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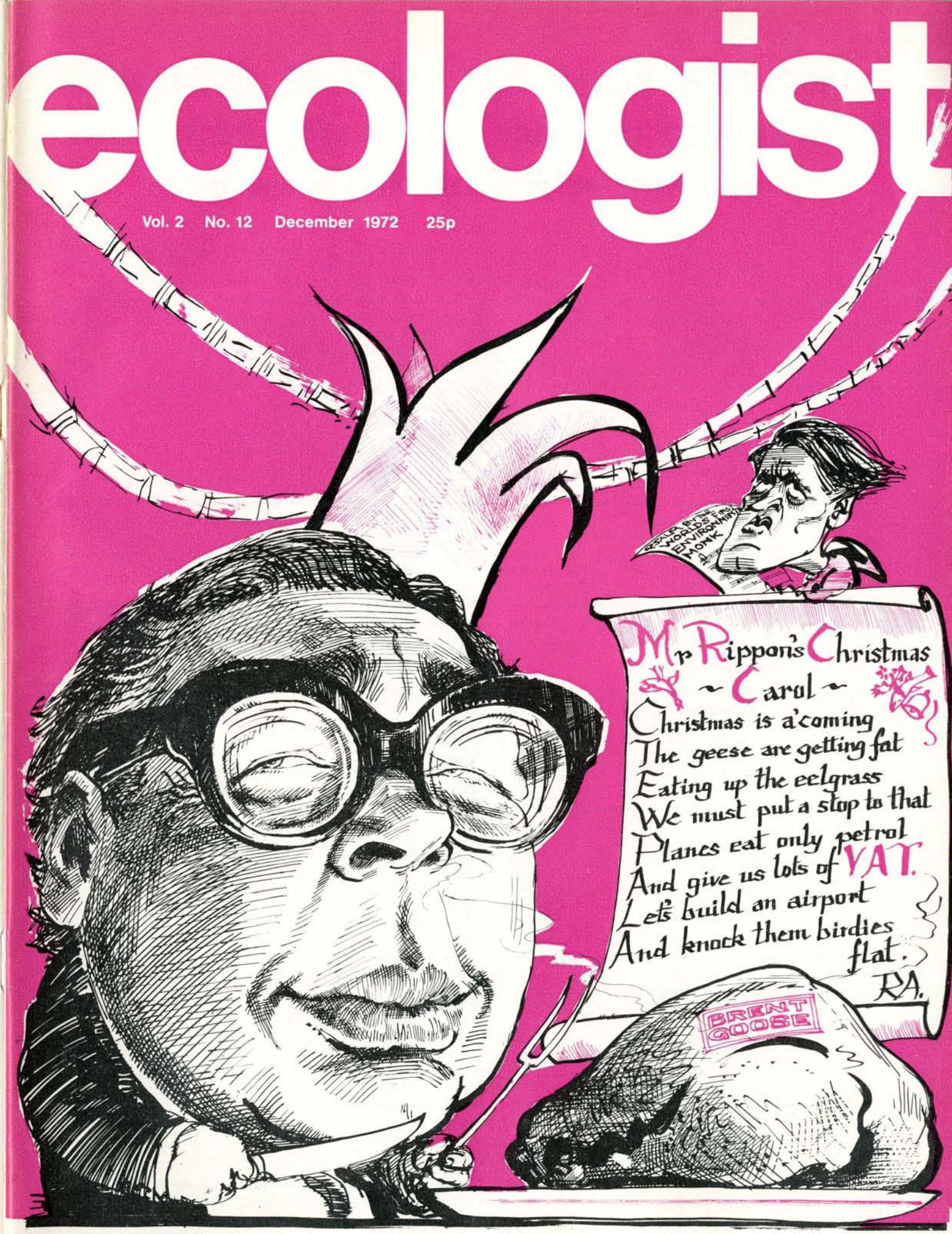

A model of behaviour by Edward Goldsmith

Low energy housing by Andrew MacKillop

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"They must be trying to create some sort of sanctuary for lame ducks."

Editorial

Robert Allen

Down with environmentalism

The festive season is upon us, peace on earth, good will to all men, and time for some terminological reform.

To begin with we must repudiate the term "environmental". It is too far gone to be rescued, now that the Department of the Environment has described the proposed airport at Foulness as "the world's first environmental airport". An airport which will considerably reduce the world population of the Brent Goose (*Branta bernicla*) and bring destruction on much of the Essex countryside can be described as environmental only by those who regard that adjective as synonymous for odious, squalid, and Natural (as in *Nature*). Sadly, the DoE has been joined by such august environmental bodies as the CPRE and the Noise Abatement Society, both of which prefer not to concern themselves with the two main issues raised by Foulness: are we to tolerate an unending expansion of air traffic, and if not shouldn't we begin to stabilise it now? And can't we do better for our fellow species than establish a *modus morendi* with them?

How then is the ex-environmentalist to describe himself? Plainly he does not wish to be associated with the enlightened predations of the DoE. I suggest "ecologist" is a good enough word. There are, it is true, one or two carping creatures within our bureaucracy and universities who petulantly seek to monopolise this description. They may be ignored — as no doubt they will one day wish to be when all that is recalled of them is not their scholarship but their greed. I am not referring to those ecologists in the Nature Conservancy who have courageously chosen to fight the destruction of Foulness by accepting a DoE grant to document what is to disappear.

Haeckel, who invented the word "ecology", defined it as "the study of the economy, of the household, of animal organisms. This includes the relationships of animals with both the inorganic and the organic environments, above all the beneficial and inimical relationships with other animals and plants, whether direct or indirect". Applied to the human animal such a study obviously embraces almost every discipline.

Ecology tells us that the ecosphere is not an assemblage of academically watertight compartments, but is a single system, composed of interconnected sub-systems which have evolved together as a single behavioural process. Yet too many of those who call themselves ecologists have shunned the systems approach, preferring instead the relative security of the laboratory or, when they tackle entire ecosystems, the simple measurement of energy flow. Few "ecologists" choose problems for their significance rather than their potential for quantification, perhaps because they feel inferior to "hard" scientists like physicists. Fewer still have bothered to study the human animal.

However, Haeckel's word is too useful to abandon as gracefully as we have "environmental". In the interests of scientific accuracy, therefore, I propose a terminological shift. Those who adopt the systems or holistic approach to ecology should continue to call themselves *ecologists*. Those who may at the moment be called ecologists but who content themselves with the simple measurement of artificially isolated relationships should call themselves *economists*. And those who at the moment call themselves economists but who are really propagandists for a particular fiscal system should call themselves *macro-accountants*.

As a *quid pro quo*, those ecologists who are left should undertake to stop attacking economic growth, progress, and technology. There is nothing wrong with growth as such. We don't regard the growth of children as unsavoury, we merely expect it to stop at some point—and this applies only to physical growth, not to the growth of wisdom or moral stature. Similarly with socio-economic systems: at some point their consumption of materials and energy must stop growing and either stabilise or collapse; but they may continue to grow in many other ways, such as harmony and justice. This said, there are three things wrong with economic growth. The first is that it is all too rarely defined, so that ecologists and macro-accountants alike find themselves entangled in arguments made futile by terminological opacity. The second is that when it is defined as growth of gross national product (GNP) it is meaningless: GNP is simply the accumulated prices of all goods and services bought and sold in a given period. Thus the prices of manufacturing, selling and advertising cigarettes are added to the prices of hospitalising and subsequently burying their victims, the sum being passed off as a total benefit to society. The third is that when it is defined as industrial output per man it is wasteful and damaging: for such industrial expansion encourages centralisation, creates pollution and blight, and reduces the capacity of the economy to provide employment.

Since it is possible to define economic growth in a number of ways besides GNP and industrial output, the ecologist owes it to himself to demand a precise definition before he weighs in. The same goes for progress. Too often ecologists allow it to be suggested that barbarian development is progress, or at least its "price". Thus in attacking a given development they put themselves in the vulnerable position of attacking progress as well. As an ecologist, I am heartily for progress, defining it as the move from a low to a high standard of living. And I define a high standard of living as one in which all men enjoy good health, good food, and the optimum opportunity for fulfilment. It is sometimes stated that "you can't stop progress", but all the evidence indicates that it has been stopped for some considerable time.

Finally, to condemn technology outright is to condemn the spear as much as the supersonic transport. What the ecologist abhors is *aristo-technology*, or technology which because of its impact on the environment and its excessive demand on capital, energy, and materials, is beyond the reach of all but a minority of mankind. What we need instead is more *demo-technology*.

The festive season is a time of optimism, something people do not expect from ecologists. Yet the mark of an ecologist should be the belief that ours is not the best of all possible societies, and that people will be encouraged to seek better alternatives once shown them. A Merry Christmas, then, peace on earth—and, the DoE, CPRE, Noise Abatement Society, and Nature Conservancy notwithstanding, good will to all species.

Low energy housing

by Andrew MacKillop

Modern building techniques are extraordinarily wasteful of materials and energy. This means not only that houses are built and run at the expense of this country's ability to sustain itself, but also that the individual house is beyond the reach of many families.
However, present and future housing demand could be met with a lower expenditure of energy and materials if existing demo-technologies (see Editorial on page 3) were implemented. Andrew MacKillop, director of Low Impact Technology Ltd., and an associate editor of the *Ecologist*, explains how.

Much of today's building in industrial nations is based on providing a flimsy shell, fabricated with high-energy materials such as aluminium and plastics on a ferro-concrete core. The combination of such materials, large expanses of glass (for instance up to 30 per cent of surface area), and three or more air changes per hour, leaves us with buildings that respond very quickly to external temperature change. This poor homeostatic performance is then buffered by massive energy use. Because these construction and servicing processes are labour extensive, and cheap energy is the basic element of our fuel policy,[1] the system is economically profitable. Further, through division of labour, building processes that require more man-hours cannot at present be used. However, because minerals and fuels are not infinitely abundant, and the environmental impact of materials, servicing and the energy supply processes is considerable, the criterion of profitability and rapid construction should not be of overriding importance.

Materials and construction

In most environments of rapid and large scale temperature variability, there are two fundamental design characteristics of vernacular building: first, that walls are very thick, and second that the building is strongly related to the site and its possibilities. Thick walls provide large temperature gradients at the living space perimeter, rather than inside. Although this increases demand for materials, these usually are from abundant local sources, and the benefits of "free walls" from sloping sites are usually taken. Most vernacular building takes advantage of energy conserving possibilities, for example, darkened south-facing walls to maximise solar-absorption, high content: surface ratios in regions of great cold and heat, wind breaking devices to reduce wind-caused heat loss, and so on.[2]

There were also strong cultural reasons for good building. A pre-industrial society is one which has very little labour division, and in which "there is a diffuse knowledge of everything by all . . . In terms of building this implies that everyone is capable of building his own dwelling—and usually does."[3] Thus improvements quickly circulated within the community, and became culturally-impressed. Out of 300,000 buildings built each year in the United Kingdom, however, fewer than 8,000 are owner built, and of these the vast majority use standardised materials and servicing techniques. When we analyse the energy inputs for producing a conventional UK housing unit we are confronted with an extremely high energy product, for housing consumes about 65 per cent of all materials produced for the construction industry (Tables 1 and 2).

As shown in Table 1, there is a large use, particularly in commercial building, of high performance, high energy materials such as steel and reinforced concrete. Consequently there has been a rapid increase in energy input and environmental impact. Yet for the conventional UK housing unit (see Table 2) there is still quite a large use of traditional materials, such as brick and timber, although the increasing use of concrete, steel and plastics, and of much metal piping and wiring, raises total energy inputs.

As shown in Alternative 1, it is feasible to produce a housing unit at an energy cost 70 per cent below that of conventional units, with only marginal changes of internal specification. Bricks used today, such as the London Stocks type have typical load failure rates from 600 lbs/sq. inch. Yet a 10 per cent soil-cement block, produced by hand with a block-making ram, can give a performance of up to about 900 lbs/sq inch,[4] and can thus permit building to three storey height with safety and durability. Whilst a brick requires an input of about 0.2 kWh/brick, the soil cement block requires under 0.05 kWh/block of similar size.

The use of glazed pipe, casein-based render, and localised energy and waste servicing techniques can all help to reduce the resource intensive and pollutive methods presently used. The use of asbestos in large quantities for fire-proofing is another example of how energy-intensive building demands rigid precautions; the presence of large quantities of explosive fuel and large electrical energy flows, in this case, makes fire-proofing a basic necessity.

As is indicated in Alternative 2, the use of hand labour for producing rammed earth walling,[5] and systematic simplification of materials can produce viable housing units at an energy cost some 92 per cent lower than at present. Until recent decades, rammed earth dwellings were common, particu-

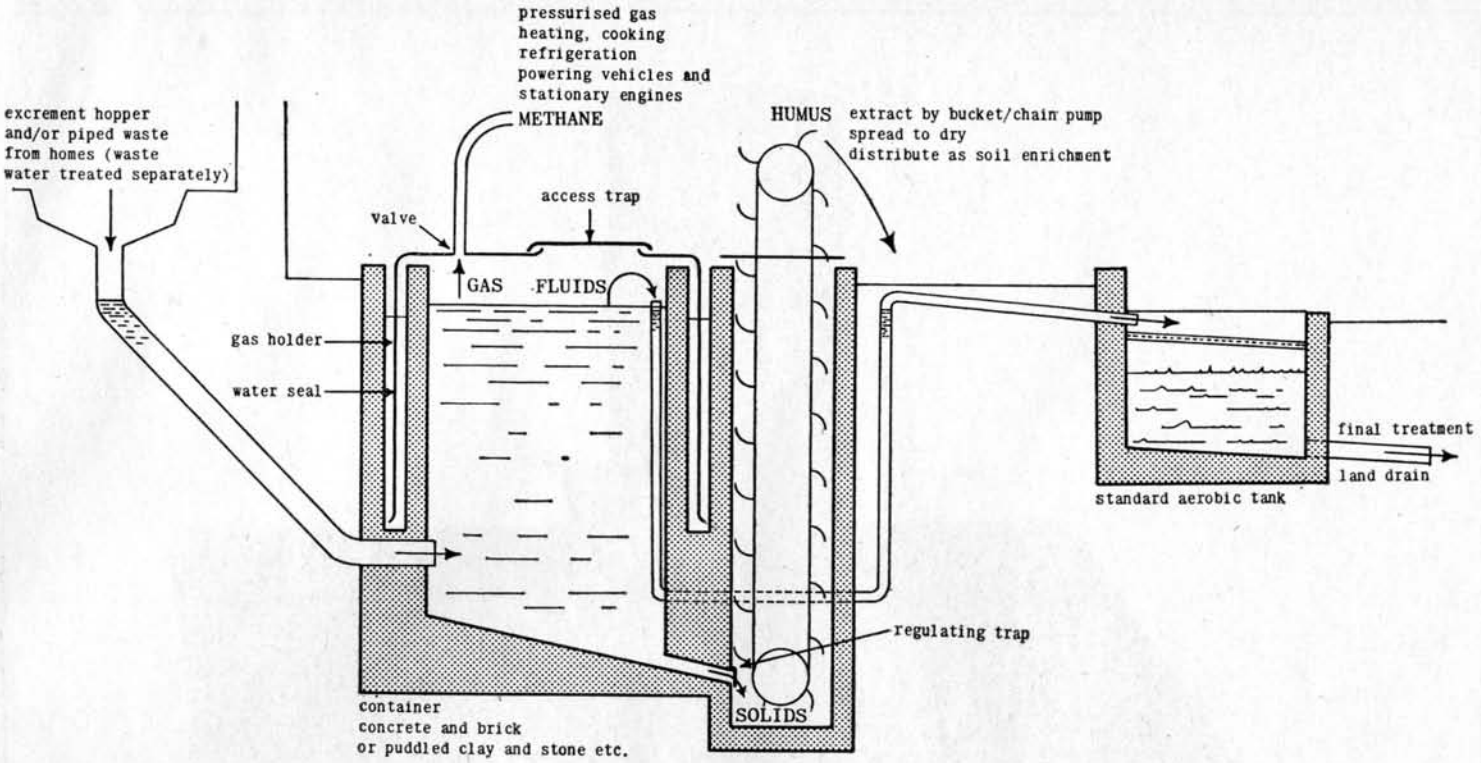


Diagram of domestic sewage plant producing methane and humus by anaerobic and aerobic fermentation respectively

larly in the south and west,[6] and often gave good service for 100 years or more.

As with materials production, the techniques used in actual construction have also become energy intensive and labour extensive. This process reaches a peak with industrially-produced, standardised wall and floor panels. Assembly is therefore simplified and routinised, producing drab, monotonous, and apparently cheap dwellings, that in fact demand very high energy and require processes that damage natural systems. Often a pseudo-utilitarian defence is offered for such building: they quickly meet minimum standards of space, window area, damp-proofness, etc. However, their construction often requires the demolition of craft-built housing that at least gave diversity, privacy and community, and which could be easily rehabilitated.

Demolition wastes vast quantities of durable and re-usable materials each year, once more for economic reasons. Basically, the result of present labour and capital charges is that a recycled brick is in many cases more expensive than a new one, and far more costly than concrete. Large quantities of glass, glazed pipe, window frames, doors and general timber are lost each year through clumsy and over-rapid demolition. Rapidly we need to evolve low energy concepts and processes for the productive disassembly of buildings whenever they must be replaced.

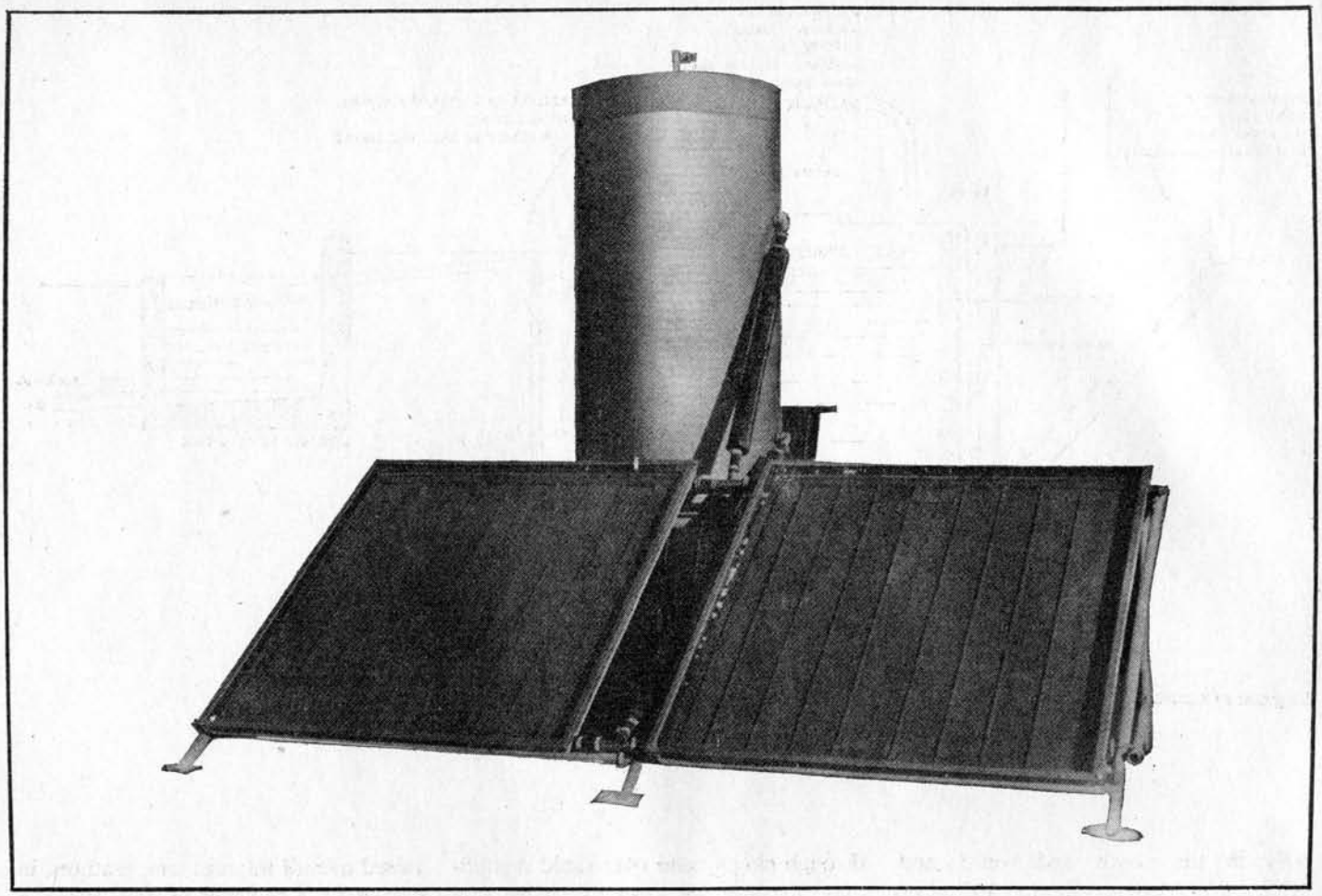
Whilst housing has only recently become significantly resource intensive, the process of constructing commercial buildings relies far more heavily on energy subsidy and high strength material. The *Gestalt* of an office building has become a plastic and glass cladded concrete tower. Here the use of concrete and aluminium and other high energy materials far outstrips the unit area use of such materials in most lower rise housing. Due to the fact that concrete becomes harder with age these buildings are reaching peaks of strength when, for economic "reasons", their internal layout, servicing characteristics, and other factors—such as plot ratio, land price and so on—make demolition necessary. Furthermore, demolition of high strength buildings is difficult, costly, and can be dangerous.

Servicing and maintenance

Energy servicing of housing (Table 3) reflects the poor thermal performance of present building and the effects of cheap energy policy on household energy use—for instance consistently raised overall internal temperatures, increasing use of water heating, more intense lighting, and so on.

Table 3 gives an approximate figure of 20,000 kWh/year being used by each dwelling, for all purposes. However there is great variation in household energy use, both within homogeneous regions and between class groups. In the latter case, Commoner has shown for the USA that there is a marked shift upwards in yearly energy use in higher income homes,[7] with the highest income families consuming over four times as much servicing energy as the lower income groups. In the UK, the CEGB gives 18,300 kWh/year as average household energy use, of which 12,000 kWh is used for heating. However the Institute of Heating and Ventilating Engineers gives for detached houses an average for space heating alone of over 35,000 kWh/year.[8]

It can be seen (Table 4) that heating energy demand for a semi-detached three-bedroom unit, maintained at a 10° C differential from ambient temperatures and with insulation standards at 1965 Building Regulation levels, mounts to over 20,000 kWh for a 30-week heating year. Assuming that water heating (ca. 8,000 kWh), lighting (900 kWh) and other energy using



Solar water heater

activities are included, the total can be quickly raised to around 30,000 kWh/year per dwelling unit. The fact that very many people accept lower heat differentials and lower lighting levels, makes up for the large variations in energy use, which leaves us with an average energy use of around 20,000 kWh/year per dwelling unit.

Present household energy use totals 351 x 10^9 kWh/year (1970), but since water, sewage handling, and waste disposal, as well as other servicing, are not included, the true total must be in the region of 410 x 10^9 kWh/year. Then by adding materials production to energy consumption we arrive at a total for the construction, materials production, and building servicing (heating, lighting, etc) sectors of our economy of about 470 x 10^9 kWh/year, with large subsidies in sectors such as transport still being omitted. This is approximately 16 per cent of our total (1970) energy use of 2.9 x 10^{12} kWh.[9] With this kind of figure we can quickly arrive at estimates of the building industry's role in air and water pollution, marine oil pollution, and so on.

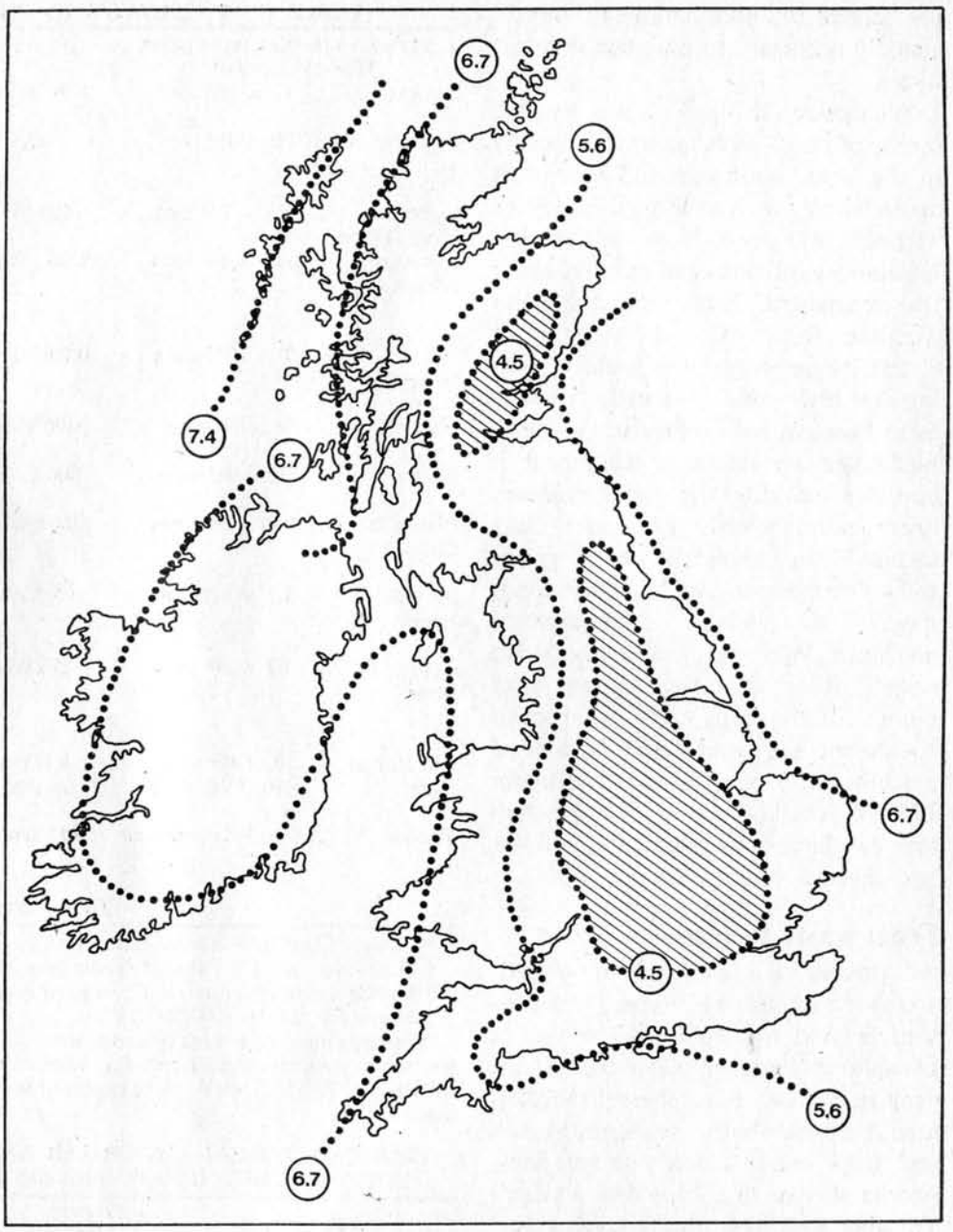
Comparative energy costs

In Table 3 it can be seen how great are the variations in gross (total) efficiency of the various servicing systems used. Thus electricity in household use is the most efficient, but overall (see below) is by far the lowest. The main reason for this is that electricity is the most *highly centralised* form of energy, and therefore requires more translations and greater distribution, which of course brings in thermodynamically-inescapable losses. This problem is recognised by the "total energy" concept, which accepts as a first premise that electricity production must be decentralised for greater use-efficiency. Further, the overall efficiency of fuel use is raised in this process by using electricity only for those purposes, such as lighting, for which a high grade energy source is obligatory. Remnant heat is scavenged by various processes, and used for heating, steam-absorbtive cooling, and so on.[10] Total energy systems are applied to single large buildings, notably offices, and to building groups up to about the level of 500 dwelling units. Although the overall translation of fuel energy to useful energy can be raised to 60 per cent compared with the more usual 30 per cent, the process only partially conserves a massive through-flow of energy, and is usually applied only to dense agglomerations of building. Thus resource supply and heat pollution implications remain as for present energy use.[11]

Oil, which is used in the most decentralised way, and is least translated, exhibits the greatest overall efficiency. With coal, overall efficiency is greatly reduced as a result of the domestic grate's poor performance, which with minor modification, such as simple multiple-chamber burners, and redesigned flues, can give translation efficiencies well over 60 per cent at capital costs far lower than for total energy equipment. Further advantages of smaller-scale equipment (under 10 kW) include the ability to use wood, dry organic wastes and other fuels, and the decentralised use of combustion equipment (on the 5–50 dwelling unit scale), more evenly spreads waste heat and by-products.

The most effective way to improve housing and building in general is to conserve inevitable energy flows, such as body heat and incident solar energy, rather than translate high energy products, usually from non-renewable sources, into some useful energy. Table 5 shows the reductions in space and water heating that can be achieved by various energy conserving processes. Over 11,000 kWh/year is saved by the first two energy conserving processes, to give internal heat differentials of 10° C (overall) with ambient temperatures. This differential is 3.3° C, or 30 per cent, higher than Parker Morris standards of 6.7° C for part central heating, the standard at which most local authority housing in Britain is now serviced.

Insulation is the most energy conservative process for high-density walling, and additional insulating material, such as wood-wool, straw and vegetation mats, mineral chips, and many recycled wastes[12] can be produced from local and renewable materials. Although glass wool and polystyrene foam have thermal conductivities of 0.034 and 0.033 W/m °C Watts per metre degrees Centigrade), they are more resource-intensive than mineral wool and grass matting which have conductivities of 0.037 and 0.043 W/m °C.[13] From present Building Regulation heat transmittance standards of 1 for roofs and 1.7 W/m² °C for external walls, good insulation can reduce loss of 0.6 W/m² °C, which is, for the latter, a 66 per cent improvement, rather than 50 per cent which forms the basis of the calculations in Table 5.



Relative wind strengths in the British Isles. Those areas unshaded experience winds strong enough to provide power.

Running on sun

Solar collection is an attractive proposition because yearly incident energy on 1 sq metre of surface oriented at about 5° W of S (185°) in the UK is about 790 kWh. Accepting a collector efficiency (solar energy-usable heat) of 50 per cent (many can reach 60 per cent),[14] this means a collection of over 14,000 kWh/year with 38m² of collector. However solar energy is a "fairweather friend", since winter collection in the UK may be as low as 3,500 kWh, while demand is for 8,500 kWh or more. Reduced overall heat differentials, which would require effective heat barriers between living and kitchen/bath/bedrooms, reduction of total window surface, and double glazing to reduce loss rate through windows to below 3 W/m² °C, can reduce net heat losses still further. Although solar collectors require double glass use, the extra 2,400 kWh/dwelling required for the glass can be recouped in under a year, and there are many other techniques available for conserving energy.

Because many sites in the UK, and much existing building, are not suited to solar energy equipment, the average figure for additional energy requirements must be in the region of 7,000 kWh/dwelling each year. This still implies a reduction for UK housing of over 300 x 10^9 kWh/year, or 40 million tons of coal equivalent. Further there are many renewable energy forms that can be sensitively and extensively tapped by small scale equipment. Present hydro-electricity requires much resource intensive and environmentally undesirable engineering, with disagreeable landscape effects, and gives a yearly output of around 16 x 10^9 kWh/year.[15] Although this is often claimed to be a very high proportion of potential, it in fact is based on an economic criterion where plant opportunities of under about 250 kWh, served by drainage zones under 500 km² in area, are *disregarded*. By tapping the potential of smaller streams through simple and low-cost equipment, total hydro-electric output could be raised possibly to more than 40 x 10^9 kWh/year.[16] This would supply over 80

per cent of the housing energy "need" actually necessary to maintain comfort levels.

Windpower in the UK is a feasible source of much useful energy, especially in the west, northwest and east coast areas, where yearly average wind speeds exceed 6 m/second. However the wind is notably capricious and requires sensitive equipment. In general, the aerodynamic form of mill is best for electricity generation, but because gearing for high rotation speeds leads to large losses of net useful energy, multiblade and vertical axis equipment is best for utilising the more frequent lower wind speeds of under 5m/second.[17] An interesting way of giving some direct heating is the use of windpower to drive Callendar-type machines. Windmills could also drive solar energy distribution fans and pumps. Both small scale waterpower equipment and mechanical-drive wind machines can give power for under £75/kW installed, a rate far lower than that for large-scale plant, e.g. nuclear and thermal power stations.

From waste to resource

At present the disposal of organic wastes consumes much energy and resources, and still pollutes. The loss of phosphorus from the biosphere into the deep ocean and lithosphere is accelerated by water-borne sewage disposal, and helps cause a loss rate for phosphorus of over 33 million tons a year.[18] Together with high nitrate levels raised by sewage disposal, the excess of phosphate can lead to rapid algae proliferation and the collapse of normal aquatic life. Further, the loss of N and P has to be made good by resource intensive fertiliser production. There is thus a very strong case for more localised cycling of organic wastes, which can be done by controlled aerobic composting in "Clivus" type equipment, at costs competitive with those for sewage and waste handling in suburban and rural areas. The use of anaerobic processes can give methane gas at the rate of 15/20 cu ft per day from the waste (51 lbs) of an average family—about equal to average cooking energy requirements. Integrated into a two-stage methane producing then aerobic organic waste handling process, the need for handling and the risk of pathogen spread from anaerobic sludge would be reduced.

There are numerous other attractive, lower energy processses suited to ser-

(TABLE 1) MATERIALS AND ENERGY USE FOR CONSTRUCTION

Yearly Materials Consumption 1967-69 *Average* *		*Energy Inputs* †		*Additional Environmental Impacts*
Cement	17×10^6 tons	1800 kWh/ton	27×10^9 kWh	Localised air pollution.
Concrete	30×10^6 tons	~500 kWh/ton		Demand for aggregate—beach damage etc.
Concrete block & pipe	1.5×10^6 tons	~400 kWh/ton		—
Asbestos cement	520×10^3 tons	2200 kWh/tons	1.2×10^9 kWh	Asbestosis of processing workers. Local asbestos water pollution.
Bricks (All types)	7×10^9 bricks	0.2 kWh/brick	3.4×10^9 kWh	150 acres/year dereliction of brick earth zones§
Plastics	4×10^3 tons	2400 kWh/ton	10×10^6 kWh	Localised water & air pollution.
Slate	22×10^6 tons	500 kWh/ton	11×10^6 kWh	Large transport component.
Plaster & Gypsum	900×10^3 tons	300 kWh/ton	270×10^6 kWh	Localised pollution; waste disposal dereliction.
Steel & Iron	1.5×10^6 tons	3.5 kWh/lb‡	4×10^9 kWh	Water & air pollution. Raised outflow of iron compds to sea.
Copper & Brass	83×10^3 tons	5 kWh/lb	900×10^6 kWh	Local air & water pollution. Mine dereliction. Raised run-off.
Aluminium	3×10^3 tons	8 kWh/lb‡	56×10^6 kWh	Fluorosis pollution.
Glass	470×10^6 sq ft	6 kWh/sq ft	3×10^9 kWh	Localised air pollution.
Timber	1.6×10^6 cu metres	70 kWh/cu.m	110×10^6 kWh	Much imported . ˙. Linked to overrapid forest clearance etc.
		Total energy use:	~40×10^9 kWh	

* From: M.O.P.B.W. *Annual Bulletin of Construction Statistics* HMSO 1969, 1970.
† Data from D.O.T.I. Censi of Production; HMSO 1968, 1971.
‡ The Causes of Pollution. B. Commoner et al *Environment* Vol 13, 3. 1970.
§ *Sinews for Survival;* HMSO 1972
All energy input figures are of energy used. Thus translation efficiency multipliers are required to give true (resource) energy input. E.g. Cement production uses large quantities of electricity with efficiency of 27.6%. Thus total energy input for cement production is ca: $1800 \times 3 = 5400$ kWh/ton.

(TABLE 2) TYPICAL MATERIALS AND ENERGY INPUTS FOR STANDARD HOUSING UNITS (Parker-Morris standard 3-bed semi-detached, 100 m² floorspace)

Materials	*Energy Inputs*
Bricks: 16,000	3200 kWh
Steel: 1.2 tons	9200 kWh
Glass : 320 ft²	2000 kWh
Concrete : 10 tons	5000 kWh
Cement: 2 tons	3600 kWh
Plaster: 3 tons	900 kWh
Timber: 4.3 cu. m.	310 kWh
Plastics: 250 lbs	300 kWh
Paint: 4700 sq. ft.	500 kWh
Copper & Brass: 500 lbs	2500 kWh
Others: —	4000 kWh
	31,510 kWh

Site Preparation
Excavation/Handling: 2000 cu. ft = 6000 kWh
Cement mixing and Miscellaneous machinery:
100 gals fuel = 4200 kWh / 10,200 kWh

Materials Transport

Bricks 60 miles at 1.5 kWh/ton mile:	3200 kWh
Timber 250 miles at 1kWh/ton mile:	1100 kWh
Cement 40 miles at 1.5 kWh/ton mile:	400 kWh
	4700 kWh

Total inputs $31,500 + 10,200 + 4700 = 53,700$ kWh

Alternative 1: 10% soil-cement blocks

8 cu. yds. cement and handling:	12,500 kWh
Soil: 50 tons (hand labour):	50 kWh
Localised wood supply:	150 kWh
Glass:	2000 kWh
In situ rendering materials:	100 kWh
Metals:	1500 kWh
Others	2500 kWh
Total Inputs:	18,800 kWh

Alternative 2: Rammed earth

80 cu. yds earth, 70 men days:	100 kWh
160 cu. yds. earth invert:	150 kWh
Glass:	1500 kWh
Timber:	150 kWh
Rendering:	50 kWh
Metals	1000 kWh
Others:	2000 kWh
Total	4950 kWh

vicing housing with the minimum of energy, and in more environmentally-desirable ways. The heat pump (reverse refrigeration) by tapping inevitable thermodynamic wells can give a performance of around 3 kW of heat for each 1 kW applied from, for example, electricity or water flow. Light steam engines, gas lighting, etc. can also aid in giving greater energy efficiency without impairing living standards.

Many of the processes discussed have favourable applications in other sectors, notably food production. The enlarged use of small rivers for water-power (by water wheel and turbine) can, and obviously should, be integrated with fish farming. The controlled enrichment of small feeder lakes into fish farm systems is now established practice in Czechoslovakia. Since enrichment stimulates plant growth in excess of fish production needs, rushes suitable for the manufacture of insulation mats can be grown, alcohol and animal feeds can then be subsequently produced through fermentation processes. Ducks and other waterfowl besides being attractive can add to the benefits of this process and increase ecosystem stability.

Conclusion

The combination of population growth, rising per capita rates of energy/materials consumption, and inefficient technologies, is making the problem of meeting housing demand still more difficult than it need be. While ultimately population must be stabilised and consumption reduced, an immediate improvement can be made by the introduction of the technologies discussed in this article: energy-efficient materials, high-quality insulation, maximum use of ambient renewable energy sources (solar, wind, water), and more sensitive response to human requirements, are all part of a rapidly evolving concept of low energy, resource extensive housing of low environmental impact.

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3 *House Form and Culture,* A. Rapoport, Prentice-Hall, 1969; and see: 'Kampongs', A. MacKillop, *Architectural Design,* July 1972.
4 "Research Results on Soil Cement Blocks", T. Kent, R. Lin and N. Teter, Paper 60-407, Annual Meeting American Society of Agricultural Engineers, 1960.
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(TABLE 3) HOUSEHOLD ENERGY USE 1970

	1	2	3		4	5 = 2 × 4	6
Domestic Energy-inputs From Supply sectors	*Domestic Energy supply* (×10⁹ *kWh /yr*)	*Energy supply No. of homes kWh/home /yr (17m homes)*	*Resource* multiplier*	*Resource Energy use kWh/home /yr*	*Use efficiency in homes %*	*Actual energy use kWh/home /yr*	*Gross efficiency % 5/3*
Electricity sales 70 × 10⁹ kWh	70	3,900	×3.6	14,000	80	3,120	22
Gas 3600 m Therms	106	5,900	×1.45	8,550	65	3,820	45
Coal 21 m tons	147	8,150	×1.2	9,750	40	3,900	40
Oil 17.5 m barrels	28	1,600	×1.22	1,950	60	1,150	59
Totals	351	19,550		34,250	(—) (Ref. E)	11,990	35

* Resource energy: depends on translation efficiency.

Notes to Table 3

1. *Electricity :* 106m tons coal equivalent used in generating 207 × 10⁹ kWh (1970)
   1 tce (UN): 8 × 10³ kWh. Assumed tce (UK): 7 × 10³ kWh
   ∴106m × 7 × 10³ = 742 × 10⁹ kWh (used) to give 207 × 10⁹ kWh (consumed)
   $$\therefore \text{efficiency} = \frac{207}{742} = 27.6\%.$$
   $$\text{Resource multiplier} = \frac{1}{0.276} = \times 3.6$$
2. Gas: Natural Gas losses (1969) in distribution 811 m Therms for 5,840 (m therms) delivered.
   ∴ loss rate = 13%. Losses in town gas production > 12½%. Efficiency ∴ ⩽87%.
   Losses in undersea production, reforming, and other handling ⩽ 18%. Efficiency 82%.
   Assumed total production efficiency not greater than 0.82 × 0.87 = 0.7 (70%)
   $$\text{Resource multiplier} = \frac{1}{0.7} = \times 1.45$$
3. Coal: Assumed total loss rate production-user ⩾ 17%. Efficiency ∴ 0.83
   $$\text{Resource multiplier } \therefore \frac{1}{0.83} = \times 1.2$$
4. Oil: 10% loss: in production drilling and transport. Up to 8% in handling, cracking, refining etc.
   Assumed loss ⩽ 18% = efficiency 0.82.
   $$\text{Resource multiplier: } \therefore \frac{1}{0.82} = \times 1.22$$

References to notes to Table 3

(1) UN: 0.125 tce ≡ 1,000 kWh. See: any *UN World Statistical Year book.* UK Min of Fuel appears to use varying equivalences for energy conversion. For instance in Fuel Policy 2,000 m cu ft. of North Sea gas, over a year, is equated with 23.5 m tce. At 10³ BTU/f³ (35 mj/m³) this gives 1 tce ≡*9,200 kWh.* Yet elsewhere 2,050 m Therms is equated with 9m tce, giving *6,800 kWh* ≡1 tce. Therefore I have used 7,000 kWh = 1 tce, 12½% less than the UN Conversion rate; this therefore will *reduce* inefficiencies rather than raise them.

(2) 1969 loss rate from: *Digest of Energy Statistics,* Min of Technology 1970. Table 52. Other figures: general gas production engineering. Total loss rate of 30% is probably an underestimate by ⩾ 5%.

(3) *The Geography of Energy.* G. Manners. Hutchinson 1964. See: National Coal Board publications. Also: Times Review of Industry: May 1959; September 1964.

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17 See, for example: *Wind Power*, vol 7, UN Conference on New Sources of Energy, Rome, 1961. UN Publications, 1964.
18 "Mineral Cycles", E. Deevey, *Scientific American*, September 1970.
19 See: "Experiments on the Methane Digestion of Dung", C. Cornovesov, *Tekhniky sel Khozkol*, **25**, 1965; and "Methane Gas Production by Batch and Continuous Fermentation Methods", W. Boshoff, *Tropical Science*, **5**, 1963.

(TABLE 4) SPACE HEATING ENERGY REQUIREMENTS

Parker Morris standard 3-bed 100 m² housing unit. Building Regulations (1965) insulation standards.

Component	*Area m²*	*Heat loss rate W/m² deg C*	*Overall temp. differential*
Roof	66	0.95	10° C
External walls	185	1,7	10° C
Ground floor	46	1,2	10° C
Windows	30	4.0	10° C
Ventilation	2 changes/hour (350 m³)		10° C
			Total loss rate 5,575 w

Gains:

2 adults, 2 children	350 w
Cooking	165 w
Solar gain	375 w
(+ lighting − cold bridge etc)	*1,000 w*
gains losses	

For 4,500 *heating hours* = 20,600 *kWh*

Net loss rate = 5,575 − 1,000 = 4,575 w

(TABLE 5) EFFECTS OF ADAPTATIONS

Adaptive Process	*Reduced heat loss kWh*	*Effect Rank*
Double insulation standards	10,300	1
Install 38 m² of solar flat plate collector	7,300	2
Reduce heat differential 10° C → 8° C	5,300	3
Reduce window size to max. of 12% of shell surface	4,400	4
Reduce ventilation to 1 change/hour	4,310	5
	Net saving = 20,600 − 4,310 = 16,290 kWh/year	

Water Heating

Effect of solar collection on energy use: reduction of 8,000 → 4,000 kWh/year. Thus total energy requirement reduced from 28,600 kWh/year → 8,310 kWh/year.

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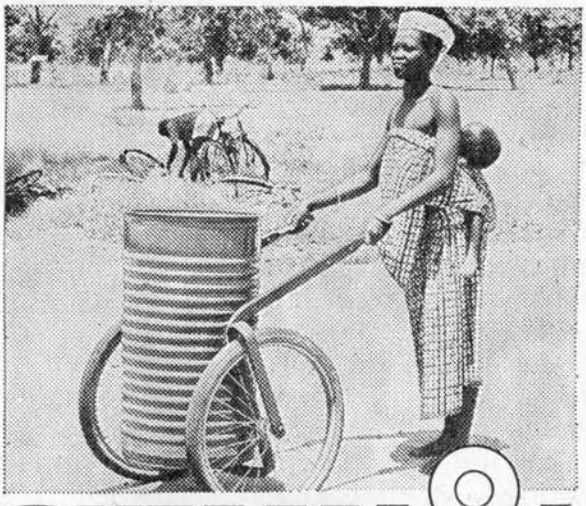

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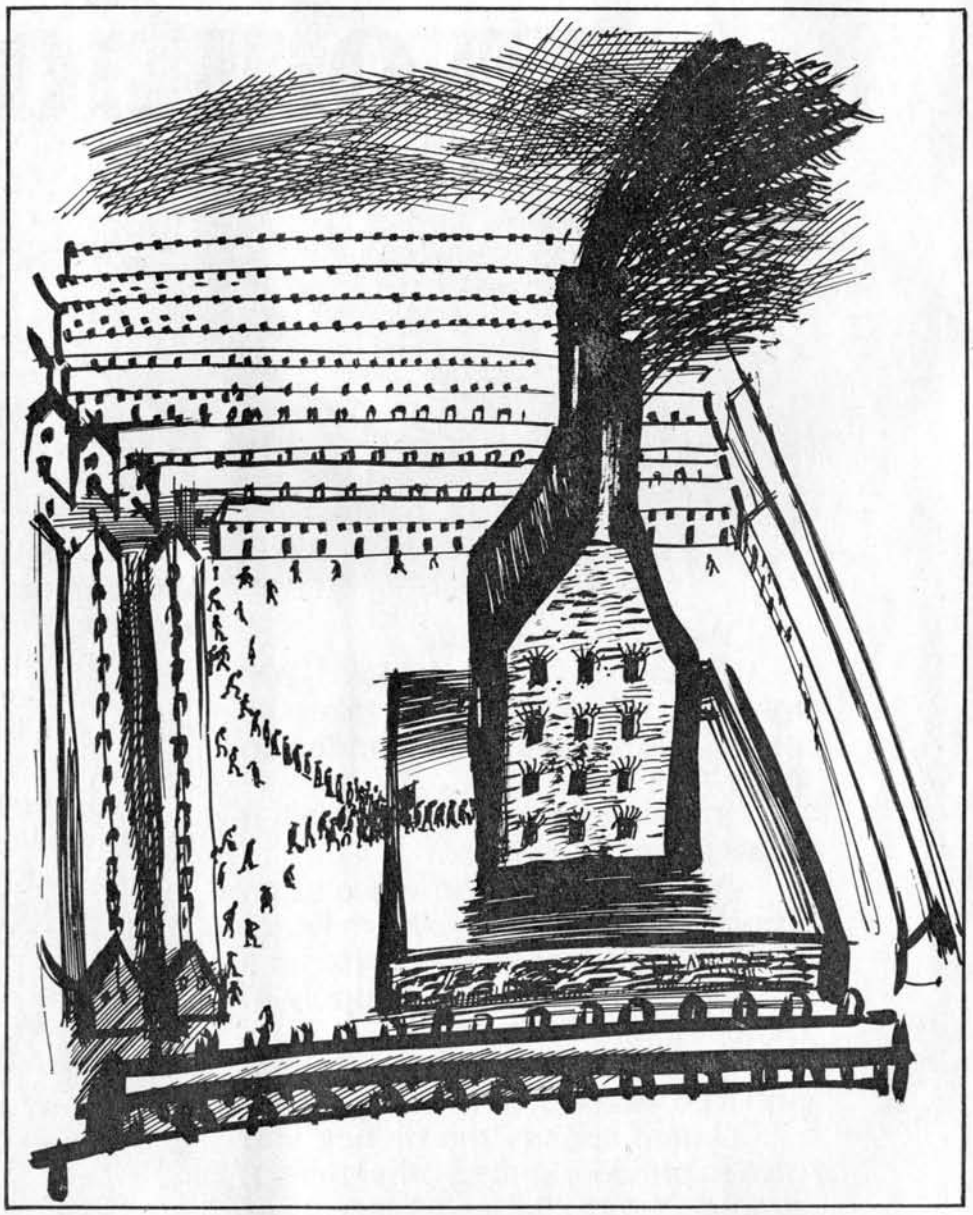
A model of behaviour

by Edward Goldsmith

The ecological approach is to look at the constituents of the biosphere not as separate entities but as part of a whole. Only in this way is it possible to predict the effect of changes, and in particular of those that we bring about to it. This means that we must regard it as a single process and describe it in terms of a single model rather than the set of very distinct ones proposed by science today. The author suggests how such a model could be developed, what would be some of its principle features and how it could be used for predicting the fate of our industrial society.



The object of this article is to provide the basis of a model permitting the prediction of change in behavioural systems, and in particular human social systems, in the process of disintegration.

I shall make several assumptions. The first is a methodological one: a model is postulated, rather than induced from randomly accumulated data in accordance with empiricist theory. Its acceptability does not reside in the empirical verifiability of its postulates which is not only often difficult to achieve, but is also inconclusive as observations are themselves models postulated on the basis of the observer's general model or world-view. Acceptability will be taken as residing in the precision of the interpretations and predictions that the model gives rise to (see "Towards a Unified Science" *Ecologist* March 1971).

The second assumption is that behavioural processes at all levels of organisation are sufficiently similar to be represented by the same basic model (see "Towards a Unified Science", *Ecologist* November 1971).

The third is that behavioural processes are directive (see "Towards a Unified Science" *Ecologist* June 1971).

Stability

The law of economy appears to be the basic law of behaviour. Things take the line of least resistance and move thereby to positions where free energy is reduced to a minimum, i.e. equilibrium. Since positions of unstable equilibrium are, by their very nature, unlikely to be maintained for long without external or asystemic intervention, changes will be towards stable equilibrium or stability.

We can regard this teleonomic behaviour as passive in pre-life forms and increasingly active as life develops.

Stability is normally regarded as the ability of a system to return to its point

of departure after a disturbance. A behavioural system as opposed to a man-made, incomplete system cannot return to its exact point of departure, but to that which involves the minimum change compatible with the maintenance of a stable relationship with a changing environment and hence with the internal stability of the corresponding supra-system.

Systems can be more or less stable. The more stable, the smaller will be the disequilibria occurring between them and their respective environments and the corresponding corrections. A system whose stability is increasing is referred to as "damped"; one which is out of control as "runaway". The behaviour pattern of a system can be represented by a series of oscillations corresponding to disequilibria and their corrections. Thus in a stable system oscillations are small and in an unstable one large. A damped system is one in which they are diminishing, while in a runaway system they are increasing. (See Fig. 1).

At the moment the particularities of social behaviour, and of policies to influence it, are judged purely in terms of their ability to achieve specific targets which are deemed desirable *per se* in terms of the society's social model or *Weltanschauung*. Attempts to question the desirability of achieving these targets are regarded as unscientific, unobjective and falling within the category of "value judgements". However, once we accept that stability is the goal of behaviour, we have at our disposal a precise criterion, an objective measuring rod for judging the desirability of behavioural trends and of efforts to influence them, regardless of the level of organisation at which they occur, and of their degree of generality.

Control

A system is defined as a unit of behaviour, and is composed of a control mechanism plus that part of the environment which it controls.

The control mechanism is fundamentally the same at all levels of organisation. Relevant data are detected, transduced into the appropriate informational medium, and organised, or interpreted, in the light of the system's model, not of its environment but of its relationship with its environment. The responses mediated are those which appear the most adaptive in the light of the model. This adaptiveness must depend on the quality of the model. Relevant to this are the number of elements, their degree of organisation, and the time-lag between detection and the mediation of the appropriate response. (See Fig. 2).

The role of the model in the determination of responses is more evident in the case of behaviour at a low level of organisation, for instance during protein synthesis; but it is equally important in a human society.

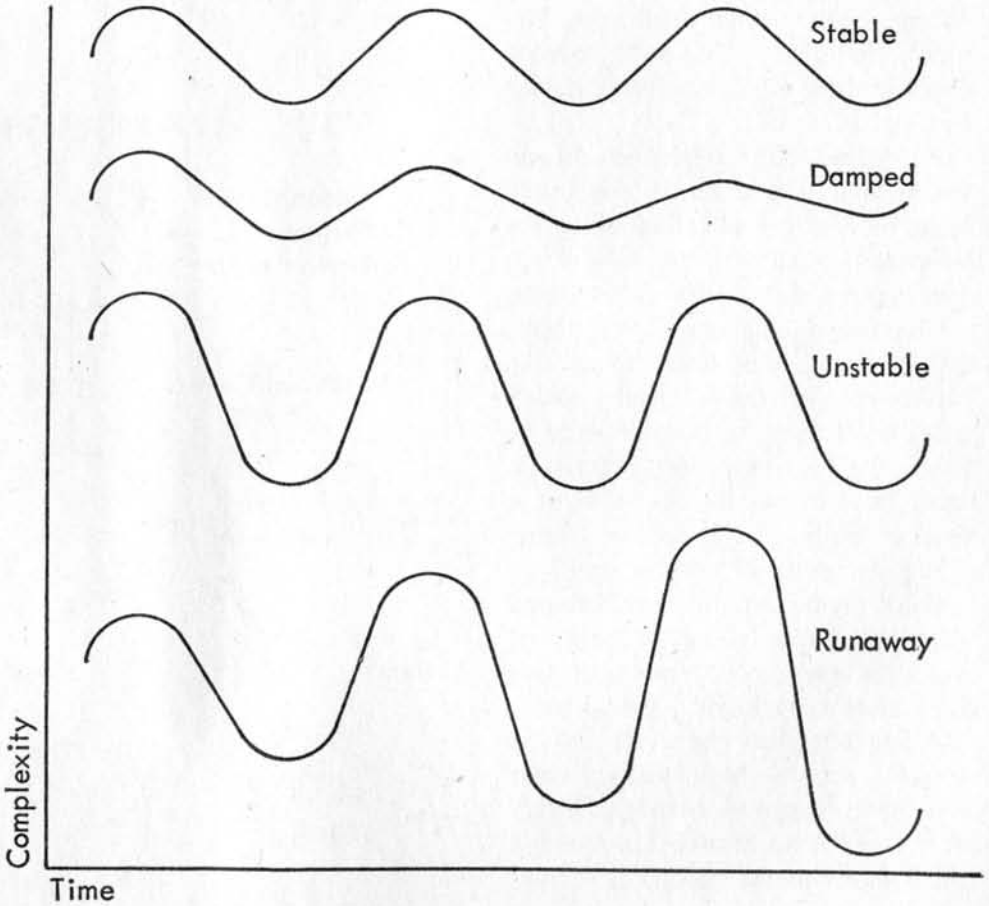
The latter's behaviour pattern can, in fact, be regarded as determined by its model, world-view or *Weltanschauung*, interacting with its environment, both internal and external. On the whole, institutionalised external controls, except superficially and in the short-term, are ineffective in counter-acting behavioural tendencies associated with a given model or world-view.

Our society has developed a very singular world-view, according to which man is above the rest of nature rather than part of it and is thereby exempt from the laws applying to other living things. He possesses something called "reason", and so long as he is provided with the necessary knowledge he will behave in a "rational" way, which means, among other things, that he will cease having too many children to prevent over-population, and that he will regard all men as his brothers—thereby, so it is believed, eliminating all human and social problems. The material problems which are supposed to have afflicted man throughout his tenancy of his planet will also be solved by means of science, technology, and industry, which will enable him to eliminate such things as drudgery, poverty, ill-health, even death.

Needless to say, this materialistic variant of paradise is quite unachievable. To do so would involve violating the first and second laws of thermodynamics as well as many of those of biological, social and ecological organisation.

It is this model that is giving rise to our equally singular social behaviour pattern which is geared to the systematic substitution of man-made and man-controlled artefacts for the self-regulating processes of nature, i.e. to the methodical substitution of the *technosphere* for the *biosphere*—a process referred to as "progress", but which involves systematically increasing

FIG 1 STABILITY



instability and must eventually lead to the breakdown of society and the disruption of its life support systems.

Environmental parameters

Evolution is a feedback process between a system and its environment. Seen slightly differently, the system evolves to fulfil a specific function within a larger system. The rate and extent of possible changes in the latter, as in all systems, must be limited by a number of different factors. For instance, in order to maintain its basic structure, the total rate of change must be limited by that of its slowest changing subsystem.

Hence environmental changes are only tolerable within certain limits. I shall use the term "environmental parameters" to refer to the minimum and maximum values of the variables, in terms of which the supra-system is described, to which the system is capable of adaptive responses. Disequilibria caused by changes in which these values are exceeded are referred to as asystemic.

Behavioural processes proceed from the general to the particular by differentiation. As the system differentiates, as a unicell, for instance, evolves into a complex metazoa, or as a foetus develops into an adult, so it becomes capable of dealing with ever more serious environmental challenges. This means that these values will increase. One can draw a graph to illustrate this (see Fig. 3).

In Figure 3, the seriousness of environmental challenges is measured along the vertical axis, time along the horizontal axis. The curve shows the development of the ability to cope with environmental challenges with time, and the two dotted lines indicate the parameters, or limits within which systemic changes can occur. It is to be noted that the curve does not rise in linear fashion, but as the result of a series of jumps. This is because, during phylogeny, different critical points or levels of organisation are reached, and when this happens, new behavioural principles enter into operation permitting greater behavioural possibilities.

During ontogeny there are critical moments, such as birth, when a child is suddenly removed from the highly ordered environment to that of a family unit. Puberty marks another important environmental change at this point, in a stable society, the child enters into the still less ordered environment of the community at large. It is significant that in most stable societies these critical moments in a child's life are marked with festivities often involving some traumatic experience (circumcision, for instance), which has a similar effect to shock treatment in helping destroy a now obsolete behaviour pattern and introducing those conditions most favouring the rapid inculcation of a new one. In Figure 3, the periods lying between these critical points have been separated and labelled. The labels used, paleo-, meso-, and neo-, are tentative and the number of divisions arbitrary. It is possible to distinguish two different types of disequilibria: those in which the maximum and those in which the minimum values have been exceeded. The former situation can be referred to as *deprivation*, and the latter as *saturation*. Again the terms are tentative.

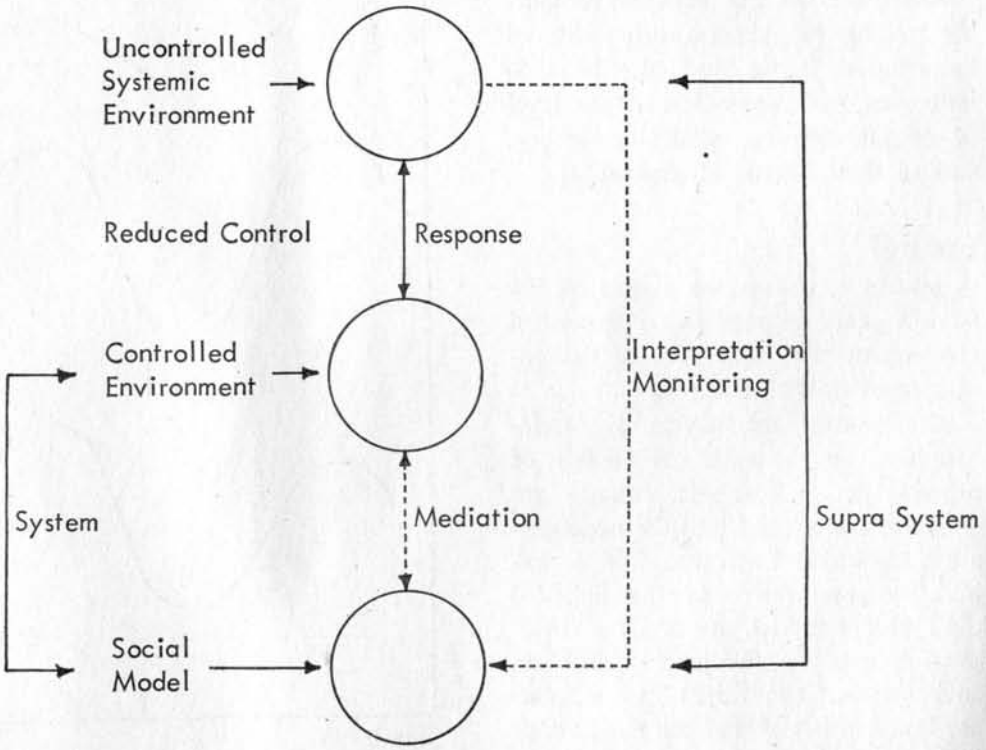
An example of the first situation would be a child subjected to insufficient motherly attention, i.e. being brought up in a family environment with insufficient order; an example of the latter situation would be a child suffering from excessive motherly attention. One can expect pathological manifestations associated with these two different types of disequilibria to be very different.

In addition one can distinguish between disequilibria occurring at the various stages of development. The earlier these occur, the more serious one must expect them to be, as by affecting the generalities of a behaviour pattern they must colour all the particularities in terms of which the former are differentiated. It is for this reason that children subjected to an unsatisfactory family environment in early youth will tend to be "emotionally unstable". They will be more likely to display pathological behavioural tendencies such as delinquency, drug addiction, etc., and will be very difficult indeed to educate—or, more precisely, socialise, whatever might be their apparent intellectual potential.

It is therefore one of the conditions of stability that a system be able to develop from the very start in the appropriate environmental conditions. Responses to asystemic environmental changes will not only themselves be asystemic but, if occurring in the early part of development, will prevent the system from being able to respond systemically to any changes at all.

It is suggested that this might provide a means for classifying disequilibria, and their corrections, systemic and asystemic. This is particularly neces-

FIG 2 A SELF-REGULATING SYSTEM



sary in a field such as psychology where the classifications used: psychoses, neuroses, etc., are non-functional, and mainly refer to symptoms. It should also prove useful in classifying social disequilibria.

Responses

A system can develop in two ways: firstly, it can increase its capacity to cope with environmental challenges, and secondly it can modify the environment in such a way that such challenges become both less severe and less likely to occur.

To a large extent it is by doing the former that it succeeds in achieving the latter. To increase its capacity to deal with environmental challenges, it must build up its model so as to improve its ability to interpret and predict environmental changes. At the same time it must increase its control over the environment, both in space and in time. This means expanding by destroying and assimilating systems otherwise organised. As a system does this, so by the same token it increases its capacity for dealing with environmental challenges and hence for further expansion. This process cannot go on indefinitely, and one must expect a hierarchy of negative feedback loops to be operative. In a social system the first to become operative are likely to be of a cultural nature.

In the final instance, the law of economy provides the final such negative feedback: if we assume that responses occur in answer to a challenge present, predicted, or imaginary, then expansion must ultimately reduce such challenges to a point where they are no longer sufficient to trigger off further expansion.

Entropy

Clearly, in the first stages of development when few predictions can be made regarding environmental change, the most adaptive organisation must be one of disorder or entropy. When the number of elements is maximal and order is minimal, the range of possible reactions to unpredictable environmental changes is maximised.

Variety

As the environment builds up, and with it one's capacity for prediction, so more effective responses can be mediated towards different possible challenges. In such conditions a corresponding number of somewhat more complex reactions must be made possible—variety can be said to be replacing entropy. For reasons of economy, there must be a limit to the number of such challenges to which a system can respond adaptively. The higher the probability of the challenge that can be predicted, the more the system must be capable of reacting adaptively to it. Therefore, the greater a system's variety the higher the improbability of the challenge to which it can adapt. What is taken for redundancy (animal populations, neuron populations, etc.) in a stable system is, in fact, variety.

Complexity

Normally variety and complexity are used interchangeably. I prefer to distinguish between them. When it is possible to predict the occurrence of environmental challenges in a particular spatio-temporal pattern, the system gives rise to a correspondingly complex response. In this way, it becomes specialised in dealing with a specific environmental situation—one that can be predicted as being highly probable. This gives rise to a *damped* system so long as unforeseen challenges can be prevented from occurring.

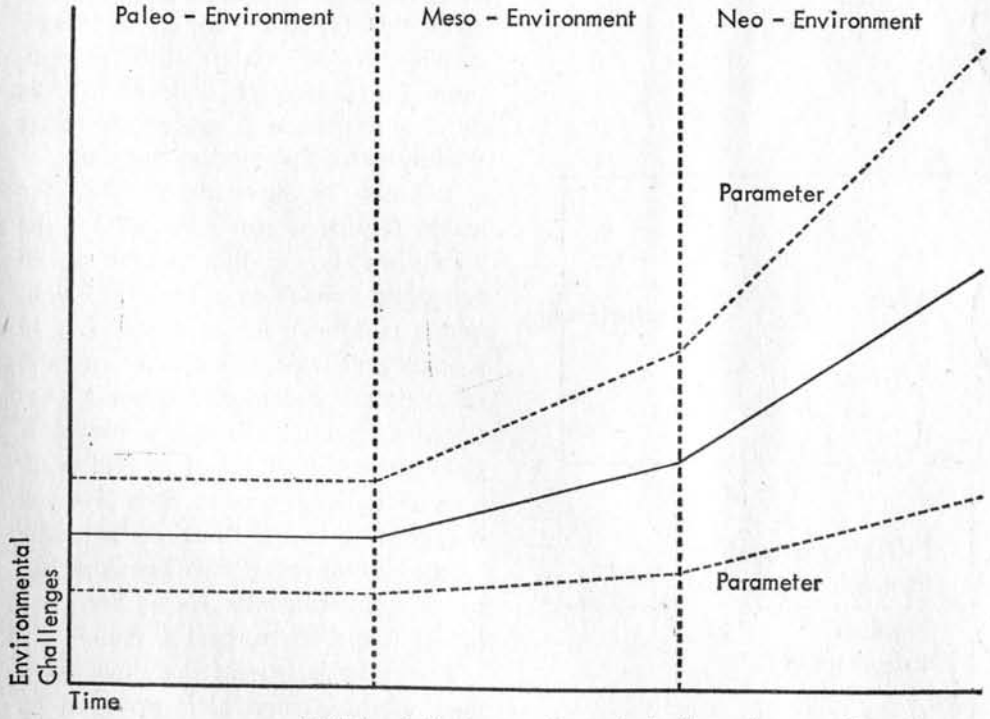
Centralisation

In communications theory, it is assumed that the recipient is interested in a message if it conveys sufficient information, i.e. if its improbability is sufficiently high. In a behavioural context this is not necessarily so, as a signal must also be important, i.e. relevant to the recipient's behaviour pattern or general to it. The more general it is, the greater must be that proportion of the system affected by it. That organisation favouring the detection of such signals and the mediation of the correct responses must display a high level of centralisation.

Compromise between the satisfaction of these requirements

Centralisation means reducing the variety of possible responses that can be mediated by sub-systems at a lower echelon of control. As a system becomes more complex so also is its variety reduced, since it is committing itself to a specific environment, thereby reducing the possible range of environmental changes to which it can react adaptively. Also as a system becomes more complex, and hence more specialised, so it is likely to become less centralised, so that responses can be mediated as much as possible by the

FIG 3 ENVIRONMENTAL PARAMETERS



Solid line indicates capacity to deal with environmental challenges and to support absence of them.

increasingly specialised sub-systems more intimately in touch with their respective equally specialised environmental situations.

It must follow that the response mediated by a system, and the organisation it will display, must be a compromise, that which in the light of its model can be predicted as likely to give rise to the most adaptive behaviour.

Disruption of the system

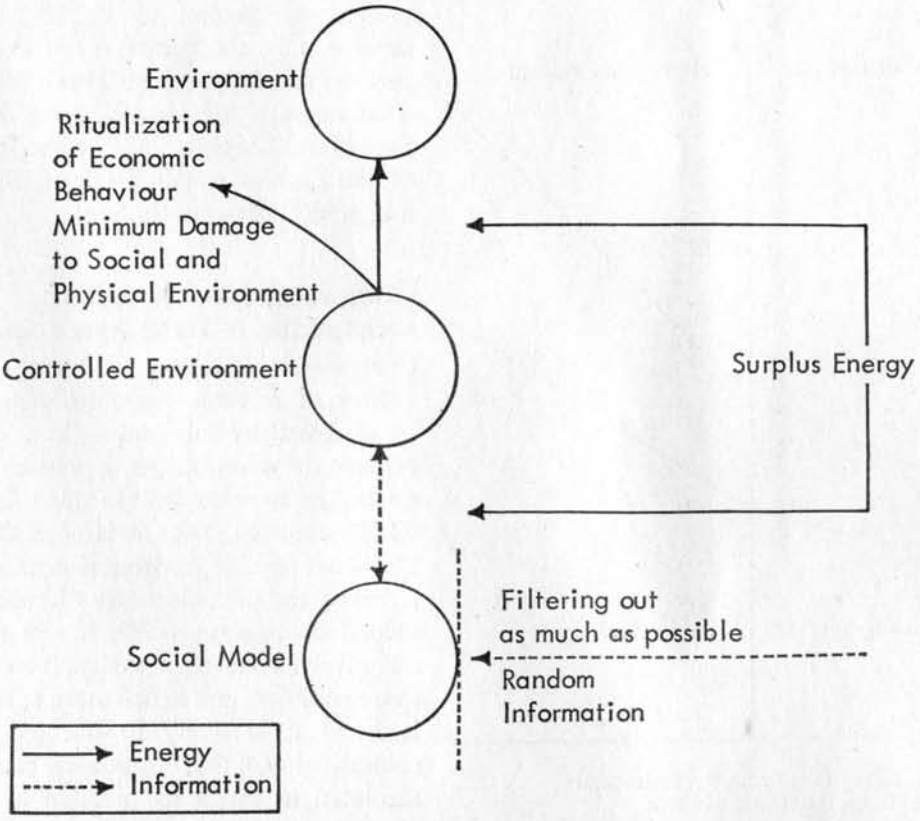
A system breaks down when the self-regulatory mechanism essential for ensuring adaptation ceases to be operative. In such conditions, there is no means of maintaining the level of variety, complexity and centralisation that would enable it to meet environmental challenges. The system, no longer under control, becomes progressively less stable until it collapses.

What is likely to cause disruption of this sort? Geophysical changes can bring about serious upheavals. They can lead to ecological invasions by alien sub-systems. Since these were not developed to fulfil specific functions within the system, it is likely that they would not have developed the capacity for ritualising their behaviour by which they would limit their impact on the new environment. Also, it is likely that the latter would not provide the necessary controls for keeping their populations in check, enabling them to proliferate and destroy the system.

Therefore, it is not surprising to find systems at all levels of organisation equipped with rejection mechanisms to exclude elements alien to it. Whether one likes it or not, such mechanisms are operative at the level of a human society, so long as it remains capable of self-regulation and hence of adaptation.

When such mechanisms break down, the introduction of alien sub-systems in any quantity could lead to increase in randomness or in a reduction in order. This can be counteracted by incorporating these new sub-systems into the system's basic structure, which can be done at different levels of organisation. Immigrants can be assimilated at the level of the individual, assuming that their cultural pattern can first be broken down, or foreign groups can be incorporated in a cultural symbiotic relationship (as has occurred with the spread of Hindu civilisation). However, this can only occur in specific cultural conditions.

FIG 4 DEALING WITH SURPLUS ENERGY AND RANDOM INFORMATION



Surplus energy

We who live in a society that equates progress with increasing energy consumption should consider that there is an optimum amount of energy required for the operation of any system. Plants only exploit a minute fraction of available solar energy, not because they are inefficient, but because, if they were to photo-synthesise more, the nutrient in the soil would be exhausted and the environment would cease to be capable of supporting them.

It is significant that stable societies appear to exploit various strategies for channelling surplus energy into those uses that will result in the minimum supra-systemic disruption. I shall refer to this as the "ritualisation of economic behaviour". It means providing a maximum outlet for surplus energy with the minimum use of natural resources in such a way as to cause the minimum physical and social disruption.

Thus in many societies we find a large proportion of the society's resources being channelled into feasts and other forms of ostentatious spending, the best known example being the potlatch of the Kwakiutl and other Indians of the American north west coast. The production of subtle and highly contrived human artefacts, and indeed artistic activities in general, can also be regarded as ritualisations. Artisans spending their life in carving a cathedral door will use considerably less resources and cause correspondingly less pollution than if they were employed in an automated ball-bearing factory. Also the finished products of their activity do not interfere with the optimum functioning of their society, as do the utilitarian consumer products manufactured by modern industry.

It must be remembered that the stable family, a *sine qua non* of the stable society, is, like the latter, an economic as well as a biological unit, and it is difficult to see it surviving in a society in which food, clothing, and other basic requirements normally produced at a family level are manufactured by some vast company and available in the local supermarket. Nor can it survive when the functions normally fulfilled by the father have been usurped by the government's social services: (education, welfare, health, etc.).

The same is true of the small community whose survival is menaced by the ever greater centralisation of indus-

trial activity required to fully exploit the so-called economics of scale, which manifest themselves as production becomes increasingly capital intensive. In such conditions a small community is either deprived of its livelihood or forced to commit itself to the production of a specific commodity which must seriously affect its basic social structure as well as rendering it particularly vulnerable to changes likely to alter the demand for the commodity in question.

On the other hand economic activity geared to the production of non-utilitarian commodities, such as works of art, has no adverse effect on social structures. If anything it is likely to reinforce them by causing the society to devote itself to those religious, artistic, and other cultural activities that distinguish it from its neighbours, and on which social structure largely depends.

We are thus led to the paradoxical conclusion that to preserve stability and thereby ensure the survival of a social system, energy should be channelled from the production of utilitarian products to that of non-utilitarian ones.

Random information

As already mentioned, learning is very similar to other behavioural processes. The generalities of the information are contained in the rudimentary model present when the process starts, and are differentiated step by step through interaction with each new environmental situation. Information must be introduced in a specific order and from a specific source. This is clear if one considers that in the case of a social animal the learning process occurring during ontogeny is designed to enable a child to fulfil its functions as a member of its family and community. Education is, in fact, nothing more than socialisation. In a feedback system the information enabling the system to react to a particular part of its social environment must be obtained through contact with that specific part of the environment rather than from some arbitrary source.

At all levels of organisation, interference with the learning process must cause serious systemic disruption. Thus when the information contained in the genes or the nucleus of a cell is modified by radiation or chemical action, the model ceases to represent its environment adequately, interpretations of environmental signals will be wrong and the responses mediated unadaptive.

If the feedback loops linking the system to its environment are severed, if behaviour becomes "institutionalised" as in the case of modern government, then behaviour can no longer be influenced by all relevant environmental requirements and from the point of view of the supra-system it must become random.

The introduction of random information into the system from the outside must have a similar effect. Unfortunately, as our society "progresses" so its inhabitants tend to be bombarded with ever greater quantities of it. Obvious sources are television personalities, newspapers, and, unfortunately, one must include to an ever greater degree our educational system which is increasingly institutionalised and centralised, and hence ever less capable of fulfilling its basic function: that of providing that information which will enable people to fulfil their functions as members of their (disintegrating) family and community.

A system will only tend to detect and interpret signals which are relevant to its behaviour pattern, i.e. will affect the value of the variables used. This means that random information which is irrelevant to a man's behaviour pattern is likely to be filtered out. However, as the environment changes, and the signals become more relevant they are more likely to be detected. It is more difficult to filter out random data in childhood. A childs' brain is not designed to encounter random data, normally excluded as much as possible from the protective family environment. Also in the child's case it will do more damage by affecting the generalities of the learning process, which will colour the subsequently developed particularities of his world-view.

The growth of instability

Once changes occur beyond the system's environmental parameters, it is no longer possible to deal systemically with its challenges. Some of these the system will not even have the means of detecting. Thus we are not provided with mechanisms for detecting the 3,000 or so chemical additives which are introduced into our food, nor, for that matter, the pollutants, such as heavy metals, pesticide residues, and radio-isotopes which also find their way into it, and into the water we drink and the air we breathe. We thus have no means of behaving adaptively towards them.

Even when we are capable of detecting the presence of asystemic elements, the tendency is to mistake them for outwardly similar elements of which we have some phylogenetic and ontogenetic experience. In this way dangerous pollutants such as strontium 90, for instance, are introduced into our life-processes. In incorporating them, we are achieving a new position of equilibrium, one, however, which reduces rather than increases stability.

The same can be said when we combat stunted plant growth—caused by sulphur-dioxide pollution—by breeding less vulnerable plants, rather than by eliminating the source of the pollutant; or when we combat increasing urban crime with burglar alarms and armoured cars, rather than recreating the social conditions in which crime is minimised.

Stephen Boyden refers to such reactions as *pseudo-adaptations*. They tend towards an equilibrium position—one in which stability is reduced rather than increased. This must be so because they are designed to satisfy a single supra-systemic requirement, rather than to provide the optimum compromise between the various supra-systemic requirements, thereby leading to increased stability. They must, by their very nature, create further disequilibria, giving rise to further pseudo-adaptations, leading to further disequilibria etc—hence causing the system to proceed ever more rapidly towards inevitable breakdown.

I prefer to refer to such reactions as *asystemic*. Practically all the behaviour of our industrial society falls within this category.

The mechanism whereby asystemic responses are mediated at a higher level of complexity, i.e. at the level of a human society is an interesting one.

It is known that perception is not an objective means of acquiring information. The perceiver tends to see what he expects to see, i.e. what in the terms of his particular model he can predict is likely to be there. Extremely unpleasant situations whose correct interpretation would be intolerable to him, i.e. would lead to the breakdown of his mental equilibrium, or his

personal control system, he will tend to re-interpret in such a way as to render them tolerable. What is true of individuals is also true of society. A society will tend to interpret asystemic situations so as to render them acceptable. Thus any information whose correct interpretation would lead one to cast doubt on the basic tenets underlying the society's model or world-view is almost certain to be interpreted so as to ensure their reconciliation.

A schizophrenic behaves in the same way when he persuades himself that he is Napoleon or Julius Caesar in order to render tolerable an otherwise intolerable situation. Those scientists who stubbornly refuse to face the realities of the present environmental crisis are behaving in like manner.

In the words of Professor Jay Forrester, once the environment has changed sufficiently it becomes "counterintuitive", i.e. normal human intuition fails to provide satisfactory interpretations of it, then responses must be "counterproductive".

The runaway social system

Unfortunately the system's instability will tend to increase by positive feedback. This means that the asystemic corrections required to restore, however precariously, the environmental conditions in which the system can function must become of an ever more radical nature, causing ever greater disruption, and hence still further increasing instability. Thus in our industrial society, measures required to bridge the widening gap between population and food supply are becoming ever more desperate and ever more destructive of the soil's food-producing capacity. It is no coincidence that 4 billion acres of desert have been created in the last 70 years.

As measures become increasingly desperate, so they tend to become ever more dependent on advanced technology and capital-intensive, highly centralised industry, putting an ever greater stress on natural resources and generating an ever greater amount of pollution. Human activity also becomes increasingly utilitarian to the point where ritualised behaviour tends to be regarded as anti-social and unethical in that it does not contribute towards providing the temporary relief of increasing human misery, thereby rendering the whole process more tolerable, helping to perpetuate it, and in the long run further increasing human misery.

Unfortunately, the society's principal institutions must inevitably be caught up in this process.

Government

The behaviour of government can be predicted with reasonable accuracy. First of all its members are likely to be imbued with the same values as the rest of society. They will therefore attempt to accelerate rather than counteract prevailing trends. Also, like all institutions, it is interested in self-perpetuation. This means that first of all it must obtain votes, which in turn means pandering to public opinion, i.e. to the basic values underlying the society's world-view. As the society disintegrates so will these values come to reflect more and more the requirements of the alienated individual rather than those of the family and the community; so will they become more trivial and short-term; and so will their satisfaction further reduce the stability of the society as a whole.

In order to perpetuate itself the government also requires finance. This it can obtain by encouraging industry and taking all those measures designed to increase the gross national product. Unfortunately this simply means introducing ever more surplus energy into the supra-system and hence ever more asystemic controls, which, as we have seen, can only increase instability.

It is illusory to suppose that any government will subject such considerations (conscious and subconscious) to that of ensuring the long-term stability

and hence the survival of the society it has been called upon to direct.

Industry

Industry is also interested in self-perpetuation and requires finance for this purpose. It depends at present on continually increasing the gross national product, hence on introducing more surplus energy into the system, and corresponding asystemic controls. The restoration of self-regulating controls is unlikely to be encouraged since these involve the replacement of energy consuming asystemic controls by energy-conservative systemic ones. In fact it must in the long run mean a considerable reduction in the GNP, and hence in industrial activities (see Figure 3).

Nevertheless it is by diversification and decentralisation and generally by co-operating in a long-term stabilisation plan that industrial activity can be maximised in the long run. The problem with industrialists as with politicians is to make them see beyond the pressing short-term problems that beset them. There is little sign of this happening.

Science

It may be surprising that science has not contributed towards reversing the present "runaway" situation. However, scientists are also people and as such are imbued with the same set of values as the rest of society. It is nevertheless surprising that they should have accepted the world-view of our industrial society "hook, line, and sinker". Indeed rather than serve as the critics of our technological society and offer us some protection against its worst abuses, they have been as involved in it, as instrumental to it, as the technologists and industrialists who have exploited their "discoveries". Functionally speaking, they are its priests. It is they who have formulated the world-view that provides its rationale, and they who have couched it in the most up-to-date "scientific" terminology and supported it with a wealth of empirical data, which confer on its principal tenets a degree of indubitability seldom enjoyed by religious dogmas.

What is more, this priesthood is backed by massive government subsidies and its prestige and influence is as great as that of the most firmly established of conventional religions. However its prestige and government backing is largely dependent on its ability to make discoveries that can be exploited commercially: new antibiotics, pesticides etc. Like other priesthoods, it has reserved for itself the sole right to dispense the *mana*, or vital force whose accumulation in terms of the current *Weltanschaung* is a measure of one's power over nature. In our society this "power" is called "scientific knowledge".

This is defined in a very subtle way. It only refers to data accumulated as a result of experimentation. Information deduced from basic principles does not qualify unless it can be "tested" empirically in the artificial conditions of a laboratory. Thus it is obvious that broad spectrum pesticides cannot possibly work, as they accumulate up food chains and thereby do more damage to the predators than to the target species that they control. In the same way it is quite evident that efforts to eradicate infectious diseases by waging chemical warfare against their vectors must be counterproductive since one is thereby substituting a precarious, highly simplified, externally controlled, and hence very unstable device for a much more complex set of highly stable self-regulating controls. However, such information is not regarded as constituting "scientific knowledge" because it is not backed by sufficient experimental data. Needless to say, this can only be acquired by trying out these iniquitous devices, thereby providing our technologists and industrialists with the green light (see Figure 4).

For science to have a stabilising role in society, it must be regarded as non-utilitarian, as it was with the Hellenes, and also its epistemology and methodology must be radically reformed, so that it can deal with the components of the biosphere teleonomically as parts of the same long-term process, and not just experimentally as separate (random until proved otherwise) entities.

The outcome

It is easy to predict the outcome of the runaway process our society finds itself in. Disequilibria will become increasingly difficult to correct. Eventually the situation will be such that no expedient will be available to prevent total collapse.

The question we must ask is whether or not there is a means of reversing the process. In order to do so, we must seek to understand it in greater detail. It is hoped that this article provides some of the material required to permit the building of a model of the process involved. It then remains to determine a detailed programme of change on the lines of the *Blueprint for Survival*, designed to restore some semblance of stability.

A team of people brought together by the *Ecologist* has set itself this task, and hopes to report on the results within about a year.

Rubbish dump blues

by Roger Housden

The recycling of garbage appears to be one of the latest of many part-solutions to environmental problems. Why is so little done then? This article examines the potential contribution of individuals and government with special reference to paper.

One of the most obtrusive environmental issues of all is the waste we spew out every day. Not only is rubbish a large scale pollutant of river, soil and city, but the greater proportion of it consists of the very raw materials that the planet is becoming so short of. The solution, then, might appear fairly straightforward. Concerned individuals could surely help matters by recovering waste materials like paper, which accounts for at least a third of all domestic rubbish, and metals, and returning them back to the manufacturer for recycling. This is what Geoff Bradley does, and he's making a roaring success of it.

Geoff Bradley's interests, however, do not lie in conservation. He is an astute and rigorous business man. About three years ago his youngest son lost his sight. When, several successful operations later, it was regained, Bradley's gratitude was such that he immediately decided to dedicate his talents to raising funds for research into blindness. He decided in 1970 to go into the waste paper business to raise funds for the Institute of Ophthalmology. He spent four unpaid months looking into the mechanics of the trade, and launched the "Fight for Sight" campaign with a £17 press conference in September 1970. Within a fortnight he had a waste paper merchant collecting from almost 300 London schools and paying him £6 a ton. Collection, however, was inefficient, and schools were dropping out of the campaign as fast as they were joining it. So the Institute gave Bradley a warehouse and he went round in a van collecting the paper himself.

By February 1971 the waste paper market had sunk to such a low ebb that Bradley was unable to get rid of his paper. Waste paper is graded into a considerable number of qualities, and domestic waste, which consists mostly of newspapers, rates among the lowest. Instead of handing over the £1,200 he had made to the Institute, he decided to invest it in an attempt to specialise in the collection of computer paper, which is one of the high quality waste papers that is always in demand and always fetches a high price. He made an exhaustive list of all the computer installations in the country, and discovered that most firms threw their waste away, while others were throwing their punch cards in with their scrap and consequently getting no more than a nominal sum for it. He visited every firm with a computer in London and asked them to donate their waste to "Fight for Sight". Most of them agreed. Those who didn't he came to a cash agreement with. "Fight for Sight" posters are in almost every punch-op's room in London. The campaign is now far and away the largest collector of computer waste in the country. By May 1972—in less than two years—"Fight for Sight" had grossed over £40,000, with a net profit of £22,000. In two years from now Bradley expects to have extended the campaign to Birmingham and Manchester, and after that the aim will be to run at what he considers to be the maximum possible turnover of £1,000 a week.

Highlighting potential

Geoff Bradley would be the first to admit though that this success in finding a loophole in the long established and apparently well covered scrap market does not point the way for those seeking a means of activating their concern for waste disposal and the conservation of raw materials. The importance of Bradley's success to the conservationists' front is rather that it highlights directly and simply the potential value of the things we throw away. For until we, the general public, become aware of this in a more specific manner, very little is likely to be done about it.

We siphon off materials from the earth, we put them through a production process, and we squeeze the bulky residue out of the other end on to the municipal rubbish dumps. The more we can increase the throughput, which we call the Gross National Product, the better we think we are doing. However, recent research by the Warren Spring Laboratories has suggested that £1 an hour net profit could be made from extracting the metals like brass, lead and zinc that are left in the incinerated waste of a well populated borough. One river in England was recently found to be dangerously polluted with nickel. Even with the market in its present depressed state, nickel is worth £1,000 a ton. Last year we imported 2.7 million tons of raw wood pulp at a cost of £160 million. Two thirds of this is to be found on the rubbish dump.

No full scale solution to this predicament could be achieved at present, though, by attempting to follow Geoff Bradley's example, because the whole market system we live under is just not geared to long term planning and accounting. Industry would be unable to accommodate more than a few men like Bradley because, with its guiding principle of maximum profit in the shortest possible time, it is simply not structured for the effective recycling of its raw materials. Materials are at present only recycled to the extent that it is immediately economic to do so. The British Steel Corporation, for example, could not operate without the scrap which makes up 50 per cent of its raw material. An electric arc furnace can operate on 100 per cent scrap, yet

because the cost of electricity is high BSC prefers to instal oxygen furnaces, which can digest only 30 per cent scrap. Meanwhile £3½ million worth of scrap iron was left uncollected last year.

Paper frustration

In a similar way, the paper industry finds it economically expedient to use lower grades of waste paper for little else than the production of packaging. Because demand for packaging has been very low for some time now, the manufacturers are most reluctant to buy up the lower grades of waste paper. Both here and in the US waste paper collection has been a favourite campaign among conservation groups. More than one has known the disappointment of a North London group which was offered £1 for the ton of newspapers it had so arduously collected. Others are pressuring local councils in the hope of convincing them of the need to recycle the paper in their refuse. Efforts such as these do promote a certain degree of local awareness of the issue, but they can never properly operate on a larger scale until industry has decided to fully exploit all the possible uses of recycled material.

It certainly lacks no opportunity. With all cardboard and heavy packaging already being produced from 95–100 per cent recycled paper, newspaper production now offers the paper industry the greatest scope for the use of low grade waste paper. The Garden State Company in New Jersey has patented the only equipment which at present produces newsprint—the paper used for our newspapers—from 100 per cent reclaimed paper. Reeds and Bowaters share the English newsprint market about equally. Reeds have developed a de-inking process that has enabled them to produce newsprint with a 30 per cent content of reclaimed paper, the other two thirds still being raw wood pulp. Reeds maintain that it is only their de-inking process that makes newsprint production a viable enterprise in England. Bowaters import all their newsprint from Canadian subsidiaries. It contains no reclaimed material at all.

It is technically possible to have our newspapers, which constitute the bulk of our waste paper, printed on much the same material day after day. But Bowaters' capital equipment is based on production from raw wood pulp, and they are heavily committed to logging subsidiaries in Canada. So all the newsprint they produce has a lifespan of a day. Reeds will have soon developed the technical know-how to produce newsprint from 100 per cent reclaimed material, but how prepared they are to pump capital into their theory and turn it into practice is entirely another question.

Obstacles to reclamation

Other than in the production of packaging and newsprint, lower grade waste paper is hardly put to use at all in England. Yet it is possible to re-use newsprint and similar kinds of products that at the moment consist entirely of virgin wood pulp. There is no technical reason why reclaimed paper could not be used to make all the bags and flimsy packets that we carry from the supermarkets to the dustbin, and even writing paper and books—particularly paperbacks—can be made without the use of any virgin wood pulp. Many large American firms now use notepaper made from reclaimed material. But with these grades as with newsprint, long established trade and investment policies, with their complicated bonds and commitments, are among the greatest obstacles to reclamation. Wiggins Teape, the largest UK producer of high grade paper, has forestry concessions and machinery geared to production from raw wood pulp. Reeds, and particularly Bowaters, are in the same predicament.

Another difficulty, by no means insuperable, is that of customer satisfaction. There is still a stigma in the public mind about materials that have been used before. Food package designers with a sizeable budget will tend to use the more expensive and more attractive card with a content of virgin wood pulp. Recycled paper cannot make a product as white as virgin pulp, and it seems that, for the moment, at least, we prefer more whiteness to more forests. One advertiser using the *Sun* and the *Mirror* complained to Reeds that their advertisement in the *Mirror*, which is made from recycled paper, was somewhat greyer than the same advertisement in the *Sun* which is made from wood pulp.

Reeds themselves, however, must bear some of the responsibility for customer reaction such as this, for they have made little concerted public effort to brighten the image of reclaimed paper—probably because they are as yet not entirely committed to reclamation themselves. Recycling is still an experiment for Reeds, an experiment taken on as a measure against the ever deepening inroads being made into the domestic market by the Scandinavians, who have a ready supply of raw materials.

For company policy, far from being planned in a comprehensive and long term manner, consists more in a series of responses to the capricious temperament of the market. The business section, then, floundering in its own vicious circle of supply and demand, will hardly be the first to attempt a shift towards a new set of priorities. If any radical change in attitude towards the conservation of our natural resources is to occur, there can only be a national effort initiated by government action. In response to the pressure of war, and the difficulties of importing wood pulp, Churchill's government mounted a full scale campaign for the reclamation of the country's waste paper. The pressures today are spiralling towards a crescendo more damaging than they have ever been. There is no sane reason why the present government cannot do for all materials what Churchill did for paper.

What government should do

The government is industry's biggest customer. The first step it could take would be to state a given time, say five years, by which all the paper it buys must contain a certain percentage of reclaimed material. At the same time it could declare a tax on the use of all raw materials. The same stipulation could be applied to the other raw materials it buys. The US government has already brought this ruling into action in the case of paper, and is currently studying its application to other raw materials. A decision such as this by industry's largest and most powerful customer would inevitably be followed by the smaller customers. Industry would then be obliged to meet this changed demand.

The necessary supply of waste paper back to the mills would largely be met by local councils, who during the time allotted for conversion to the use of reclaimed material, could remodel their waste disposal system to resemble the one operated by the borough of Worthing, which has been geared to reclamation for fifteen years. Worthing's residents separate their waste paper

from the rest of their rubbish, and the Council collects it in a separate container and sells it back to the industry. The Council also extracts and sells metals, glass and rags contained in its refuse.

The preparatory period would also be necessary for concentrated local and national publicity campaigns, whose aim would be both to increase public awareness of the need for reclamation and to encourage the individual to take part in the campaign. Worthing's reclamation system only works because residents dutifully separate their rubbish at source, and in this respect the borough's continual publicity campaign, involving a personal canvass on every household, posters, handbills, and constant advertising and statements in the local press, has been vital.

An industry's blithe unconcern

Breathing space would be needed for the packaging industry too. At present it rarely considers what happens to its products once they have been disposed of. Our tin cans are extremely difficult to reprocess because the tiny film of tin is not sufficient to be worth saving, and yet it contaminates the metal that forms the rest of the can. Aluminium lids make the process even less worthwhile. Paper packaging that is laminated with a plastic film coating may look nicer, and may be more waterproof, but it cannot be recycled. Of plastic milk bottles nothing needs to be said.

No reclamation policy would get very far without an intensive research programme. The government, then, would, have to commit itself to investing far more in research than it does at present. It was the last Labour government, through the now defunct Ministry of Technology, which gave Reeds the initial funds to research into de-inking processes. The only government sponsored reclamation research being carried out now is by Warren Spring Laboratories who are only undertaking small scale work. The Department of the Environment is doing precisely nothing about the issue.

Ultimately, of course, recycling is no lasting solution in a situation of constantly rising demand. It is, after all, only a way of conserving what we have, and not a method of increasing our basic stocks.

The changes in attitude required can only come gradually, and unfortunately are usually only developed by force of necessity. In the meantime, the effective recycling of the resources we have, coupled with a tax on the use of raw materials, is something we could start on now, and could be one of the first steps towards the more lasting solution.

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

11-12 January 1973—Ecological Problems in the Food Industry. Technological Symposium 1973 at the Tel Aviv Hilton. Speakers include Prof. S. Goldsmith, Dept of Food Science and Nutrition, Massachusetts Institute of Technology who will speak on the Utilization of Food Industry Wastes. Further information: Moss Murray, Voice and Vision Ltd., 26 Upper Brook St., London W1Y 2DQ. Tel. 493 6050.

11-13 April—The Changing Flora and Fauna of Britain. Symposium held by the Systematics Association at University of Leicester. Further details: Dr Paul Parker, Botanical Laboratories, University of Leicester, LE1 7RH.

30 May-2 June—Third Annual Health Foods, Beauty and Slimming Exhibition, Central Hall, Westminster. Further details: Graham Claringbold, Marketing Exhibitions Ltd., Milton House, 25 Oakhill Road, London SW15 2QJ. Tel. 01-874 2374.

3-7 June—Man's Impact on the Canadian Flora. Annual Meeting of Canadian Botanical Association at University of Western Ontario, London, Ontario, Canada. Further information: Chairman, Local Arrangements Committee, C.B.A./A.B.C., Dept of Plant Sciences, University of Western Ontario, London 72, Ontario, Canada.

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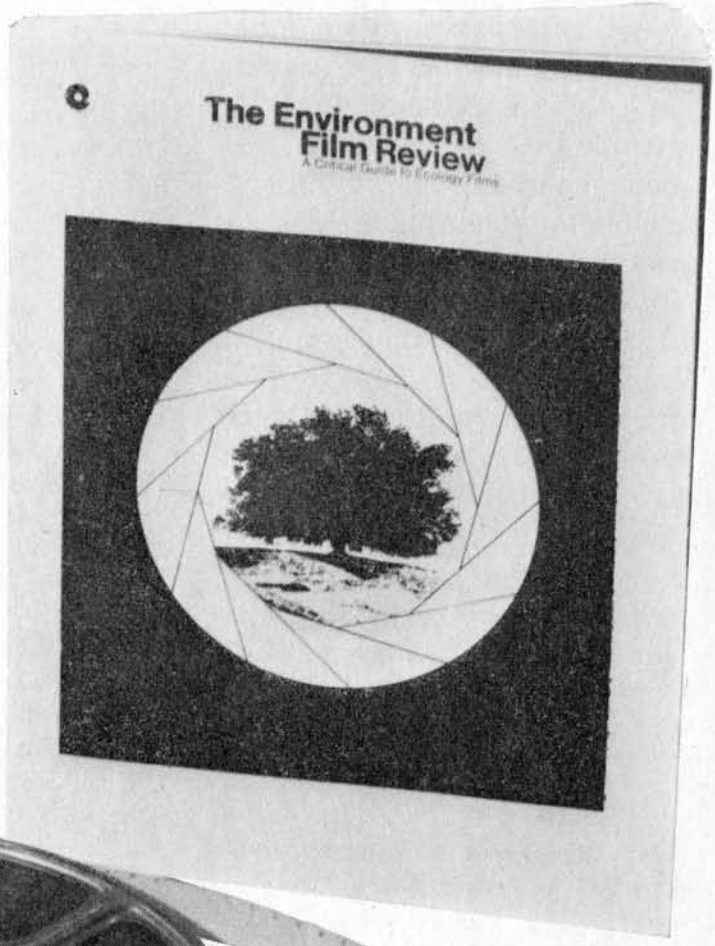

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Should we forbid smoking?

by Dr. Allan Chatelier and Robert Waller

The authors suggest that the object of government legislation and research should be to find ways of making smoking harmless. Evidence which has been ignored in this country points to the curing of tobacco as the reason why it now causes lung cancer. Where naturally dried tobaccos are still smoked, lung cancer is no more a problem than tooth decay where unrefined foods are still eaten. Is it possible that we have to suffer the high incidence of lung cancer in order that tobacco should be cheap enough to be an article of mass consumption or that tobacco companies can increase their profits by speeding up the time taken to cure tobacco from three months to six days? Why has this possibility been so neglected?

The report in *The British Medical Journal* (22 October 1971) that smoking cigars is relatively harmless to health compared to cigarette smoking calls attention once more to the difference between tobaccos that have been air-dried and those that have been flue-cured, that is artificially heated to speed up the curing process. Cigar tobacco is air dried and cigarette tobacco is almost entirely oven dried. At the Chester Beatty Research Institute a team led by Professor R. D. Passey treated rats to the smoke from the two kinds of tobacco. In their report they conclude: "The smokes of flue-cured tobaccos are more dangerous to man and to animals than those of air-cured tobaccos." In Britain, they say, the main bulk of tobaccos used in cigarettes are made of either air-cured tobacco or of a blend of these with flue-cured tobacco in varying quantities. This might account for the different lung cancer mortality rates in different countries.

This is by no means a new suggestion and only confirms research already done in some other countries. What is astonishing is that we have had to wait so long in this country for confirmation of the wilful indifference we have shown to previous attempts to prevent the flue-curing of tobacco.

In December 1962 a letter appeared in *The Lancet*:

CHANGES IN CIGARETTE MANUFACTURE AND LUNG CANCER

Sir—When cigarette smoking took precedence over pipe smoking, the economics of tobacco manufacture underwent a change. Tobacco for the pipe must be moist: while for making cigarettes it must be relatively dry, so that the cigarette never becomes soggy or collapses when lit.

Between reaping and manufacture, tobacco should go through a vital process of fermentation akin to the turning of raw green grass into ripe sweet hay and in much the same way—by bulking—during which process it undergoes chemical changes and sweats out irritants, and mellows. For this to occur some moisture must be left in the tobacco after it is "yellowed", by hanging it up to shrivel. When warm spring weather comes this retained moisture allows the tobacco to ferment. The process can be repeated (though to a lessening degree each time) for four or five successive seasons. With each successive sweat the tobacco mellows like wine when ageing and becomes correspondingly cooler when it is smoked.

Before the 1914/18 and 1939/45 wars tobacco was kept in warehouses for at least 18 months to allow for the two whole ripening processes. Under the pressure of a sudden and inflated demand (each of the wars greatly increased the demand for cigarettes) manufacturers and growers lost sight of the vital need for adequate fermentation. In their endeavours to keep supplies of tobacco abreast of the war-inflated demand, as well as to make up the loss of stock through submarine warfare and bombing of docks, growers and packers embarked on a revolutionary change in the curing of tobacco.

Vast changes took place in some of the overseas packing plants more particularly in Rhodesia, where the growers, because of the dryness of the climate, had already been trying to remedy the lack of "body" or substance in their tobacco.

The effect of this on the brighter, flimsier cigarette tobaccos—already hotter when smoked than the redder, fleshier pipe tobaccos—was disastrous. Sometimes oven drying was carried to the point of more or less denaturing the tobacco, and depriving it of any chance of fermentation. Hence much of the "grass", although yellow, retained the irritants, tars etc. which would have been sweated out by proper fermentation.

The term "gasper" was applied to cigarettes before 1914; it applied originally to a cheaper type of cigarette, mass produced from American oven dried tobacco, as compared with the more expensive (often hand-made) cigarette made from naturally cured tobacco: and the most notable result of the 1939/45 war on smoking habits in this country was the rise of the "gasper" to the position of the most universally smoked cigarette.

Is it unreasonable to suppose that the heat generated in cigarettes, made in some cases from excessively dry and inadequately fermented tobacco, is at least a contributory cause, if

not a primary one, of cancer of the lung?

London, NW4. *T. Constantinides.*

This letter was wholly ignored. Two years later a paper was published by Dr Jan Beffinger, a Polish agronomist and authority on the fermentation of tobacco, whose investigations showed that the increase of lung cancer was related to the introduction of the American type tobaccos into the European countries. These tobaccos replaced the oriental type of cigarettes which were enzymatically fermented. Dr Beffinger stated that it was the lack of full enzymatic fermentation of the tobacco leaves that was responsible for the carcinogenic action of the smoke. This report was also ignored.

The Chester Beatty team confirms Dr Beffinger's claim that oven drying prevents the full enzymatic fermentation of the leaves. As cigar tobacco is dried without artificial heat, the enzymes are not inactivated at the relatively low temperatures, so that natural fermentation is not interrupted; this fermentation breaks down the plant sugars. At the end of the three months drying process—as compared to a week with the oven dried tobaccos—only traces of sugar remain. The high sugar content of cigarette tobaccos makes them acid, while cigar smoke was found to be alkaline.

The dangers of acid cigarette smoke has been noted by research done in the Soviet Union on the relationship between smoking and lung cancer. One of the first reports by Dr A. B. Savittsky of the USSR Academy of Medical Sciences stated that there was no relationship between the smoking of Russian cigarettes (made from enzymatically fermented tobacco) and lung cancer. This statement was backed up by the experimental research carried out for the Moscow Ontogenetical Institute by Dr D. P. Szotadze with tobacco tar extracted from the smoke of tobaccos produced in Eastern Georgia. He found that this tar has no carcinogenic effect on laboratory animals. Professor R. D. Passet, in recent experiments, found that rats exposed to cigar tobacco suffered little or no damage to the respiratory system, while cigarette smoke caused severe and usually lethal damage. The Passey team also reported that cigarette tobacco yielded more tar but less nicotine than air-cured tobacco.

The Russians do not deny that they have cases of lung cancer, especially in industrial areas, but their Ministry of Health has clearly stated that they do not face this to anything like the same catastrophic degree as in the UK and the US. In this article we are not claiming that artificially dried tobacco is the sole factor in lung cancer, but that it is sufficiently implicated to justify its prohibition, as in East Germany. The official statistics (1958) showed that lung cancer in the USSR and in Poland was 6 per cent of the total tumours while in Britain it was 26 per cent (1960). Both Poland and the USSR use enzymatically fermented tobaccos.

Control over the tobacco industry

Tobacco products are blended from different tobacco varieties and processed in different ways: consequently they have many different chemical compositions. Which varieties are used for blending is the "secret" of the manufacturers. There is still no legal way in Britain and the US of checking it and of making comparisons. Such a control is, however, imposed in East Germany by the State Tobacco Research Institute at Dresden. The Institute tests the tobacco leaves used, including blended products, for assessing their degree of enzymatic fermentation. They use the Russian "oxygen index" method based on the amount of oxygen being absorbed by the fermenting leaf. A well fermented leaf does not absorb oxygen. The State Institute is particular that the tobacco should be completely enzymatically fermented before it is taken for manufacture. The credit for this goes to Professor C. Pyriki, the Director.

How much longer can we ignore these findings?

The reluctance of the British and American governments to take this research seriously has several possible explanations. There is an apparent conviction that there is a straightforward relationship between lung cancer and tobacco smoke. This is far too simple a conclusion: but the implications of assuming it need to be stressed. It means that thousands of people must go on dying of lung cancer because we are content merely to say "Stop Smoking; if you don't the consequences are your own fault". The facts show that most people who are heavy smokers cannot give it up. Wouldn't it be better to lessen the risk by banning oven-dried tobacco? To say "Stop Smoking" is very like telling people that if they get malaria it is their own fault for letting themselves be bitten by mosquitos. The correlation between mosquito bites and malaria was only the beginning of Ross's research, not the end.

The simple correlation between smoking and lung cancer established by the investigation of Professor Richard Doll seems to have put the medical profession to sleep. This acceptance of a single factor explanation is unworthy of their standards of excellence and rigour of proof. Clearly smoking and lung cancer involve more factors than one. In this article we have suggested that it is not all tobacco but tobacco cured in a new way that is the primary cause. There may be other contributory causes. Doll reported that smokers in urban areas had a higher incidence of cancer than those in rural areas: the rise in lung cancer can be correlated with the rise in the use of "Derv", which deserves investigation. There may be a synergistic effect. In any case Doll's investigation, based on doctors over 35, did not satisfy the numbers required by probability theory to establish near certainty; most extraordinary of all it ignored the anomalous fact that the statistical findings did not apply to countries like the USSR, Poland, Spain and Japan, where people smoke just as much as they do in Britain.

The single-factor attitude is a council of despair, for we know that it is beyond the control of so many people to stop smoking that the cigarette industry is hardly affected. Do the economics of the industry play a part in suppressing research into oven-dried tobacco? The economic value of cutting down the curing time by months goes without saying. Hence "instant" tobacco lines up with so many other cost-cutting techniques in food production that ignore biological consequencess.[1] The destruction of the enzymes by heating is similar to the removal or destruction of enzymes, vitamins, trace elements and fibre in the refining of carbohydrates. Tobacco is thus among the natural products rendered deficient in essential substances by modern food technology and hence we can classify lung cancer as yet another disease of civilisation.

[1]Some of these are described in *Just Consequences*, ed. Robert Waller (London: Charles Knight).

Two fables by Wolf Mankowitz

The Night of the Men

The moment had arrived when Women were able to fight, organise, procreate and satisfy one another without the assistance of Men. So they decided in a single night of long knives to slaughter the males of the world.

The leaders of the Women planned the Night of the Men with total efficiency, so that in the space of a few hours the entire male sex was wiped out and the sun rose upon a planet free of oppression, war, inequality, power-politics and sexual slavery.

Women ran industry and the security services, took over bureaucracy and discussed and settled the world's problems in an atmosphere of amity the human species had never before known.

And so things continued for a while until, imperceptibly, the more dominant women started to grow beards and their slaves began to plot another Night of the Men.

The Secret Saints

The power of Man had grown as great as his folly, and the end of the world was imminent, so that the Secret Saints by whose unrecognised human goodness life has always been preserved at the very edge of the abyss, decided to meet together.

So from the ends of the Earth the Saints travelled, thirty-six nondescript and tattered elders about to reveal themselves for the first time at this critical moment in human history.

But in Paris they were moved on from the bridges of the Seine, which a zealous Minister was clearing of beggars in preparation for a great International Peace Conference. And in London their assembly was broken up by a group of militant Pacifist demonstrators. And in New York they were set upon by Blacks who resented the fact there were not more Negro saints represented. And in Moscow they were accused of bourgeois idealism. And in China they were locked up as Russian Imperialist spies. To Israel they were not admitted because some of them were not Jews, and in Arabia they were instantly recognised as Jews and held hostage. And wherever they went upon the face of the Earth their assembly was banned, and their merciful intercession in Man's destiny prevented.

So that the meeting of the thirty-six Secret Saints upon whose unrecognised goodness the survival of Man depends, has not yet taken place, and consequently the power of Man continues to grow commensurate with his immeasurably destructive folly.

The Conservation Society and Labour's new programme

When the main opposition party undertakes a major re-thinking of its entire political programme claiming to put forward longer term proposals which might take up to ten years to implement, as well as proposals which could form the basis of its manifesto for the next general election, then conservationists will especially be looking for signs of fresh thinking and a recognition of new political concerns.

Seen against this long term background *Labour's Programme for Britain*, published in August by the party's National Executive Committee, is a considerable disappointment. Not for what it contains, which so far as it goes is largely acceptable to conservationists, but for what it does not say.

Labour's Programme is all the more disappointing in view of the well-publicised process of participation with which the job of assembling it began. If this document accurately reflects current Labour thinking on conservation and the environment then the party is living in the past.

Fortunately it is explicitly not a manifesto but is published as a basis for discussion throughout the country. The National Executive Committee extends an open offer for suggestions as to how its proposals can be improved. The Conservation Society has accordingly decided to produce a *Conservation Manifesto*, which will be submitted to the Labour Party. All members will be asked to say what they would like to see included. If you are not yet a member and would like to participate please apply to John Davoll, 34 Bridge Street, Walton-on-Thames, Surrey, KT12 1AJ, for membership.

In the coming 12 months the National Executive Committee will continue with its work on the programme. There will be further consultation with local constituency parties on specific policy issues and the work of various study groups will be fed into the policy-making process. A shorter document, taking into account this work and debate and decisions at this year's conference, will be put before the 1973 conference, recommending priorities for the next Labour manifesto. This will be *reflected*, the National Executive Committee says, in the election manifesto.

What, on the basis of the work done so far, is the Labour Party likely to offer the voter interested in conservation and the environment at the next general election?

We are told that the National Executive Committee has in hand a study which aims to produce a comprehensive plan for the environment, and this study will certainly include: a stringent statutory code of practice, with severe penalties, to govern the disposal of toxic waste; standards for motor vehicle exhausts; the replacement of the Alkali Inspectorate; a pollution levy on firms causing pollution; municipal enterprise in the business of recycling; tighter restrictions on noise levels for motor vehicles; tighter control over aircraft noise. Elsewhere in *Labour's Programme* we are told that a free family planning service must become universally available.

These proposals are mostly acceptable as far as they go but the question is, Do they go far enough? The answer must be an emphatic No! They might be regarded as the beginnings of an "environmental" platform for the next general election—even if a not particularly inspired one—but they do not amount to a long term policy on the environment and resources.

Labour's Programme for Britain displays an extraordinary narrowness of vision. It is as if the United Nations Conference on the Human Environment and all the public discussion in recent years on questions on population, resources, pollution and the environment and the interaction between them had never taken place.

It would have been too much to expect the Labour Party to put forward a fully-articulated set of proposals to deal with the kind of conservation/environment problems which have come to the fore in the last few years because no one can claim to know all the answers. But *some* of the answers are known and we also know the general direction in which society ought to be moving.

Where *Labour's Programme for Britain* fails so utterly is that it shows no awareness at all that rapid population growth combined with rising real incomes, in a world of diminishing natural resources poses problems which ought to be at the centre of political concern.

In fact the meagre proposals contained in this document can be regarded only as an apology for a policy on conservation and the environment.

The Labour Party does not appear to have woken up to the fact that, whether it likes it or not, conservation and the environment are now very much on the political agenda, that a growing number of people think these matters important and that they have votes. The upshot of this is that the party which makes the most positive appeal to the conservationist vote stands to gain considerably.

In the 1960s the Labour Party attracted the support of many uncommitted middle-of-the-road voters, not because its political programme was generally liked but because the Labour Party was judged to be more liberal on the pressing social questions of the day.

Will the conservationist vote be as important in the 1970s? And if so, which party will get it? Labour, Conservative or Liberal?

Coming this Fall in Technology Review

"The Moscow agreement (on arms limitation)...required political courage and diplomatic skill....Never before in the history of the human race was a decrease in weapons perceived as contributing to the security of a country."—Kosta Tsipis, Laboratory for Nuclear Science, M.I.T.

"The energy flux caused by man (including the combustion of fossil fuels and the liberation of atomic energy) is still small compared to the total energy flow within the biosphere....But the energy flow and entropy production of our present civilization are already too large to maintain the entire ecosystem in a stable, non-polluting state."—Werner and Elisabeth Stumm, Swiss Federal Institute for Water Resources.

"Engineers must in these times be assailed by the same kind of self-doubt that has plagued the atom-smashers.... It is past time for explicitly recognizing the potential for conflict between growth for the sake of satisfying priorities, old and new, and the limits to growth itself."—Francis H. Schott, Vice President, Equitable Life Assurance Society of the U.S.

"We are now able to say not only that we can observe continental motion but also that we can explain its dynamics."—M. Nafi Toksöz, Professor of Geophysics, M.I.T.

"Practicing engineering is practicing the organized forcing of technological change....Every act to inject technology into our society has anthropological connotations which, depending on how we plan and what we do, can be either subversive or benign."—Gordon S. Brown, Jackson Professor of Engineering, M.I.T.

"We...now believe that low-level electrical currents and potentials... have the capability of bringing about very major biological effects of a very basic nature,...based upon perturbations produced in pre-existing biological electronic control systems which regulate very basic life functions."—Dr. Robert O. Becker, Veterans Administration Hospital, Syracuse, N.Y.

"Although only a tiny fraction of the nitrogen in the air passing through a furnace, and likewise only a portion of the nitrogen compounds in fuels, are oxidized to NO_X, the total tonnage of NO_X emitted to the atmosphere in the U.S. is the equivalent of ten times the U.S. production of nitric acid."—Charles N. Satterfield, Professor of Chemical Engineering, M.I.T.

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Friends of the Earth Newsletter

In June this year the Government said the right thing—twice. It said it was in favour of a 10 year moratorium on commercial whaling at the Stockholm Conference on the Human Environment, and at the International Whaling Commission meeting. However, it seems that there's a big discrepancy between what the Government says and what it actually does.

On October 14th FOE groups throughout the UK held what they hoped would be their last whale demo, as on October 17th the Government was to announce whether it would ban the importation of whale products.

FOE head office, accompanied by two 25 foot cardboard replicas of baleen whales and that famous jazz band The Blue Whale Unit, toured central London in an articulated lorry to the strains of the "Last Few Blues". The Bristol, Havering and Cornwall groups had ring-ins to the Japanese, Russian and South African embassies, and to MPs, while the Newcastle and Watford groups marched with mock coffins bearing "Save the Whale" slogans. FOE Barnes mounted an 8 foot dummy whale on a van and toured Barnes, Putney and Wimbledon distributing leaflets; and in Portsmouth over 900 signatures were collected for a petition. Shops were picketed in Liverpool, Southend, Southport and Edinburgh, and in Dublin the FOE group there are pressuring their Government to introduce a similar import ban.

Needless to say, Anthony Stodart's answer to David James's question in the House on October 17th came as rather an anti-climax. He replied:—

"The voluntary action by industry is already reducing the use of whale meat and edible oil to a very low level. The desirability of further (sic) action by the Government will be considered in the light of investigations which my Rt. Honourable Friend the Secretary of State for Trade & Industry, John Davies, is now making into the availability of substitutes for sperm oil."

Friends of the Earth sent to the Ministry of Agriculture, Fisheries & Food a paper on sperm oil substitutes on August 22nd—two months ago—in plenty of time, one would have thought, for them to have made up their minds. Furthermore, there is a precedent for this kind of legislation: the Americans banned whale products in 1971 and do not appear to have suffered any economic hardship as a consequence.

There are substitutes for all whale products, and in the last few years much research has been done on alternatives to the sperm oil which is still widely used in industry today. The oil is used mainly as a machine lubricant and is useful because of its low freezing point and because it does not "gum" under stress. It is also used as a gear lubricant, especially in automatic gearboxes, in cosmetics as superfatting agents, hair oils, dye solvents, creams, lotions, lipstick, textile finishing, printing inks, leather dressing and plasticisers for carbon paper. The oil from the Jojoba bean (Simmondsia chinesis) can replace sperm oil in virtually every instance, and where it cannot, blends of vegetable and/or mineral and synthetic oils can be used. The only disadvantage of the Jojoba plant (which grows wild in Arizona, Mexico and Baja California) is that it would probably be five years or so before Jojoba oil comes onto the market in significant quantities since it takes three to five years for the plant to produce beans in a commercial quantity, although this delay could possibly be shortened somewhat if the plants were grown under optimum conditions. The sooner Jojoba products are produced commercially the better for the whales, and for the third world too, as they would undoubtedly find the Jojoba bean an important cash crop.

But if sperm oil is a problem, there's nothing to stop us banning all other whale imports now. The other main use for whale products is whale meat—eaten in this country by our cats and dogs. The Pet Foods Manufacturers' Association announced on June 28th that its members who use whale meat in their products "are phasing out current stocks and are placing no further purchase contracts".

The Pet Foods Manufacturers' Association did tell us that they had 25 members, but refused to let us know who they were. We then wrote to all the pet food manufacturers we knew of and asked them if they belonged to the PFMA; and if they didn't, if they used whale meat or intended to in the future. We received 8 replies.

The Government constantly preaches that voluntary action is preferable to legislation. It is hard to understand their reasoning as voluntary agreements must have the full backing of the whole industry before they can be effective.

Petfoods Ltd., the largest pet foods manufacturer in the UK, recently launched a promotional campaign—"The Great Gift Race"—in cooperation with the World Wildlife Fund. It is sad to think that the WWF has lent its name to this campaign when Petfoods Ltd.'s tins of Pal and Pedigree Chum still contain whale meat. Admittedly they placed their last order for whale meat in December 1971, but according to the Docks Manager of Grimsby and Immingham Docks (from Jan. 1st-August 20th) 4,834 tonnes of whale meat have passed through the docks; and "the majority of the whale meat received at Grimsby and Immingham Docks still goes to Petfoods Ltd. of Melton Mowbray". It's perhaps worth remembering that "every entry helps the World Wildlife Fund".

David James, MP, however, is undaunted and has tabled another question about whale imports for November 21st, by which time the DTI might have completed their research into sperm whale substitutes, and hopefully have something more meaningful to say on the subject of whales.

Angela King

Down to Earth

by Lawrence D. Hills

Life support gardening

Once it was calculated that building a housing estate on a farm did *not* reduce food production. The greater yield from keen gardeners growing vegetables cancelled out the land lost under roads, houses and front gardens gay with flowers. Now this 1938 figure is a long way out, with houses crammed on every costly acre and prosperity growing blades of grass enough for one motormower where a family fed before.

Just how much of our food can we raise in the two beds 13 feet wide and 100 feet long beside the path down the middle of the back garden of the average semi-detached home that cost £550/£650 in 1938 and now fetches £10,000/£15,000? How much more land would we need to support ourselves and our families on a sustained yield basis, without loss of fertility as the sunlit years roll round? And how much time will it take—peasant slavery or leisure to laze as we imagine that South Sea Islanders do?

There is another reason why we need this information rather soon in terms of horticultural research, as well as the longing to leave the rat race and join the goat, chicken and soft fruit race down in the country, that all townsmen feel. We live on borrowed land, for most of our recent increased production is from gaining the extra third on every farm that grew the oats, beans and hay to feed the horses that worked the other two thirds. When our fuel runs out, as it will in less than the life of an oak, with consumption doubling every ten years, we lose that third, and so does all the rest of the world that shares our gamble that fuel gluttony can go on for ever.

The Henry Doubleday Research Association is starting a Life Support Garden on the Trial Ground at Bocking, to replace some of the guesses with firm facts and provide some of the information for which Members of the 250-odd bodies concerned with pollution and the environment are clamouring. They would be glad to hear from other experimenters, for knowledge is needed from varied soils and climates.

The obvious crop for maximum food production is the potato, with blight-resistant varieties to avoid repeating the Irish potato famine of the 1840s when more people died of starvation than nuclear weapons have killed so far. It is not safe to grow them on the entire plot, for crop rotation is essential to avoid potato eelworm, blackleg, corky scab and other fungus diseases. The safe limit would be 25 per cent of that plot, or 50 feet of 13 foot rows.

Allowing 30 inches between rows, and a good garden yield of 1½lb a foot of row, that is 390 lb of second earlies or maincrops. According to the often quoted figures in the US Handbook of Agriculture (1939), a moderately active man needs 160 lb of potatoes a year, his wife 140 lb and two children aged five and eight, 120 lb each, a total of 540 lb, so the average garden cannot keep the average family in potatoes round the year. Another 100 feet of rows would level the difference, with a garden 20 feet longer, but this allows nothing for extra potatoes to replace the 690 lb of flour they will need for bread, cakes, pastry and puddings.

The daily target for that American family is 9,460 calories a day, plus 315 grams of protein, 351 grams of fats, 1,232 grams of carbohydrate, 4.26 grams of calcium, 5.69 grams of phosphorus, 56.4 milligrams of iron, 35,800 International Units of Vitamin A, 280 IUs of Vitamin B1, and 290 milligrams of Vitamin C.

The co-operation of the Vegetarian Nutritional Research Centre will here be extremely helpful, for we not only know of many more Vitamins than in 1939, but we also know more of protein quality.

Proteins are made up of amino-acids and if some of these are missing from a diet the consequences are disastrous to health. A major problem among vegetarians is the slow-down in mental and physical ability from merely cutting the meat and fish out of a normal diet. Cheese must go up to supply protein and minerals, and to replace these, and to supply the balance of proteins means a large area under pea tribe plants. We cannot grow those which supply the proteins for the vegetarian races of India, and the amino-acid balance of the haricot, butter and broad beans we can grow in our climate is as unknown as their yields.

The easiest item on the list to supply is the Vitamin A, with three breakfast cupfuls of cooked carrots supplying the daily ration for the whole family, and a cupful 30 calories. Carrot rows go eight inches apart and maincrops thinned to eight between plants yield about a pound to the foot of row. Beetroot yield about the same from the same area, but with the advantage of supplying choline, one of the Vitamin B Group discovered since 1939, normally eaten in eggs, and kidneys, liver and brains, soya beans and yeast. Onions go a foot between rows and can produce 1¼lb a foot from sets.

With rotation of crops and a steady succession of sowings, it is possible for a skilled gardener to take very heavy yields from a small area. The greatest need that genetical research could provide for, is a clubroot-resistant cabbage, but the Durham miners cropped their pit pony manured allotments solid with leeks through the winter and fed their families through strikes and slumps. A winter programme of 25 per cent cabbage tribe, 50 per cent leeks and the rest broad beans with a winter green manure crop is about the maximum for the North, and winter lettuce for Southern gardens.

The time question is also important, for it is possible that the farmworker digging the long garden of his tied cottage in the unpaid overtime that he must work still to bring his pay up to half that of "special cases" in industry, is more efficient in fuel-for-food terms than the farm. It takes about 35 minutes to dig seven square yards thoroughly, and seven minutes to dig just as deep and well with a Merry-tiller over the same small area, but the machine has fuel costs, and oil, spares and replacement.

The answers that we shall find in "Life Support Gardens" are to questions no-one has ever asked before, but we shall need them by the end of the century. Is the horse on that third of our land, with his slow pull, the manure in the stable, and Blossom's foals her own replacements, our best bargain; is it a small tractor on methane gas, or is it the fork, the spade and the hoe? No-one knows, but there is still time to find out.

Books

The parts and the whole

WORLD OF WILDLIFE, published weekly by Orbis Publishing Ltd., 20p per part.

Rising production costs, coupled with erosion caused by the reader-seducing telly, have threatened many book publishers with extinction. The least adaptive being the most vulnerable, encyclopaedia publishers have resorted to a wide variety of aberrant patterns of behaviour. Some even give their products away, which sounds to me like pseudo-adaptation.

One response amounts to a major publishing breakthrough. By borrowing ideas and techniques from popular magazines, some more enterprising encyclopedists have devised the part-work. A clear case of convergence, the similarity between each issue and a magazine is no more than cover-deep. The device has made it possible to produce major works to a very high standard at a small fraction of the cost of an equivalent set of bound volumes. Yet when he has collected and fitted them into the binder provided, the reader may notice little difference.

At their best such books may be excellent as well as popular. *World of Wildlife* is both. Certainly it is popular; by the time it reached Part 53 the demand for back issues was sufficient to warrant the republication of the entire series.

It is tempting to believe that this popularity is due to the ecological approach the work adopts. Each animal is presented in relation to its habitat; the niche is shown to exist and the species to fit it. The conservation theme is strong. The threat from man to the creature, its habitat and to the ecosystem of which it is part is assessed whenever this poses an immediate or potential threat to its survival. *World of Wildlife* is intended for those who are prepared to become interested in natural history. There is no lack of pretty pictures, but always the aim is to involve the reader in the fate of their subjects.

It is difficult not to become interested and involved. The illustrations are sharp and informative, the text is written simply and clearly and the compilation is methodical. Each weekly part forms one chapter in the completed volume and more than one chapter may be devoted to a single species. Eventually there will be ten volumes, three covering Africa, three Eurasia, two America and one each Australasia and the oceans.

The parts add up to an impressive whole and it is likely that *World of Wildlife* is informing a large readership of one important aspect of man's assault on his environment. Its commercial success is obvious. It is also making a considerable contribution to the environmental movement.

Michael Allaby

The murderous automobile

THE AUTOMOTIVE NIGHTMARE. Alisdair Aird. Hutchinson of London. 1972. 301 pp. £3.50.
LEICESTER: TRANSPORT AND THE ENVIRONMENT. Leicester Ecology Group. 1972. 25p.

Most readers of the *Ecologist* still own cars. Despite twinges of ecological guilt they will aver they need them for all sorts of reasons, from getting to work to collecting small parcels of non-persistent pesticides because the only shop selling them happens to be seventeen miles away. And quite clearly they are right: present society depends heavily for its functioning on the use of the car. That this dependence is strictly analagous, in its long and short term effects, to addiction to something like heroin is perhaps less obviously clear.

Alisdair Aird has a job as a journalist with *Motoring Which*? His employers are noted for the candour with which they discuss the short-comings of consumer products and their manufacturers. Aird gives us the whole automotive works. After this book it is hard to see him on any manufacturer's list for an all-expenses-paid holiday in the sun, champagne and whatnot, new model launch.

Cars are designed to fall apart and then be difficult to repair. They are designed with deliberate faults which can easily be rectified thus enabling a "new and improved" model to be produced a year later with maximum publicity and acclaim from the same journalists and sycophants who lauded its defective predecessor a year before. And it is not just the buyers' money which is at stake. The concentration of designers on the meretricious, as opposed to the good, has lethal consequences for society. The blood on the hands of motor manufacturers is greater than that of all the armaments manufacturers together.

Insurance companies combine with manufacturers and repairers, with government connivance, in a tight financial cartel from which the car owner is excluded. His role is to pay up and shut up. Road engineers, most of them self-appointed apologists for the road industry, give physical existence to a primacy of motor values over those of civilized urbanism and rural health and amenity. The law treats the motoring criminal with a leniency which in any other sphere would have the hang-and-floggers tearing down Parliament. A slum delinquent stealing a joy-ride will probably go to jail; a drunken company director or a psychopathic speedster in a Jaguar killing a pedestrian will get away with a £50 fine and a year's suspension of his licence and feel hard done by.

Pollution we know about. But we do not know its full effects. For the first time we have a full generation growing whose lungs have from birth had within them the car-spawned seeds of cancer and whose tissues from before birth have been poisoned by lead. Perhaps, as the car industry repeats, all this is no harm. Perhaps it is even good for us.

We have had what have been called diatribes against the car before in the *Ecologist*. Some people thought we were exaggerating, which we were not. But here it all is again, copiously documen-

ted, scrupulously researched and totally credible. Aird is a self-confessed enthusiast for the car and this is his considered verdict.

For many readers the attack on the defects of the car will be the main message of the book. And it is indeed a worthwhile one. The myth makers have succeeded in deluding most of the population. The *Evening Standard* in London can carry a headline "Motorist Stabs Man" without a tremor of awareness of the absurdity of the distinction. Pirelli with grotesque tastelessness carry an advertisement for new tyres which shows an oaf in a track suit leaning against a sports-car describing his philosophy of driving. "I drive so fast the tyres get a lot of stick. It's foot down when the wife's not on board", and so on. The ideal world of indulgence and freedom is as far from reality as a masturbatory fantasy is from the reality of human response and responsibility. But fantasies of speed kill.

There is, however, another message in this book and it is even more important. Aird discusses the importance of the motor-industry in the whole industrial structure of Britain. If the motor-industry failed, the industrial heart of the country would stop. And a host of other industries would fail too. They vary from the manufacture of those dangling windscreen dolls, which form such happy distractions from the rigours of motorway driving, to the provision of hot-food vending machines in Snowdonia. The day our oil supplies are restricted the motor industry will be in a decline and all the rest with it.

Aird sketches the possibilities and then seems unwilling to follow his own direction of thought. It is as though he were afraid of where it would lead him. It would, in fact, have required another book.

We will run out of freely available oil for the motor-car. The only question is one of time—10 years or 30 years is the margin of error. But we are planning as though we were in the clear for ever; as though we have some moral entitlement to a limitless supply of energy for our needs and fancies. But it is a stone cold sober certainty, as even a cursory reading of the oil industry news would confirm, that we will be in serious trouble well within the building time of most of the urban development plans currently in vogue. The motor industry will be in decline—with all that implies.

The only choice is whether the decline is controlled or uncontrolled. Do we contribute to the magnitude of the debacle by trying to build up the industry or do we begin now to run it down so that the adjustment when it comes is somewhat less painful? It is clear what we should do. It is equally clear that the initiative will have to come from the people, from us, acting responsibly. Neither Government nor industry is able to face the reality before it. It has been suggested we should always buy imported cars: this ensures that the British car industry declines and we begin to adjust to it painlessly. But this is an attempt to have and eat our cake. The logic of the situation is clear and unescapable and if we accept it we must act on it. It is no longer a question of issuing dire warnings and then carrying on as though that were sufficient.

We should not now buy a car if we can, even at personal inconvenience, do without one. If we own one, we should use it as little as possible. If we must buy one it should be a second-hand one rather than a new one. And if we must buy a new one, it should be a small one and a cheap one rather than a large dear one.

Leicester, like everywhere else in the country, has a traffic problem. Rather it has a planner problem. The Ecology Action Group has prepared a very professional looking document which contains a series of articles which look at the city, the way it is being shaped by its present planners, the inevitable results of present policies, and rational alternatives. Just as Government and industry are keeping us firmly on a course for maximum eventual damage and social disorder, local authorities have equally failed to comprehend what they are doing. The responsibility remains with us as individuals to make the right personal decisions and to contribute, as this Leicester group is doing, to the development of sanity in local and national planning.

Gerald Foley

Weighing and measuring

GEOLOGY OF SOILS, by Charles B. Hunt, W. H. Freeman, £5.00; FUNDAMENTALS OF SOIL SCIENCE by H. D. Foth and L. M. Turk, John Wiley & Sons, £5.75; SOIL GEOGRAPHY by James G. Cruikshank, David and Charles, £4.20; METHODS OF STUDY IN QUANTITATIVE SOIL ECOLOGY: POPULATION, PRODUCTION AND ENERGY FLOW, edited by J. Phillipson, Blackwell Scientific Publications, £4.00.

Behind all the splendid generalisations and theories about the environment there lies the biophysical system itself, overwhelming in its complexity, and the brave company of scientists at work weighing and measuring it. For all our complaints about the limitations of the specialist approach in science, we need the specialists because the generalisations are based on their findings. Thus it is no coincidence that the giants of the environmental movement —such men as Dubos, Ehrlich, Commoner and Fraser Darling—began as specialists themselves. If he is to understand his planet, sooner or later the lay student must come to grips with at least one of the scientific disciplines that contribute to the broad vision of man in the biosphere.

The problem is where to begin. Perhaps the most appropriate starting point for a thorough study of the environment is the soil itself. Since it supports all land-based ecosystems many other studies flow from it and without some knowledge of soils they will be that much more difficult.

Pedology begins with geology and Professor Hunt has written a simple, straightforward, but detailed account of the formation of rocks, the evolution of soils and soil classification. The British reader must be wary of American books on geology: there are differences in terminology that can be confusing. This book is concerned with North America—and some of the geological features described call for rather detailed knowledge of American geography. Yet when it comes to soils the problem tends to disappear since American classifications are gaining international acceptance. At least, that problem disappears. The terms themselves remain, and they are forbidding. The American classification that is being accepted is the 7th Approximation of the US Soil Survey, so called because it represents the seventh attempt by its authors to classify soils. To do so they have invented a new language, one of which Professor Hunt does not altogether

approve. He quotes examples of what he regards as horrendous jargon: "The Umbraqueptic Cryaquents are comparable to the Cryaqueptic Cryaquents in colour values, and to the Orthic Cryaquent in chromas"! (Do we take this on trust or should we challenge it?)

Professor Hunt writes as simply as he can and his book contains a combined index and glossary, which is invaluable.

Professors Foth and Turk are joint authors of one of the standard works on soil science and this is the fifth edition of their book. They take the story a stage further and describe the soil as a medium for plant growth. For some reason they go out of their way to attack the belief that food grown without artificial fertilisers is nutritionally superior to that grown with them and while they approve (as do all soil scientists) of the return of organic matter to the soil their comments on composting are inaccurate. They fall into the trap that awaits all specialists of assuming problems can be solved wholly within their special province. Thus food production can be increased by increasing fertiliser use, which is a statement that is made frequently and with great confidence. It assumes the resources exist to make the fertilisers available, which they may not.

Yet the authors of all three books are worried about the future of our food supply and each of them warns, very clearly, that a limit exists to the population the planet can support, and that we damage the soil at our peril.

Foth and Turk use the 7th Approximation and give detailed explanations of the 10 main soil orders. It is these that are accepted. Their subdivisions are controversial and so complex that even the most experienced pedologists use them only with great caution.

Dr Cruikshank explains this, and the reasons for it. His book is based on his lectures at the Queen's University, Belfast, and is the only one to give an outline of the history of soil classification, going back to the late eighteenth century soil map of Suffolk, then leading up to and beyond the work of the Russian, Dokuchaev, almost a century later, who was one of the world's first, and foremost, pedologists. His system, which divided soils into "horizons", provided a theory of soil formation, so linking the study of soils, associated traditionally with agriculture, and geology. He was a giant, in the naturalist-geographer tradition of Darwin and he founded a Russian school of pedology that led the world until the Americans moved ahead some fifteen years ago.

Dr Cruikshank is a geographer and he explains how soils are sampled and tested and how soil maps are compiled for various purposes. Anyone attempting his own sampling might find himself in trouble since some of the descriptions of techniques are incomplete, but the principles are clear enough and once back in the laboratory Dr Cruikshank describes some of the main tests.

The Geography of Soils introduces the student to the ecology of soils with an excellent summary of the main species. So, from geology we have moved to ecology proper. Dr Phillipson is a soil ecologist and the book he has edited is a contribution to the International Biological Programme.

The aim is to standardise laboratory and field methods so as to achieve some uniformity in collecting and examining soil flora and fauna.

The complexity increases. Most of the techniques are experimental and no one way of doing anything has achieved universal acceptance, so all Dr Phillipson can do is to allow workers to describe their own preferred methods and let the ecologists choose for themselves. This, then, is a technical handbook for the professional and it will be of little value to the amateur except to impress on him the fact that the upper horizons of the soil are a world of their own of which as yet we know comparatively little. Its inhabitants are small, many of them microscopic, and those that are mobile may attempt to evade capture, so that even when they have been separated from the communities of which they are part, assessing their numbers is not easy. Determining diets, respiration and the efficiency with which they utilise energy is no easier. In the words of one contributor, "collection of protozoan faeces is impracticable"!

By the time the indefatigable student has worked his way through these books he will have a theoretical knowledge of the soil that will stand him in good stead.

In the process he will have acquired three, or, if he desires more detailed knowledge of soil ecology, four, valuable reference books.

Michael Allaby

BOOKS FOR CHRISTMAS?

One of the minor perks of editing a magazine like thisi that an increasing number of attractive books on animals and plants come our way. They would make ideal presents, Christmas or otherwise, so in case some of you are like me and leave everything to the last moment, here is a selection of the latest.

Peter Lowe have brought out two splendid books of illustrated ecology, **Animals of the Antarctic: the ecology of the Far South** by Bernard Stonehouse (£3.25) and **Animals of the African Year: the ecology of East Africa** by Jane Burton (£2.95). Both are profusely illustrated in full colour and are a delight simply to browse through. However, unlike many picture books, the text is also of a high quality, fully covering the animals of each area and their ecology, the intricacy of which is not shirked but presented clearly. Indeed it is unfair to describe them as picture books: they are worthwhile treatments in their own right—with the added distinction of superb pictures. The difference in prices is difficult to explain.

Less well illustrated is **The Oxford Book of Vertebrates** by Marion Dixon and Derek Whitely (Oxford University Press, £3.50). The pictures are paintings not photographs and less pleasing than those of such companion volumes as **The Oxford Book of Food Plants.** The text is of the standard we have come to expect from the series, but for anyone not interested in sea fishes, reptiles or amphibians, he would probably do better buying the Collins' **Guide to Mammals of Britain and Europe** and **Guide to Freshwater Fishes of Britain and Europe,** which are more informative and useful in the field and together cost only 10p more than the Oxford Book—which covers the vertebrates of Britain only.

Collins' field and pocket guides remain quite unrivalled, and their latest, the **Guide to Aquarium Fishes and Plants** by Arne Schiotz and Preben Dahlstrom (£2.50), is beaut-i fully illustrated and provides comprehensive information on those freshwater ,brackish-water and marine fishes, invertebrates, and plants available for aquaria. The newcomer and the initiate will find the chapters on maintaining freshwater and marine aquaria invaluable.

Also from Collins are three delightful books on plants, **Finding Wild Flowers** by R. S. R. Fitter (£2), **The Scented Wild Flowers of Britain** by Roy Genders (£2.50), and **Food for Free** by Richard Mabey (£2.50). The first is a useful handbook to plant-hunting in Britain and it includes a county-by-county guide to the most interesting habitats, special plants, societies, and literature. The second is a charming and thorough account of the fragrant or aromatic flowers of Britain. There is an introduction to the chemistry of plant scents, their classification and their utility, and to insect pollination. The bulk of the book is devoted to giving a botanical description of each plant, together with notes on habitat and frequency, months of flowering, history, literature, and uses.

Most exciting I think is Richard Mabey's **Food for Free,** a guide to the edible wild plants of Britain. Whether you want to discover a cornucopia of rewarding details about plants, or are appalled at rising food prices, or are a homeless wanderer, or believe that the agricultural revolution was the beginning of the end, this is a book of rare quality and is a must. There are a whole host of plants—fruits, flowers, spices, herbs, greens, roots, fungi, nuts, and shellfish too since they are gathered much as plants are—still in the British countryside which can be eaten. The stomach and palate are excellent ways to an appreciation of the great variety of plant life, and Mabey's is the perfect guide. Over 300 species are described, with details of their appearance, history, taste and nutritional value, and how to find and cook them. Local as well as scientific names are given, and the book as a whole is both scholarly and amusing, careful and sensuous.

Photographing Wildlife by J.-M. Baufle and J.-P. Varin (Kaye & Ward, £3.75) is fabulously illustrated, clear enough for the relative beginner, but detailed enough for the expert. It is very good as an aid to overcoming the special problems of photographing wildlife indoors and outdoors.

It would have been nice to have ended with some books for children, but the only two we have been sent are of decidedly poor quality. **S.O.S. Save the Earth** is a gimmicky book (the earth with a real plaster on it and the caption "first aid or it will die") from Collins (£1.50) which contrives to be both alarmist and bromidal. **Beneath the Oceans** (Macdonald, 90p) gives a poor idea of ocean ecology and is sometimes just wet: "It is possible that a water-breathing man, *homo aquaticus*, could be developed who could live entirely in the sea"!

Robert Allen

The fervent gardener

GROW YOUR OWN FRUIT AND VEGETABLES, by Lawrence D. Hills. Faber & Faber, £2.50.

To Lawrence Hills gardening is not a hobby. It is a way of life, almost a religion. He approaches it with an evangelical fervour that is never content to tell us that gardening is good for us, that it is enjoyable, or that it is satisfying to produce our own food. No, we are ordered to join in, he drags us willy-nilly out of the back door, even bullying us a little when his enthusiasm gives way to a hint of impatience at our dullness. "Don't do that, do this!" he commands, although now and then he relents just a little: "Oh well, if you must grow that thing..." but it doesn't last: "...do it this way!"

All of this sounds very unfair. All I mean is that once again Lawrence Hills has produced far more than a text book. The man is infectious and the really determined armchair gardener, who dreams of cabbages but comes no nearer to them than a deckchair in the wilderness on a sunny day, should beware. Mr Hills will disturb him, will undermine his lethargy.

Of course, it is a text book as well, and a very full one. One expects a good deal of space to be devoted to comfrey, the weed with a thousand uses—eat it, use it as a medicine, compost it, mulch with it, the list goes on and on—but along with the usual vegetables and fruits there are less common ones: Pei Tsai (Chinese cabbage) and salsify and kohlrabi. The fruits include walnuts, which may cease to be grown in this country because we lack the patience of our grandparents who would wait eight or 10 years for a tree to come into full production.

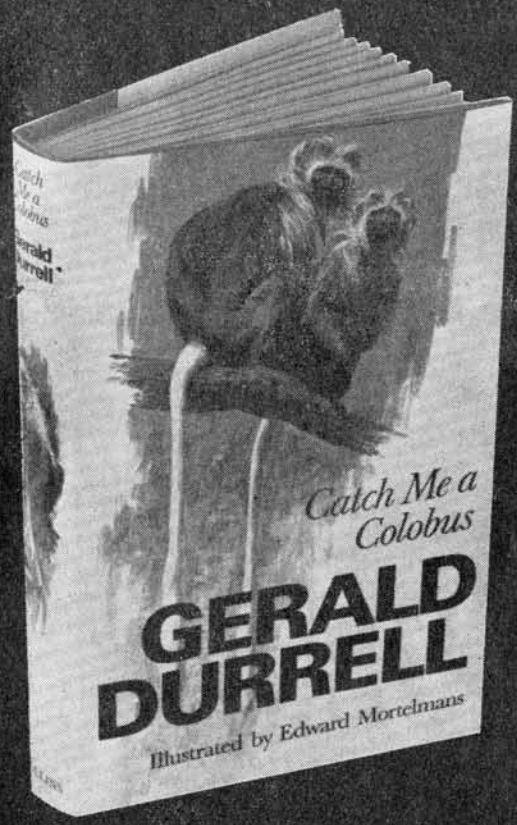
Together with the instructions for the cultivation and care of each variety there are details of its nutritive value. This is most unusual and most valuable to those who, like the author himself, take their fruit and vegetable growing seriously. After all, the aim is to produce wholesome food, so we may as well know the value of each plant.

The organic gardener must learn how to deal with pests and weeds and how to balance the nutrients in his soil. There is more work and more skill in this than that required for an expensive trip to the chemist, but, as Lawrence Hills describes it, it is fun. He tells us how to cheat pests and, if we have to spray, what to use and how and where to obtain it. There is a recipe for boiling up fag ends to make a nicotine spray. Through it all he seems to have some kind of personal relationship with all the insects and animals in his garden and although he tells us how to kill them at times I suspect him of a secret affection even for the pests!

Again, unlike any other gardening book, this one ends with a section on how to prepare the vegetables we have grown, written by Mrs Hills. It is full of original, delicate and subtle suggestions for preserving and enhancing flavours and, of course, for protecting nutrients. Why don't other writers follow the process through from soil to stomach?

Grow Your Own Fruit and Vegetables will restore the zest of the gardener whose enthusiasm is beginning to wilt and as an exhortation for those who are just starting with their first garden I do not believe it can be bettered.

Michael Allaby



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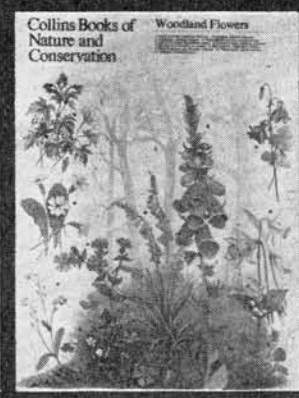

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Feedback

1 Who cares about the environment?

A *Newsweek* survey during the US Presidential election asked voters what they thought were the most important issues. Pollution and environment came sixth, behind the Vietnam war, the high cost of living, unemployment, drugs, and crime, but ahead of tax reform, defence spending, school busing, and women's rights.

2 Change of air

The Leeds branch of the British Society for Social Responsibility in Science has shown that the published results of the National Air Pollution Survey are unreliable. All but one of the nine instruments used to measure smoke and sulphur dioxide pollution in Leeds give "inaccurate and non-representative results." The instruments are neither sited at nose-level nor in areas where pollution is known to originate, but are often tucked away in out of the way places. The group regards the situation in Leeds as typical of the country as a whole.

The results of the National Air Pollution Survey suggest that smoke and sulphur dioxide emissions have declined over the past ten years and are likely to continue to do so. However, the Leeds group concludes from its study that these results "cannot be considered as reliable information either about absolute levels or about trends in air pollution".

Observer, 22.10.72

3 Two of a kind

The Soviet Union and the United States have agreed to co-operate on 30 projects aimed at tackling mutual environmental problems. Russian and American scientists will help each other over the air pollution of St Louis and Leningrad, the water pollution of Lake Tahoe and the rivers Potomac and Delaware, and of Lake Baikal and two Soviet rivers yet to be designated, and the urban environmental problems of San Francisco and Atlanta, and Leningrad and one other Soviet city.

Time, 2.10.72

4 Insect resistance

Researchers from the Agricultural Development and Advisory Service at Wye, Kent, have found that the glasshouse whitefly is now resistant to malathion, DDT, and dichlorvos. They predict that such resistance will become widespread, and report that alternative chemical controls are being sought.

Nature, 239: 164-5

5 Back on the treadmill

It is well known that many insect species are resistant to a number of insecticides and that the housefly is outstanding for its resistance to a great many of them. Extremely powerful insecticides such as dimethoate and naled now have to be used to obtain some measure of control. This has led to a search for alternative control methods, among them the application of the insect juvenile hormone or its analogues at critical stages of the life cycle, when it induces various abnormalities and death.

Now two researchers from the Department of Entomology at the University of California, Riverside, have discovered that insecticide-resistant houseflies can develop resistance to juvenile hormone analogues (JHA). They applied the JHA ZR-0515 to flies resistant to organochlorines (DDT/lindane), carbamates (OMS-15), and organophosphorus insecticides (parathion, chlorthion, fenthion, OMS-12, and dimethoate). They found that those resistant to dimethoate, OMS-15, or OMS-12 were highly cross-resistant to JHA, those resistant to fenthion, chlorthion, and parathion were moderately cross-resistant, but those to DDT/lindane very little. Interestingly, they noted that "while high cross-resistance was observed in strains subjected to long-term specific insecticide pressure in the laboratory, the field strain examined has demonstrated only minimal cross-resistance to the JHA, despite the fact that the strain possesses the highest resistance to organophosphorus insecticides we have observed in California field populations".

Nature, 239: 401-2

6 Poisonous plankton

For a time this September, the sale of shellfish in Massachusetts was banned outright and shipments of fresh and frozen clams and mussels from Massachusetts, New Hampshire and Maine recalled. An invasion of inshore waters by the highly toxic phytoplankton, *Gonyaulax tamarensis* extended from Cape Anne just north of Boston to Penobscot Bay in Maine, where it merged with the permanent mass of poisonous plankton which floats off the coast of northern Maine and southern Canada.

The poison affects the central nervous system, leading to loss of muscle coordination and breathing difficulties. Before the shellfish ban took effect, hospitals reported 32 cases of paralysis caused by the plankton.

Newsweek, 2.10.72

7 A curious bird is the pelican. His eggs can hold more than his belly can

The claim by Blus *et al* (*Nature*, 235, 376) that DDE residues are the cause of thin eggshells in brown pelicans is rejected by William Hazeltine. His objections to the claim are (1) the data points of residues and shell thickness are for three separate colonies, and although the aggregate correlation is good, there is poor correlation in each of the separate colonies. (2) Whole eggs were examined and not the yolks alone, yet the residues accumulate only in the yolks, and both yolks and residues are subject to metabolic change during incubation. (3) An inappropriate statistical method was used.

Using corrected data and the appropriate statistical method, Hazeltine finds a correlation between DDE residues and eggshell *thickness*, but he does not believe that "DDE causes shell thickening in brown pelican eggs"!

Nature, 239: 410-11

8 A knock for mock

At his banquet on the 13th November, the Lord Mayor of London enjoyed a plate of turtle soup which, unlike the turtle soup conservationists have learned to avoid, may contribute to the survival of the turtle rather than its extinction. The soup was made from the first farmed turtles to reach Britain. John Lusty Ltd., manufacturers of turtle soup, have forged links with Mariculture Ltd., a West Indian firm that claims to have domesticated the turtle. If its farming techniques succeed they may make the hunting of turtles uneconomic, so allowing wild populations to recover.

John Lusty press release. 30.10.72

9 Chlorine from power plants

Chlorine in the form of hypochlorite or as gaseous chlorine is used by power plants several times a day as an anti-fouling agent in cooling systems. Two ecologists from the University of Minnesota have found that such chlorine depresses rates of photosynthesis and respiration of phytoplankton much more severely than does waste heat.

Source: *Science*, 176; 1414-5.

Letters

Treading on Editorials

Sir,

The Editorial in your September issue, "Stepping on Epping", contains much with which one is in broad agreement, but I hope that you will allow me the courtesy of commenting and enlarging upon some of the points which you make.

In the interests of accuracy, I wish you had described the free-range cattle in Epping Forest as bullocks or heifers, which is what they are, rather than "cows", which the most superficial glance would reveal the majority not to be. Age and gender apart, however, it is true that these animals play an important role in the Forest today, a point which is perhaps not appreciated by those that press for their removal. Anyone who has discussed the matter with me, or has heard me speak about it locally on a good number of public occasions, will know that I am a firm advocate of retaining the cattle on the Forest. Apart from their effect in slowing traffic (which I would suggest is marginal), they are important in maintaining at least some grazing pressure as a check to scrub advance in the open areas. Those who argue that mowing is an acceptable substitute forget the manuring and trampling effect which selective grazing animals have on an area: the floristic variety of such areas is quite different from that of mown swards. Indeed, one would hope that grazing intensity of cattle on the Forest could be increased.

There is no disputing the fact that the dissection of the Forest by roads already presents a serious problem: seen in its historical perspective, the construction of the Epping New Road was a disaster. I am sorry that you consider our silence on the question of current motorway developments to be "ominous": in so describing our lack of a public statement, you are reading into it a significance which it does not possess. Until the route of Ringway 3 is published, detailed comment would be premature, but the Centre would certainly deplore any development which violated the Forest and was detrimental to the public enjoyment of its natural aspect.

Perhaps it is not generally realised that the Epping Forest Conservation Centre has no responsibility for the management of Epping Forest, which lies with the Corporation of London, as it has since 1878. It is true that the Centre belongs to the Corporation, but it is managed by the Field Studies Council for the teaching of field studies. Apart from its educational work with schools and colleges, the Centre maintains a public information service and acts as a base for ecological research. It is the last of these functions which has already enabled us to give advice to the Corporation on management matters, and I trust that as this aspect of our work grows, so will our usefulness in this respect.

Ecology is a highly complex subject and woodland is one of the most complex ecological systems known to Science. To attribute the loss of certain animal species to what you simply term "a poor state of management" is, I suggest, to oversimplify to the point of misleading. This analysis would seem to ignore the influence of increasing population mobility, generating both more traffic on the roads and greater disturbance within the woodlands, and the influence of successional change within the Forest.

Presumably, however, your statements are supported by factual evidence based on some kind of ecological survey carried out over a period of time, and you are therefore in a position to supply data as to species, their distribution and abundance both within the Forest and in the adjacent areas. We have already appealed locally for assistance in compiling this sort of information and I should be most grateful to receive a copy of the additional data which you presumably have. This will be invaluable in our work, and will be used, in conjunction with the Corporation, in assessing management policies in the area.

Yours faithfully,

Paul A. Moxey,
Epping Forest Conservation Centre,
High Beach, Loughton, Essex.

We are glad that Mr Moxey has stated his opposition to any violation of Epping Forest. Although we appreciate that the Conservation Centre has no responsibility for management, it can only be as influential as it should be if it speaks out vigorously against potential threats, and demands action against existing damage.

Detailed ecological surveys, although interesting, will take far too long to save Epping, and in any case we know enough already to be alarmed at the condition of the Forest. If large herbivores like the fallow deer and carnivores like the badger find the Forest inhospitable that is sufficient indication that something is wrong. This argues poor management, for although the Corporation is not responsible for the presence of the A11, it could certainly press for traffic restriction, and it could also regulate the numbers of visitors to particular areas of the Forest, a growing management policy for fragile ecosystems such as Epping—EDITOR.

Eco-Ships

Sir,

I was most interested in the article "The Sailing Ship in a Fuel Crisis" by Basil Greenhill, the Director of the National Maritime Museum (*Ecologist*, September 1972). He makes a strong case out for the use of the sailing ship, in the face of an energy crisis. It may well come to pass when we can no longer look forward to cheap fuel to fight against the natural forces that surround our globe. By developing "sail" technology and preserving the skills not yet lost that go with it, we could, indeed, produce an eco-ship.

This idea is reinforced when you think of the exploits of such people as Sir Francis Chichester, Sir Alec Rose, Robin Knox-Johnson, Chay Blyth and those enormous single-handed greyhounds that took part in the trans-Atlantic Race this year. Men are not becoming more courageous or, indeed, more adventurous, it is just that materials are more suited to the uses required of them. Everything is lighter and stronger and while "chafe" is still the sailor's constant worry, he can look after it—and single-handed too. It is, therefore, possible to think way beyond the 250 tons per man of the large American schooners, just as Basil

Greenhill foresees. A German consortium is, in fact, at this present time studying a novel design which could carry cargo under sail very competitively. Cargo carrying is not the only advantage that can accrue from developing the use of the sailing ship.

The great gathering of the world's sail training ships in connection with the Sail Training Association's Tall Ship Race and Operation Sail, which took place at Kiel during the Sailing Olympics shows that a great deal of expertise is still about. The majority of the world's maritime nations still train their navy or merchant navy under sail and many are convinced that the greater the growth of technology, the more urgent the need for part of their education to be face to face with the environment in which they choose to work. The demand for many differing types of skill, divides even the small community that is found on a modern ship. If this division starts during the training process, the difficulty of working one with another is amplified, damaging the quality of life afloat.

Training through the sea rather than for the sea is a developing educational force. It harnesses the energies liberated by the continuous demands of a sailing ship and this together with the dramatic change in the environment possible at sea, enables the individual to re-evaluate himself in a different setting. This "new view" can be achieved in a very short time afloat.

This is by no means the end of the possibilities that can be obtained by looking anew at sailing ships. For example, most zoologists are trained on the seashore. Understanding of life in coastal and economic waters has been valuable not only to those who are going on to specialise later in these subjects, but also to those who wish to have a greater understanding of what life is all about.

A study is being made of the possibilities of a multi-disciplinary ship where study of the marine environment goes on while others who have chosen the sea as a career learn part of their skills afloat.

This overpopulated island is surrounded with water which has been traditionally used for war and commerce. It has as great a part to play in the future in education. Perhaps an appreciation of this will lead us to value the sea in a new way and so prevent us from using it, senselessly, as a sink for all our wastes.

Yours faithfully,

Maldwin Drummond (Chairman),
The Sail Training Association,
Manor Office,
Calshot Road,
Fawley,
Southampton.

Vapona

Sir,

We should like to comment briefly on the fact that in a recent edition of your journal, the "Friends of the Earth" newsletter makes a reference to the mid-Essex Group campaign against our product, Vapona Fly Killer. We should like to make the following points.

1. As you would expect, Shell companies are at all times conscious of their proper responsibilities in connection with the environmental effects of their products.
2. Mr Roger Anderson, local Organiser of the FOE Group concerned in mid-Essex, wrote to us on 10 July 1972 concerning Vapona Fly Killer and suggested that a small number of people from his Group would like to visit either our offices or laboratories. A visit subsequently took place and the people concerned were given some idea of the immense technical background to Vapona products.
3. The labelling of Vapona products, and indeed the amount of information we provide with each and every one, has in general, always been considered by both Trade and Consumer alike, to be exemplary. Long prior to marketing, Vapona products received Commercial Clearance under the Pesticides Safety Precautions Scheme of the Ministry of Agriculture & Food. Such Clearance is not lightly given and is of course reviewed from time to time, as indeed it has been in the case of Vapona products. Under this voluntary scheme, the wording on labels is agreed by discussion between the appropriate authority, and companies wishing to market products coming under the Scheme.

We are in close and regular touch with the appropriate Technical Authorities on such matters, and specifically would say that the statement made in the article that Vapona will in future carry a stronger warning on the package about dangers to health, is incorrect. Also, we are not aware of any leading retailer who has agreed to withdraw stocks pending further tests of Vapona. Our labelling of Vapona products will, of course, continue to be in accordance with the above Scheme.

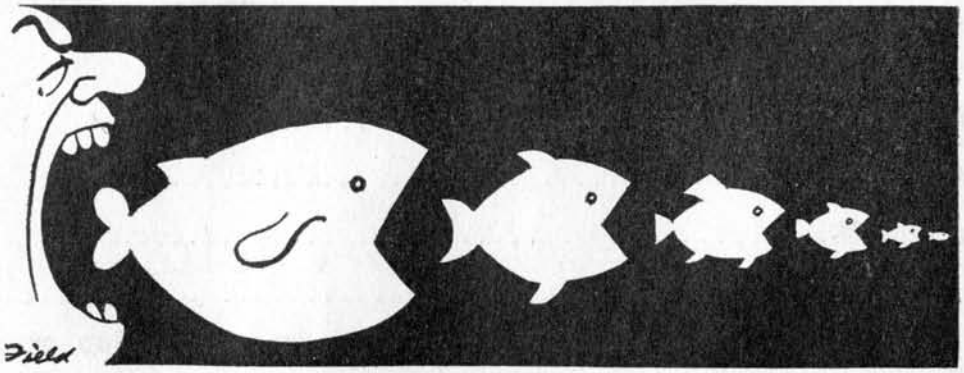
Finally, the insecticidally active part of Vapona strips is the well known chemical dichlorvos, probably one of the most safe and well documented insecticides in current use. In the Vapona strip formulation, the use of this chemical represents a considerable technical advance over some previous chemicals used in formulations which were undoubtedly more persistent and residual in character.

This of course is again in line with the policy of many major Companies to continually look for product improvements and innovations, not only in relation to performance, but also and in the particular case of chemicals, to safety.

In conclusion, therefore, we feel that Vapona products have made and will continue to make a significant contribution towards hygiene in the many situations in which they are now recommended for use in International markets.

Yours faithfully,

P. White,
Shellstar Limited,
Fertiliser Plant Ince Marshes,
Chester CH2 4LB.



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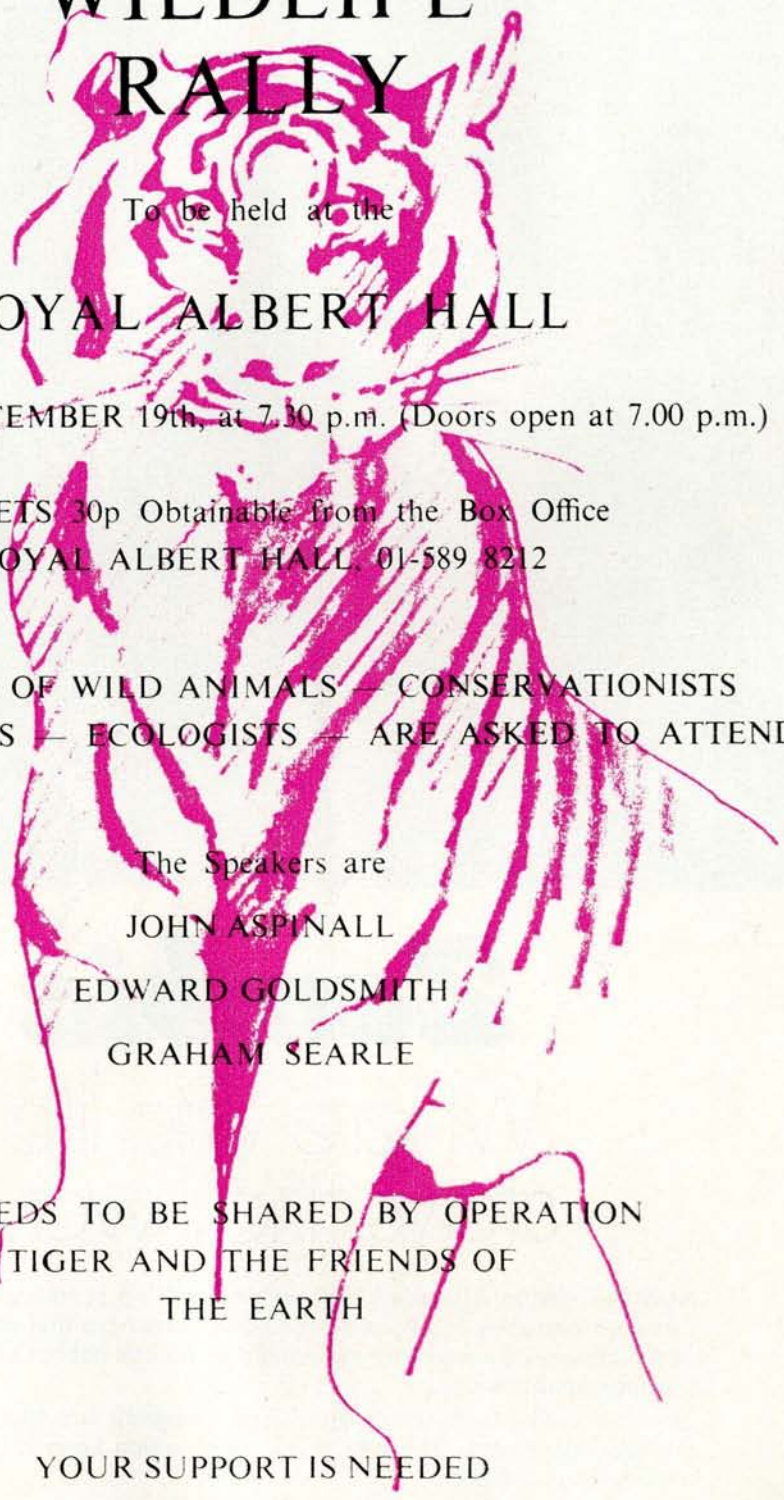

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