should be used as sparingly as possible, and public transport should be used instead. Better still, ride a bicycle, and even better than that, whenever you have the time, walk. Best of all, make time to walk: haste is no better than waste.

Robert Allen



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THIS ISSUE (JULY/AUG): Bangladesh on Bangladesh. Raising the School Leaving Age. Schumacher on Christian Responsibility and Economic Crisis. STEPNEY WORDS Rudolph Steiner's Education, Civil Rights. Review: "The Liberation of Work." Kropotkin on Agricultural and Industrial Co-operatives. Michael Young: The Case for Neighbourhood Councils. Neighbourhood Voices (Neighbourhood News & Reports).

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Towards a unified science

Grammatical realism

The notion that thought is seriously influenced by grammar and that people who speak a different language will thereby tend to think in a different way was first clearly formulated by Benjamin Lee Whorf, whose approach to language was highly original.

He writes: "We are inclined to think of language simply as a technique of expression, and not to realise that language first of all is a classification and arrangement of the stream of sensory experience which results in a certain word order, a certain segment of the world that is easily expressible by the type of symbolic means that language employs. In other words, language does in a cruder but also in a broader and more versatile way the same thing that science does."¹

It must therefore suffice to examine the structure of a language in order to understand the generalities of a culture's world view, or general model, which it must thereby reflect. He writes, with reference to the language of the Hopi Indians: "Hopi language and culture conceals a metaphysics, such as our so-called naïve view of space and time does, or as the relativity theory does; yet it is a different metaphysics from either. In order to describe the structure of the universe according to the Hopi, it is necessary to attempt—in so far as it is possible—to make explicit this metaphysics, properly describable only in the Hopi language, by means of an approximation expressed in our own language, somewhat inadequately it is true, yet by availing ourselves of such concepts as we have worked up into relative consonance, with the system underlying the Hopi view of the universe."²

One can illustrate the basic difference between the European world view and that of the Hopi in this manner. In the European languages we

have a rigid distinction between space and time. This, however, is not the case in Hopi, which rather distinguishes between words having different duration and gives rise to a notion of space/time much more closely akin to that of present-day science.

"Our language thus gives us a bipolar division of Nature. But Nature herself is not thus polarised. If it be said that 'strike, run, turn' are verbs, because they denote temporary or short-lasting events, i.e. actions, why then is 'fists' a noun? It is also a temporary event. Why are 'lightning, spark, wave, eddy, pulsation, flame, storm, phase, cycle, spasm, noise, emotion' nouns? They are temporary events. If 'man' and 'house' are nouns because they are long-lasting and stable events, i.e. things, what then are 'keep, adhere, extend, project, continue, persist, grow, dwell' and so on doing among the verbs? If it be objected that 'possess, adhere' are verbs because they are stable relationships rather than stable precepts, why then should 'equilibrium, pressure, current, peace, group, nation, society, tribe, sister' or any kinship term be among the nouns? It will be found that an event to us means 'what our language classes as a verb' or something analogised therefrom. And it will be found that it is not possible to define 'event, thing, object, relationship' and so on, from Nature, but that to define them always involves a circuitous return to the grammatical categories of the definer's language.

"In Hopi language, 'lightning, wave, flame, meteor, puff of smoke, pulsation' are verbs—events of necessarily brief duration cannot be anything but verbs. 'Cloud' and 'storm' are the lower limit of duration for nouns. Hopi you see, actually has a classification of events (or linguistic isolates) by duration type, something strange to our modes of thought."³

Another closely associated tendency among Europeans is to regard all processes as events involving particular objects or things. A noun must be involved referring to the latter, and a verb is required to denote what in fact is happening to it. *So entrenched in us is this notion of a process that when the thing involved is not apparent we tend to postulate it.* Whorf writes:

"We are constantly reading into Nature fictional acting entities, simply because our verbs must have substantives in front of them. We have to say 'It flashed' or 'A light flashed', setting up an actor, 'It' or 'light' to perform what we call an action, 'to flash'. Yet the flashing and the light are one and the same! The Hopi language reports the flash with a simple verb, *rehpi*: 'flash (occurred)'. There is no division into subject and predicate, not even a suffix like *-t* of Latin *tona-t* 'it thunders'. Hopi can and does have verbs without subjects, a fact which may give that tongue potentialities, probably never to be developed, as a logical system for understanding some aspects of the universe."⁴

Another difference between European languages and Hopi is that in the former we find things having nothing in common such as tables, chairs, telephones on the one hand, and summer, beauty, love, on the other, all enjoying the same grammatical status of nouns. This has undoubtedly contributed towards that muddled thinking associated with the treatment of universals and abstract ideas and other forms of nominal realism. This is not the case in the Hopi language, in which "... all phase terms, like 'summer, morning' etc., are not nouns but a kind of adverb, to use the nearest SAE analogy. They are a formal part of speech by themselves, distinct from nouns, verbs, and even other Hopi 'adverbs'. Such a word is not a case form or a locative pattern,

like 'des Abends' or 'in the morning'. It contains no morpheme like one of 'in the house' or 'while morning phase is occurring'. These 'temporals' are not used as subjects or objects, or at all like nouns . . . One does not say 'It is a hot summer' or 'Summer is hot'; summer is not hot, summer is only *when* conditions are hot, *when* heat occurs. One does not say 'this summer' but 'summer now' or 'summer recently'. There is no objectification, as a region, an extent, a quantity, of the subjective duration feeling. Nothing is suggested about time except the perpetual 'getting later' of it. And so there is no basis here for a formless item answering to our 'time'.⁵

On the other hand, Hopi language emphasises the dualism that we tend to establish between the perception of data and the formulation of a hypothesis to explain them: what, in fact, can be referred to as the empiricist fallacy. Whorf writes: "Why do we not, like the Hopi, use a different way of expressing the relation of channel or sensation (seeing) to result in consciousness, as between 'I see that it is red' and 'I see that it is new'? We fuse the two quite different types of relationship into a vague sort of connection expressed by 'that', whereas the Hopi indicates that in the first case seeing presents unspecified evidence from which is drawn the inference newness. If we change the form to 'I hear that it is red' or 'I hear that it is new', we European speakers still cling to our lame 'that', but the Hopi now uses still another relater and makes no distinction between 'red' and 'new', since in either case the significant presentation to consciousness is that of a verbal report and neither a sensation *per se* nor inferential evidence."⁶

Finally, the basic variables of a general model which to many may appear *a priori*, will also vary with different languages. Thus Whorf writes: "Concepts of 'time' and 'matter' are not given in substantially the same form by experience to all men but depend upon the nature of the language or languages through the use of which they have been developed. They do not depend so much upon *any one system* (e.g. tense, or nouns) within the grammar as upon the ways of analysing and reporting experience which have become fixed in the language as integrated 'fashions of speaking', and which cut across the typical gram-

matical classifications, so that such a 'fashion' may include lexical, morphological, syntactic, and otherwise systematically diverse means co-ordinated in a certain frame of consistency."⁷

From these considerations it must follow that, in Whorf's words: "We are . . . introduced to a new principle of relativity, which holds that all observers are not led by the same physical evidence to the same picture of the universe, unless their linguistic backgrounds are similar, or can in some way be calibrated."⁸

The relevance of the Whorf thesis to the development of Western philosophy is infinitely greater than might at first be thought. Thus Ogden and Richards point to the influence of Greek grammar on the work of Aristotle: ". . . the categories and similar distinctions, which play a large part in Aristotle's system, cannot be studied apart from the peculiarities of the Greek language." In general, the Hellenes attached a great deal of importance to the study of grammar. They never attempted to study it cross-culturally, and thereby establish the relativity of grammatical systems. Consequently, as Potter writes: "They were all too prone to assume that the structure of their own language embodied the universal shape of human thought on a background of cosmic order."⁹

According to Stuart Chase: "The Greeks took it for granted that back of language was universal, uncontaminated essence of reason, shared by all men, at least by all thinkers. Words, they believed, were but the medium in which this deeper effulgence found expression. It followed that a line of thought expressed in any language could be translated without loss of meaning into any other language."¹⁰ The Romans appear to have inherited this concept and Latin grammars such as Priscian's exerted a considerable influence on medieval scholars such as Antoine Arnaud, who compiled a "*grammaire général et raisonnée*": "... in the assured belief that the Latin tongue embodied in itself canons of logic which were universally valid, and that Latin grammar was grammar 'proper'. Such views prevailed well into the nineteenth century, and they are by no means without adherents even today."¹¹

This is particularly the case with language in cultures where there is a

strong preoccupation with outward forms, such as syntax. Voltaire is supposed to have said that French is the most logical language. This expresses a deep rooted sentiment current in all lettered Frenchmen. So much attention is paid during the course of a Frenchman's concentrated education to mastering the intricacies of French syntax that the laws found to apply to this closed system are implicitly assumed to apply to the very different world which it purports to represent.

The English have been particularly fortunate in that, for 400 years, the educated classes spoke mainly French, and consequently the highly complex syntactical structure of Anglo-Saxon was slowly abandoned in favour of a much-simplified derivative. In recent times, the English language has been subjected to further simplification in America. As a result, preoccupation with form has yielded to a preoccupation with content, and the tendency to mistake the laws governing our language for those governing our biosphere has correspondingly diminished.

Nevertheless, it would be a gross illusion to suppose that this tendency did not influence the course of English and American thought, nor indeed that it is not continuing to do so at the present time. *Edward Goldsmith*

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- ¹¹ Potter, *op cit*, p. 145.

The Ecologist Readership Survey

We regret that we were much too optimistic when we promised the results of the survey for this issue. We have yet to complete analysis, but will publish them as soon as possible.

1-7 September—International Air Pollution Control and Noise Abatement exhibition, Jönköping, Sweden. Details from Elmia AB, Box 6066, 550 06 Jönköping 6, Sweden.

12-13 October—Water Pollution Research Autumn Lectures on "The design of sampling programmes", "Sludge treatment and filtration", "Population dynamics in the activated-sludge process" and "Fisheries and pollution". Cost: £18 including course papers and lunches. Apply to The Director, Water Pollution Research Laboratory, Elder Way, Stevenage, Herts. SG1 1TH.

2-4 December—International Symposium on Energy, Man and the Environment, Zurich, Switzerland. Details from Gottlieb Duttweiler Institute for Economic and Social Studies, The Green Meadow Foundation, CH-8803 Rüschlikon, Zurich, Switzerland.

The article "Mining in Snowdonia" in our June issue is based upon portions of a major book entitled *Eryri, the Mountains of Longing*, to be published this October by McCall

This month we start a new service for our readers to enable you to obtain further reading material on the articles that appear in *The Ecologist*. This month's selection contains books that are introductory or standard texts on the environmental crisis facing us, but future issues will contain new books and books relating to articles in that issue.

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in New York and by Allen and Unwin in London. This book will be the fifth title, and the first British title, in the Friends of the Earth series "The Earth's Wild Places." Its text will include a far more complete and detailed survey of the Snowdonia National Park than Friends of the Earth could compress into one article. We regret that a paragraph crediting the article as an adaptation of part of the book was inadvertently omitted in printing.

We should also like to correct the caption of the first picture in this article, which should read *Llyn Mymbyr Uchaf* (not *Uyn Mymbyr Uchuf!*). The last picture is not of Cader Idris, but is near Cader Idris.

Social disorganisation and its causes by Edward Goldsmith. We regret that the references were omitted from this article last month, and we therefore include them below:

BANFIELD, EDWARD C. 1958. *The Moral Basis of a Backward Society*. New York: The Free Press.

CHELHOD, G. 1958. *Introduction à la Sociologie de L'Islam*. Paris: Bessou.

DURKHEIM, EMILE. 1958. *Professional Ethics and Civil Morals*. London: Collier/Macmillan, Glencoe Free Press.

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African Political systems. Oxford: OUP.

HSU, FRANCIS L. K. 1942. *Under the Ancestor's Shadow*. London: Kegan Paul.

KORNHAUSER, WILLIAM. 1960. *The Politics of Mass Society*. London: Kegan Paul.

LEWIS, OSCAR. 1966. The culture of poverty. In *Scientific American*, 215.

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London: Routledge & Kegan Paul.

MAIR, LUCY. 1962. *Primitive Government*. Harmondsworth: Penguin Books.

MANGIN, WILLIAM. 1967. Squatter settlements. In *Scientific American*, 217 (4).

SARGENT, WILLIAM. 1967. *Battle for the Mind*. London: Heinemann.

WHYTE, WILLIAM FOOTE. 1943. *Street Corner Society*. Chicago: Chicago Press.

Jay W. Forrester is Professor of Management at the Massachusetts Institute of Technology. His latest book, *World Dynamics*, has just been published.

J. P. Scott is Regent's Professor in Psychology and Director of the Center for Research on Social Behavior, Bowling Green State University, Ohio.

L. B. Powell is a free-lance journalist, specialising in agriculture.

F. W. Service is Principal Scientific Officer at the Nature Conservancy's Monks Wood Experimental Station. He is currently working on biting insects.

Next month's *Ecologist* brings you Tibetans in Wales by Michael Allaby, The Costs of Pollution by Edward Goldsmith, and Ruth Harrison on modern farming methods. Also included are reports on Germany's attempts to protect the environment, and on the East-West politics of pollution; plus stopping motorways, saving turtles, and the second part of Jay Forrester's Alternatives to Catastrophe.

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EAST CROYDON, SURREY

Feedback

Sweden bans 2, 4-D and 2, 4, 5-T

The Swedish Poisons and Pesticides Board has decided to seriously restrict the use of the herbicides 2, 4-D and 2, 4, 5-T. They may no longer be used for spraying from aircraft or for spraying in or near water. Manual application is still allowed. The decision was not unanimous.

The Board based its decision on special studies made by experts on ecology, toxicology and genetics. The main conclusions of these studies are:

"The acute toxicity of the substances seems to be fairly low. They do not seem to undergo any metabolic breakdown and are excreted fairly rapidly and completely. Accumulation has only been shown in a few lower, aquatic organisms. This and other evidence indicates that the risk of poisoning from these substances is low.

"The evidence concerning the teratogenic, carcinogenic and genetic risks of the substances is conflicting and extremely difficult to base any decision on. The question is further complicated by the fact that 2, 4, 5-T is often contaminated by extremely toxic and dangerous chemicals. These are dioxins and seem to be among the most toxic substances known. Some of the reported effects of the defoliants may be caused by these impurities.

"Effects on game of the diminished supply of food due to eradication of deciduous trees and bushes is known to occur. The risk of an increase in insect numbers in the bark of trees is considered great, since the trees killed by defoliation are left and these are infested by numerous insects.

"Changes in vegetation may cause not only short-term disruption but more serious long-term changes. Most of the known or suspected ecological effects are unwanted and should be avoidable if the use of the herbicides

is restricted and the applications controlled.

"Discussions on the danger of 2, 4-D and 2, 4, 5-T have centred round these substances and their derivatives and to some extent the impurities in 2, 4, 5-T. However, the effects of some of the solvents used and other substances added may be more harmful. The possibility of synergistic effects has not been investigated. Some of the substances used in the preparations are known to form strongly carcinogenic compounds with nitrites."

Environmental Planning in Sweden, May 1971

Out of the frying pan?

Some 2,000 factories are to be evicted from Tokyo and resited on reclaimed land on the edge of Tokyo Bay. The removals are part of a £2,315 million 10-year plan to protect the citizens of Tokyo from air and water pollution. Unfortunately, the Bay is already highly polluted and is unlikely to benefit from the moves.

Guardian, 31.5.71

Cutting boosts nitrate loss

Six watersheds in a New Hampshire forest are being studied in an attempt to understand the effects of different forestry practices on them. In one of the watersheds, all the trees were cut and removed, with the result that water runoff increased by 40 per cent. In addition, nitrate runoff increased by 50 times to as high as 90 ppm. According to Dr Gene E. Likens of Cornell University, who is carrying out the study with Dr F. Herbert Bormann of Yale, it will take 100 years to replace the nitrogen lost in 3 years.

Science News, 99 (16)

Dirty work at Avonmouth

Air pollution from the Avonmouth industrial estate, near Bristol, is so bad that Dr Robert Hansen, medical officer of health for mid-Gloucestershire, has recommended that a plan to build houses in the area be abandoned until a full investigation has been made. Inspectors from the Department of the Environment are studying reports and the Department's Air Pollution Laboratory is making tests. Two firms, ICI and RTZ, have monitoring stations on nearby farms, but apparently they are not revealing their findings to the farmers.

Not surprisingly the farmers are angry. Mr Richard Slaughter, who runs the Manor Farm Stud at Easter Compton, three miles from the estate, reports that his newly-born foals have gone unaccountably lame:

"After two to three months—just when they started to eat grass for the first time—their joints began to swell and eventually they could barely walk and then only stiff-leggedly.

"As soon as I sent them away to another farm, eight miles away, they began to get better and are now quite normal. I am convinced there is some kind of metal pollution on the grass."

Sunday Telegraph, 30.5.71

Chromium deficiency and diabetes

Foods made with white flour and white sugar could be a cause of diabetes in middle age, suggests Dr Walter Mertz of the US Food and Drug Administration's vitamin and mineral division. When flour and sugar are refined, from 40 (flour) to 93 (sugar) per cent of the chromium is lost. Chromium is a key component of insulin, the hormone which regulates

the body's use of glucose, and diabetes is a result of inadequate insulin. Dr Mertz is to test his theory on 50 diabetes-prone patients, who will be given trace amounts of chromium in their food. If they show an improvement a further 1,000 patients will be added to the study.

Rodale's Health Bulletin, 9 (10)

6 Selenium in plankton

Concentrations of selenium, a trace element more toxic to man than mercury, have been found in zooplankton in Lake Michigan ranging from 0.1 ppm to 1.2 ppm. The concentrations were discovered by Dr Richard A. Copeland of the Environmental Research Group, Ann Arbor, downwind from Chicago, which suggests that selenium enters the lake after being released with emissions from the burning of fossil fuels. The body needs traces of selenium, but the difference between the traces needed and the levels at which it is toxic is so slight that it could quickly become a health hazard. Dr Copeland was unable to say whether the selenium in the plankton had been accumulated by fish.

Marine Pollution Bulletin, 2 (5)

7 Circulatory diseases cause most deaths

Circulatory diseases are still the biggest cause of death in England and Wales, followed by cancer and respiratory diseases. Circulatory diseases (principally ischaemic heart disease, but excluding cerebrovascular disease), accounted for 214,029 deaths (37 per cent) in 1969; cancer for 114,704 deaths (20 per cent); respiratory diseases for 86,156 deaths (15 per cent); and cerebrovascular disease for 79,728 deaths (14 per cent).

Pneumonia caused 41,081 deaths, the highest number for 40 years; chronic bronchitis caused 29,881 deaths, the highest since 1963 (though the number of men dying from it—22,824—is the highest for more than 30 years); while lung cancer and breast cancer continue to rise: the former by 792 to 24,695 deaths, the latter by 418 to 2,417 deaths.

Registrar General's Statistical Review of England and Wales for 1969, Medical Tables.

8 Reprieve for New Forest

The Ancient and Ornamental Woodlands of the New Forest are to be protected from the predations of the Forestry Commission. Mr James Prior, Minister of Agriculture, has announced that the Commission will end its policy of replacing hardwoods with conifers. However, areas where this has already occurred will not be returned to hardwoods.

Guardian, 3.5.71

9 North Sea endangered

The British firm, John Hudson Ltd., has commissioned a £500,000 waste ship which can dump waste into the North Sea at the rate of 1,500 tons in five minutes. The company plans to dump about 400,000 tons of industrial effluent a year. It hopes to pick up waste from companies in France, Belgium, Holland and Germany, as well as Britain. "In May," says chief engineer David Durston, "a ban on all dumping in the Rhine comes into effect. We really hope to pick up some lucrative business then." The wastes will be dumped in the outer Thames estuary and elsewhere in the North Sea off the coast of the Continent.

Mr John Belcher, the chief executive of John Hudson's waste disposal division, has stated: "We shall not dump anything that will damage the marine environment, in the short or long term. We have put a lot of money into this operation and I cannot emphasise too much that we want it controlled. Indeed, we hope the practice we've laid down will become part of an accepted code of practice."

Customers must give a full description of the manufacturing process and effluent, and provide a sample for analysis by Hudson's consultant chemist, Bostock, Hill and Rigby of Birmingham. The results of this analysis will be sent to the Fisheries Laboratory of the Ministry of Agriculture, Fisheries and Food at Burnham on Crouch, Essex, which will say whether the effluent can be dumped. The consultants will also advise on the composition of each dumping run so that substances which might react with each other are not dumped together. However, neither

John Hudson nor the Fisheries Laboratory will know for sure what is being dumped. As Dr J. E. Portman of the Laboratory said, "we can't check every road tanker load. There is a risk that one load may not be the same as another".

The enterprise has not been greeted without criticism. Dr Kurt Grasshoff, Professor of Marine Chemistry at Kiel University, has said: "Personally I would not dare to decide whether such dumping of a complex mixture of chemicals will do no harm and will not have short or long-term influence on the vulnerable marine ecosystem."

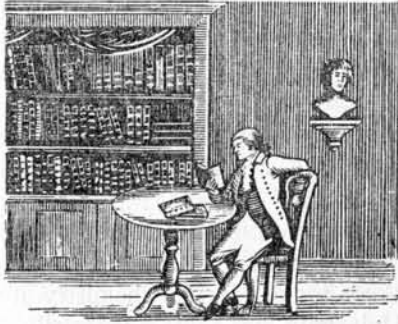
Dr Karsten Palmork, of the Institute of Marine Research in Bergen, feels that even very diluted effluents could have "disastrous effects on the survival of marine life".(1)

The Norwegians are particularly concerned at dumping in the North Sea and want it entirely banned. They argue that the chemical balance of the water is so delicate that the slightest change could partially destroy the senses of fish. Dr Soeren Jensen, head of the analytical laboratory of the Swedish Conservation Board, finds the British assertion that the dumping will do no harm "incredible".(2)

Norway, Sweden, Finland, Denmark and Iceland have agreed to prohibit the disposal of industrial and chemical wastes in international waters by 1 January 1972.(3) Already one Norwegian firm, Norsk Hydro, has closed a plant supplying raw material for PVC production. It had been polluting Oslo fjord, and, the firm claims, it could not bear the additional costs of installing a treatment plant. Most of the 250 workers there are to be given new jobs.(4)

In Holland, the Government has disclosed that the Rhine countries have been dumping increasing quantities of chemicals in the North Sea. In 1968, 135,000 tons of waste acids and 4,100 tons of alkali were dumped. By 1970, this had risen to 490,000 and 23,500 tons respectively.(5) Small wonder the Natural Environment Research Council has described the state of Britain's coastal waters as "precarious".(6)

(1) *Observer*, 18.4.71; (2) *Guardian*, 17.4.71; (3) *Daily Telegraph*, 22.4.71; (4) *Guardian*, 30.4.71; (5) *Daily Telegraph*, 21.4.71; (6) *The Times*, 2.4.71



Ecological discipline

DISCIPLINE OF PEACE, vol. 2 of "Classics of Human Ecology". By K. E. Barlow, Charles Knight & Co. Ltd. £2.25. ENVIRONMENT, an Alphabetical Handbook, by Peter Gresswell, John Murray, £3.75. HONEST ECOLOGY by Mary French. Published privately and obtainable from the author at The Chantry, St Ive, Liskeard, Cornwall. 20p.

If man is to build a lasting peace, his society must base itself on relationships between men, society and the environment that approximate more closely than they have in the past to the relationships found in natural systems. Purely economic criteria must be modified in the light of the ecological price of economic activity. We must beware, too, of concluding that we need a remedy—"that ways of producing more food will cope with the multiplication of men; that sewage treatment will cope with the fertility of the soil; that 'the pill' will put paid to the increase of men; that the Minister will stop the environment being polluted. The situation is not of this kind. Such remedies could conceivably defer the problem for a generation or so but it would then recur in aggravated condition. The problem is of quite another kind. The problem is nothing less than to reach a new understanding of the state of man. Man is in relation to, and ought to be in balance with, other forms of life because his survival depends on these as much as upon what he himself sees fit to do."

Dr Barlow wrote his book in 1942. He was thinking ahead, past the ending of Hitler's war, to the possibility of building a stable peace beyond it. It was war-time, most people were subject to, or at least familiar with, military codes of behaviour. It was natural that he should speak of "the discipline of peace"—in any case, the word

"ecology" was little known. He attempts to place man in an ecological context. He examines this context in some detail, arguing closely from one point to the next until he has constructed a picture of man so woven into the fabric of the natural environment of which he is a part that it is quite impossible to consider his behaviour in isolation from its ecological effects.

In his preface, Robert Waller, who is editor of the "Classics in Human Ecology" series, explains that the aim is to re-issue books that may have received too little attention because they were ahead of their time. I do not know what attention Dr Barlow's book received, but it is topical today, and that in a field that is developing fast. It is only by the occasional reference to rather specialised scientific work—particularly in biochemistry—that I was able to detect that the book was not written yesterday, and these points in no way detract from the argument. For this alone it is remarkable.

It is remarkable for more than that, though. The elegance of the argument makes it a delight to read, while Dr Barlow's obvious commitment to what we might call an "ecological outlook" makes his book impressive and convincing. My only doubt was about the book's price, which I felt was high for a book that deserves wide distribution.

The Discipline of Peace deserves to be called a classic of human ecology and Charles Knight and Co. are to be congratulated on republishing it.

Over the last year or two most of the environmental shouting has been done by the rural conservationists. This may have produced a certain imbalance in the movement to halt environmental degradation. After all, nine out of ten of us live in an urban area. Thus a book that relates the two but which is most convincing when it deals with planning is to be welcomed.

Peter Gresswell presents his informa-

tion—and he has a great deal—in the form of an encyclopaedia. This has advantages. The information is made easily available and by listing after each entry the relevant legislation, the most important books and papers and the organisations, both voluntary and statutory, that the individual may approach for guidance, the format justifies itself. It is far neater than even the best index, which has to be separated from the bibliography, notes and appendices. There are drawbacks, though. How, for example, do you say that it is often the details that make or mar a built environment? Mr Gresswell does it by including an entry for "Details" and at this point the whole thing begins to look a trifle gimmicky.

Peter Gresswell is a chartered surveyor and so planning, building and civil engineering are his province. He is rather less confident when he writes of the natural environment and he devotes much less space to it. To my mind this is not important: his lists of books and information sources is more than adequate. It is his summaries of the built environment and what has happened and is happening to it that are important. He marks items that have an entry to themselves each time they turn up under another heading. I found this cross-indexing useful.

Most of the writers on environmental topics are scientists or people, like Mr Gresswell, who work within what they regard as a scientific discipline. They believe they are impartial and at times I wonder whether someone should tell them that they are emotionally involved with "a cause". There is nothing wrong with emotion, of course. Perhaps man's future would be rosier if more of those devoted to improving it allowed themselves an occasional emotional outburst at the grosser of our follies. Mary French is emotional and makes no apologies for it. Nor should she. She has spent much of

her life watching the decay of small rural communities and now she writes with force about "honest ecological thinking, most essential now that we humans have the power to wreck the living world and in some areas are already beginning to do so". This thinking, she claims, is unlikely to come from scientists—in public at any rate; which is my point exactly, although I believe we may have to exclude certain American scientists who are highly emotional in public. Mrs French's point is that if solutions are to be applied, then ordinary people, young people, parents, housewives, must learn the facts and face them. Only then can they prepare themselves for the changes in their way of life that may be necessary. She suggests an "eco-political" party which "would have to persuade parents to control their fertility and all of us to reduce our claims upon the world's resources". "Is such a party possible?" she asks, "Are we honest enough and courageous enough to appreciate the necessity for drastic evolutionary redirection?" That's fighting talk! In the end, man must "accept the discipline of the science of home". She uses the word "discipline" in the same way as Dr Barlow. Neither, I think, imagines draconian legislation. Their "discipline" is the willing acceptance of our responsibility towards the planet and the life forms with which we share it. Yes, that is emotional, and a good thing too!

Michael Allaby

Pesticides in the environment

AN ECOLOGIST VIEWS THE ENVIRONMENT by Donald A. Spencer, National Agricultural Chemical Association.

Dr Spencer has 40 years of practice as a biologist with the last five as Chief Staff Officer of Animal Biology in the Pesticide Regulation Division of the Agricultural Research Service. He holds membership in the Wildlife Society, American Society of Mammalogists, British Ecological Society, International Association for Great Lake Research, and the American Association for Advancement of Science. Quite an authority, until one reads what he has to say in the publication.

He says, "environmental benefits are derived from the use of pesticides". He then steps back a little to claim that

pesticides are only a small segment of the pollution problem and that the problems are what he calls "control-able". Since when has it been possible to control a freely available poison, distributed on a worldwide scale and capable of giving farmers an extra short-term profit?

He says many sectors of our environment are better now than 40 years ago, quoting the river Thames as a typical example. And he is correct. There are a very few isolated examples available for biased quotation, but can an ecologist seriously balance the current weight of rescue against the current weight of deterioration.

He then says that the level of DDT in sea water is only one thousandth that likely to produce damage to plankton. He does not mention local concentration, or the uncertainty of long term influence even when concentrations are very low, or the contribution of DDT to the general damage when mixed with all the other chemicals washed down into coastal waters.

The next loaded statement is that man is a good husbandman and looks after his topsoil. Some men are, but devotion to preservation soon becomes lost in the effort to produce heavier yield in shorter time. Dr Spencer should ask FAO about erosion, including that arising from the over-enthusiastic use of chemicals.

One of his classic comments is that "Emotion is a pollutant we cannot live with". My own version is that if we do not get emotional about pollution we will allow short-term profit motives to destroy common sense. We have to become emotional when publications


imply that there is no problem, however obvious it is.

There is a statement in the publication that insecticides strongly resist movement when incorporated in soils and do not pass into lower water levels. Then follows a long list of selected statements which appear to indicate low contamination of water. Alternatively translated, these selected statements indicate nearly two thirds of the tested samples contained insecticide and would therefore provide a lack of balance in the environment.

The publication also questions that significant quantities of agricultural chemicals reach the sea, including a long account of a study of oysters and DDT accumulation. Do we have to wait for all shellfish to become poisonous before we worry about existing conclusive evidence?

The rest of the publication is a straightforward uninhibited claim that birds and fish are not, as was thought, seriously damaged by insecticides. Such a claim is too ridiculous for comment. As a so-called ecologist Dr Spencer should appreciate that the evidenced damage to birds and fish is the hard core of the problem. Pesticides is only one part of this problem but it is a significant part. There is no doubt we must have pesticides until we can use better methods of control, but I think we must accept that they are poisons to be progressively eliminated before we upset the environment beyond recovery. Publications which appear to prove that pesticides bring benefit should at least indicate that they are strictly the opinion of the author and his financial backer.

Allen Jones



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Letters

Viper conservation

Sir,

We are not surprised to learn of Robert White-Stevens' defence of DDT (Vol. 1, No. 12, p. 26). What we should like to know is what this gentleman is doing at the Bureau of Conservation and Environment of Rutgers University.

Robert White-Stevens, "American Cyanamid's all-purpose spokesman"—to quote Frank Graham Jr. (*Since Silent Spring*)—was one of the most active participants in the campaign to discredit Rachel Carson and extol the virtues of pesticides following publication of her book. Graham also tells us that "White-Stevens was one of the first to counter the evidence of bird mortality in pesticide programmes" by dubious means. He was brought to England last year by Cyanamid to take part in the notorious "symposium" whose aim was to discredit the Report of the Swann Committee on Antibiotics, the invitations to which were so designed as to give the impression they had been sent out by the Royal Society of Medicine.

Rutgers University might well be advised to have another look at the viper it appears to be nurturing in its bosom.

Yours sincerely,

J. Bower,
Hon. Secretary,
The Farm and Food Society,
37 Tanza Road, London, NW3.

V/STOL menace

Sir,

May I advise caution before accepting the claims of V/STOL protagonists as a solution to our noise problems? (see Vol. 1, No. 10, p. 3).

Vertical take-off and landing air-

craft are unlikely to be commercially practicable on a large scale for some time. But STOL aircraft, needing shorter runways, could be operating before 1980 in a very big way, and the prospect is highly dismaying.

What the advocates of STOL aircraft do not tell us is that they will make more noise on landing than conventional jets—their landing flight pattern is the same, but their more powerful jets are likely to emit more noise. On take off they will be noisier than conventional jets on the runway and perhaps within three miles of their climb from the airport. Thereafter, because of their steeper rate of climb STOL aircraft may be less of a noise nuisance. The difference is nothing to enthuse over.

A powerful lobby was reported some months back as asking Government for a grant of £250 million in order to develop V/STOL aircraft. All plans are to extend civil aviation throughout the UK. Envisaged are more airports serving major towns and cities not presently blessed with such facilities, these STOL services acting as feeder lines to intercontinental air routes.

To one living near Heathrow Airport the idea of a vast increase in overflying of this country, with STOL aircraft leaping up from many more airports, is unattractive. And this country cannot afford to take more valuable land and clothe it in the concrete of a modern airport and the motorways all airports seem to demand.

It's a problem, but STOL aircraft are no answer—in fact I believe them to be the biggest menaces since the introduction of civilian jets.

Yours sincerely,

Gordon Landsborough,
46 Ormond Avenue, Hampton,
Middlesex.

Biocontrol

Sir,

Trevor Booth (Vol. 1, No. 12, p. 40) implies that growers would be most reluctant to deliberately introduce red spider mite (*Tetranychus urticae*) on to their crop at regular intervals in order to maintain the predatory mite *Phytoseiulus riegeli* (*Persimilis*).

This is not the case. Work at the Glasshouse Crops Research Institute at Littlehampton demonstrated the feasibility of controlling red spider mite on cucumbers by the use of the predaceous mite some years ago, and the then National Agricultural Advisory Service (now the Agricultural Development and Advisory Service) took up this work with the GCRI and showed that control of red spider mite could be obtained on commercial holdings. The system involves introducing the pest (red spider mite) at 10-12 mites per plant 10 days after planting out. When the red spider mite feeding areas are apparent, the predator is introduced at two per alternate plant. If all goes well, a balance is struck which may last the whole season, but it is possible for the predator to eat itself out of a job (it has no built-in limitation mechanism). If this happens it dies out, red spider returns through the glasshouse ventilators or doors or on clothing, and the process must be repeated.

The advantages of this method of control are:

1. It is environmentally more acceptable than toxic chemicals.
2. It saves the grower both materials and labour.
3. It controls red spider mites resistant to chemicals.

The advisory service has been keen to foster this approach amongst growers, and the fact that out of some 180 acres of cucumbers in the Lea

Valley about one-third is treated in this manner, is a measure of its success. (Almost half the country's home-grown cucumbers are produced in the Lea Valley. Similar methods are being employed to control white fly, the other main pest of cucumbers.)

Yours sincerely,

J. S. Butter,
County Horticultural Adviser,
Herts-Essex Glasshouse Advisory Unit,
Agriculture Development and
Advisory Service,
Crown Court, Pegs Lane, Hertford.

Return of the Airship

Sir,

Your journal has played a part in the revival of interest in the airship as a transport medium of real commercial potential, with an attractive lack of severe effects on the environment as regards noise, energy consumption and use of ground space. (See Vol. 1, No. 4, p. 24).

As a result of this revival, the Airship Association has been established as a forum for the discussion of airship affairs and as a focus for interest in the airship. The provisional committee, set up after a meeting at the House of Commons, includes enthusiasts, potential users and owners, engineers and journalists, as well as Members of Parliament. Soon, it is hoped that a series of meetings and other activities will begin.

The committee hopes to hear from people who are interested in the airship and its development and would appreciate the courtesy of your columns to invite enquiries addressed to any member of the committee or to the Chairman, C. S. Dawson, 20 Myddleton Gardens, Winchmore Hill, London, N21.

Yours sincerely,

G. M. Beresford Hartwell,
Airship Association,
65 Beddington Gardens, Wallington,
Surrey.

Sand and gravel

Sir,

Lawrence Hills' article on gravel extraction (Vol. 1, No. 9, p. 24) recognises the national importance of sand and gravel supplies but is in effect a challenge to the exercise of planning control. On this aspect some of his

comments on the statutory provisions are open to question.

Almost the whole of the Town and Country Planning Act 1947 was repealed nine years ago when its provisions were consolidated in the 1962 Act; this in turn has been amended by the Act of 1968. The Acts have never limited permission to a 10 year period, nor do they impose any general obligation to restore to agriculture. Requirements for after-treatment are imposed by conditions attached to planning permissions. The conditions reflect planning policy for the area which may include a variety of uses for worked-out pits.

Mr Hills states that once a pit has planning permission it stays open permanently. In most cases, however, when the gravel is exhausted the pit will be restored or landscaped in accordance with requirements legally imposed on the operator. When the permitted development has been carried out, the operator has no right under the Planning Acts to extend his workings outside the permitted area or to initiate a different use of the land. For further development a fresh application for permission is needed. So far as the Acts are concerned the local planning authority may, if they wish, prevent the introduction of other development, or the use of plant in a worked-out pit for the processing of gravel imported from other sources.

When permission is given for gravel extraction conditions may be attached not only to control after-treatment, including types of filling material, but also to regulate the times of working and other activities associated with the operation of the pit. Working near dwellings may also be prevented; the distance is a matter for the authority's discretion and no limit is prescribed for this purpose. I should add that applications for permission are not made by the Sand and Gravel Association. They are made direct by operators to the appropriate local planning authority, and the operators are responsible for discussions with the authority and for complying with the terms of any permission granted.

Yours sincerely,

J. G. Orr,
Director,
Sand and Gravel Association of Great Britain,
48 Park Street, London, W1Y 4HE.

First hons ecologists?

Sir,

You may be interested to know that 10 applied biology students at Hatfield Polytechnic took their final exams in ecology recently. As far as I know we will be the first students to have honours degrees in ecology. Further information can be obtained from Mr D. Brookes, Dept. of Biology, The Hatfield Polytechnic, Hatfield, Herts.

Yours sincerely,

Richard J. C. Barron,
Boscarn, Port Isaac, Cornwall.

Writing to MPs

Sir,

I write to commend Lawrence Hills' excellent article on "Democracy and Pollution" (Vol. 1, No. 10, p. 26), and would suggest that all who failed to read it should make good their omission.

As a one-time MP, and as I hope soon to be, prospective candidate, I fully endorse all that he writes on the "mechanics" of pressurising individual MPs. This should be done by individual letters which, as he says, carry weight far out of proportion to the effort of writing them; or, alternatively, through visiting the MP at his monthly surgery.

The fact that the media give greater coverage to environmental issues than before, should not lead your readers into thinking that the average MP is conscious of the issues involved. Unfortunately, many are indifferent to the point of philistinism. This attitude is vividly portrayed by the comment that "if it meant giving men jobs, I would sink a mine on the side of Helvellyn". This was said to me by one of my Labour colleagues when I was urging him to vote against the Cleveland Valley Water Bill. The loss of the botanically unique Cow Green meant nothing to him, nor, I suspect, to the vast majority of his constituents. Thus, by voting for the Bill he would have incurred little political penalty.

But then, as Mr Hills notes, the fear of losing votes and office is the ultimate deterrent which will make individual politicians and councillors listen. At the moment few politicians feel that environmental issues lead to

the casting or withholding of votes, so that conservationists must assume an overtly political role and make this fear work for them.

I hope *The Ecologist* will continue to point to how this can be done and urge upon its readers the need for concerted action. I suspect that had you alerted your readers to Sidney Chapman's excellent Urban and Rural Environment Bill, some hundreds might have been induced to write to the Ministry and you might then not have reported that the Bill had been "talked out".

Yours sincerely,

Peter M. Jackson.

Dept. of Economics and Commerce,
The University, Hull, HU6 7RX.

consider how many positive advantages to mankind have resulted from our development from the hunter-gatherer state. Do not be misled by peripheral or "material" benefits and do not be fooled by benefits accruing from technological achievements either solving or alleviating problems caused by technology. Beware also of the trap in thinking that "civilised" behaviour is our prerogative, or that primitive peoples are incapable of such niceties as mercy and compassion.

Have a good think. I look forward to seeing how many benefits can be spotted. I can't see any!

Yours sincerely,

E. R. Sones.

28 Tye End, Stevenage, Herts.

This must be so because a primitive people is, almost by definition, a people whose way of life has been unchanged for a long time.

By contrast, we do not know whether our civilised ways of living are indefinitely viable. They may well be part of a cycle leading inevitably to collapse; your columns provide plenty of evidence that this may be so.

Populations at the density levels of civilised countries are not likely to achieve stability by the same kinds of physical means as small primitive societies living on relatively large land areas, but we may have real lessons to learn from them about how people can achieve satisfying lives without the belief in continually rising "standards of living" which plays so great a part in our society.

Yours sincerely,

R. Cattran,

127 Cassiobury Park Avenue,
Watford, Herts. WD1 7LH.

See *The Ecologist* Vol. 1, No. 1, p. 41 and No. 2, p. 42 for brief discussions of hunter-gatherer equilibrium. This will be treated in greater detail in later issues.—Ed.

Progress? What progress?

Sir,

A point often stressed is that while technology, civilisation and the pursuit of progress (so-called) have raised "some" difficulties there have been undoubted benefits. A useful mental exercise for your readers would be to

Primitive stability

Sir,

The articles on primitive peoples in your June issue (Vol. 1, No. 12, pp. 22 and 24) were interesting but omitted to mention what is possibly the most compelling reason for studying them: that their societies, unlike any others in the modern world, are internally stable.

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